



# SOLICITATION, OFFER AND AWARD

City of New Braunfels  
Purchasing  
424 S. Castell Avenue  
New Braunfels, Texas 78130

Solicitation No. 12-028  
Aquatic Vegetation Restoration

☐ Invitation for Bid (IFB)  
☒ Request for Proposal (RFP)

Date Issued:  
September 13, 2012

## SOLICITATION

Page 1 of 29 Pages

Proposers must submit sealed proposals in triplicate signed original and one CD for furnishing the services identified in the Schedule. Proposals will be received at the office of the City Secretary at the address shown above until: 10:00 a.m. on September 27, 2012. Proposals received after the time and date set for submission will be returned unopened.

For Information Call: Mary Quinones

Phone No.: (830) 221-4389

Fax No.: (830) 608-2112

(NO collect calls, Telegraphic, Email, On-Line or Fax offers accepted)

Email [mquinones@nbtexas.org](mailto:mquinones@nbtexas.org)

5% Proposal Bond Required: ☐ YES ☒ NO (If YES, See Para 4(d) of Terms and Conditions)

100% Performance Bond Required: ☐ YES ☒ NO (If YES, See Para 4(d) of Terms and Conditions)

## OFFER (Must be fully completed by offeror)

Offeror's State of Residence: Texas (See Para. 6(f) of Terms and Conditions)

Pre-Proposal Conference on September 21, 2012 at 9:00 am. in Parks Admin Office. 100 Golf Course Rd. New Braunfels, TX 78130.

Prompt Payment Terms: \_\_\_ % Discount if paid within \_\_\_ days.

In compliance with the above, the undersigned offers and agrees to furnish any or all items or services awarded at the prices stipulated for each item delivered At the designated point(s) and within the time specified herein. Award shall include all solicitation documents and attachments.

FOR INFORMATION, CONTACT THE PERSON ABOVE.

MANUALLY SIGN ALL COPIES SUBMITTED. SIGNATURE IS MANDATORY.

\*Submit Signed Offers in Triplicate Original\*

Proposer E-Mail Address: [ecoborny@bio-west.com](mailto:ecoborny@bio-west.com)

Name BIO-WEST, Inc.  
And 1812 Central Commerce Court  
Address Round Rock, Texas 78664  
of Offeror

Name and Title of Person Authorized to Sign Offer (Type or Print):  
Edmund L. Oborny, Jr.  
Principal

Signature *Edmund L. Oborny Jr.*

Date: 9-26-12

Phone No.: (512) 990-3954

Fax No.: (512) 990-5153

Name, Address and Telephone No. of Person authorized to conduct negotiations on behalf of Offeror. (Applies to Request for Proposal only)

## AWARD (To be Completed by CITY)

Contract #  
NB 13-011

Awarded as to item(s):  
A11

Contract Amount:  
\$130,772.00

Vendor Code #:

Delivery Date or Term of Contract:  
December 31, 2013

Remarks: This contract incorporates the RFP, attachments and contractor's response.

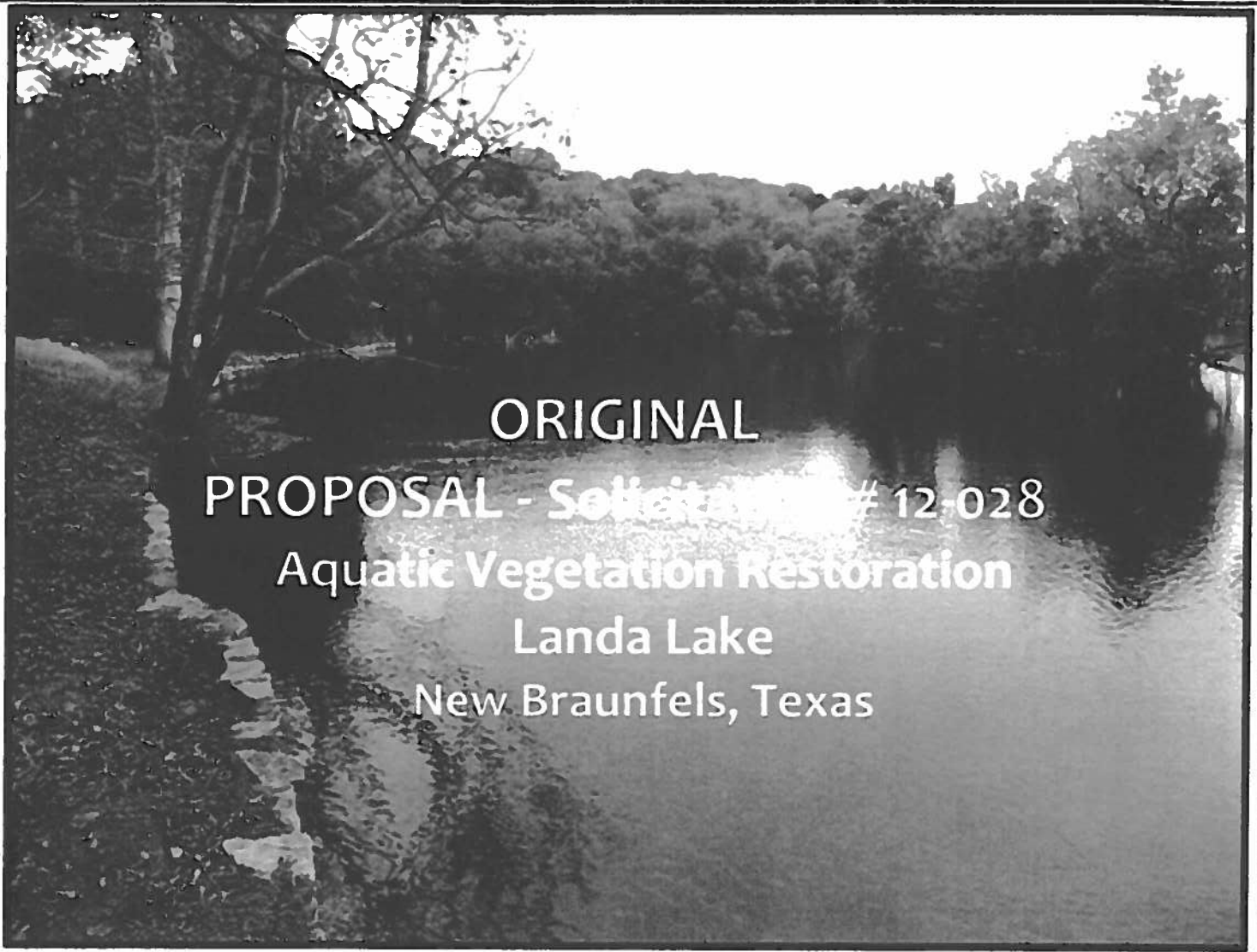
This contract issued pursuant to award made by City Council.

Date: December 10, 2012 Agenda Item No.: 4C

Important: Award may be made  
on this form or by other  
authorized official written notice.

*Michael Morrison*  
Michael Morrison  
City Manager

12-11-12  
DATE



**ORIGINAL**  
**PROPOSAL - Solicitation # 12-028**  
**Aquatic Vegetation Restoration**  
**Landa Lake**  
**New Braunfels, Texas**

**PREPARED FOR:**

**City of New Braunfels**  
**Purchasing**  
**424 S. Castell Ave.**  
**New Braunfels, Texas 78130**



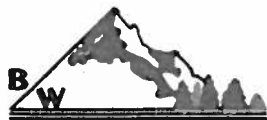
**PREPARED BY:**

**BIO-WEST, Inc.**  
**1812 Central Commerce Court**  
**Round Rock, Texas 78664**

**&**

**Center for Reservoir and**  
**Aquatic Systems Research**  
**Baylor University**  
**Waco, Texas 76798**

**September 27, 2012**



**BIO-WEST, Inc.**

1812 Central Commerce Court  
Round Rock, Texas  
78664-8546  
Ph: 512.990.3954  
Fx: 512.990.5153  
www.bio-west.com

27 September 2012

City of New Braunfels  
Attention: Purchasing Department  
424 S. Castell Avenue  
New Braunfels, Texas 78130

**RE: BIO-WEST, Inc. Proposal for Solicitation No. 12-028**

Dear Reviewer,

Enclosed please find BIO-WEST's proposal and cost estimate to conduct the proposed Aquatic Vegetation Restoration in Landa Lake for the City of New Braunfels. BIO-WEST, Inc. is a multi-discipline, environmental consulting firm specializing in environmental services focused on endangered species and associated habitat. Established in 1976, BIO-WEST conducts research, inventories, and assessments of natural resource systems throughout the United States. The firm is a leader in environmental consulting and problem solving, and has earned a widely acknowledged reputation for providing objective, credible services and superior products to a wide variety of agencies, organizations, and private clients.

BIO-WEST has extensive experience and expertise with the aquatic vegetation and endangered species of the Comal Springs ecosystem. We have had the privilege of conducting comprehensive and critical period monitoring in Landa Lake since 2001. In addition to BIO-WEST's experience, we have enlisted the assistance of Dr. Robert Doyle of Baylor University who is the foremost expert on aquatic vegetation restoration in Landa Lake, with many of the plants he transplanted in the lake back in the 1990s still in good health today. We are excited about this opportunity and feel our team, assembled specifically for this project, has unparalleled experience and expertise that can provide the City with the best services possible in the context of the Habitat Conservation Plan.

We appreciate the opportunity to bid on this exciting project and look forward to hearing from you. If you have any questions or comments concerning our proposal, please contact me at your earliest convenience at the contact information below:

Sincerely,

Ed Oborny

Enclosures

Edmund L. Oborny, Jr.

Principal

BIO-WEST, Inc.

1812 Central Commerce Court

Round Rock, TX 78664

Phone: (512) 990-3954

Email: eoborny@bio-west.com

Environmental  
Analysis  
and  
Permitting

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Fisheries

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Wetlands

Wildlife

## II. Executive Summary

As is evident in the attached proposal, BIO-WEST, Inc. has assembled a project team with extensive experience regarding aquatic vegetation restoration and successful transplant techniques, unmatched familiarity with Landa Lake and technical expertise with the endangered species of the Comal Springs/River. To accomplish this project, BIO-WEST has enlisted the assistance of 1) Dr. Robert Doyle of Baylor University to lead aquatic vegetation restoration efforts, 2) Mr. Tim Osting of RPS Espey to assist with hydraulic modeling, and 3) D&M Owens construction for vegetation removal and disposal as well as any project-related construction activities. Integrated together, the BIO-WEST project team is perfectly suited for assisting the City of New Braunfels with developing and implementing a plan for aquatic vegetation restoration in Landa Lake. Factors that set the BIO-WEST study team apart from the competition include:

- The Project Team's commitment to the community of New Braunfels and health of the Comal River.
- ❖ Over the course of the Variable Flow Study (2000 to present), BIO-WEST has routinely donated time to conduct teacher workshops, student field trips, and even demonstrations for inspiring young artists, through outreach activities in Landa Park.



BIO-WEST in Landa Park - Melissa Fontenot (Upper Left and Lower Right), Ed Oborny (Upper Right and Lower Left)

- ❖ D&M Ownens has been a family run business in the New Braunfels community for over 30 years with a sincere appreciation for the Comal River.

- ❖ Both Mr. Ed Oborny (BIO-WEST) and Dr. Robert Doyle (Baylor) have spent the majority of their careers working with aquatic plants and animals of the Comal ecosystem. We have seen the good times and the not-so-good (droughts and floods), and are dedicated to making this system the best resource it can be for the community.
- ❖ Another community highlight during our tenure has been the cooperative agreement formed with the Comal chapter of the Texas Master Naturalist Program. Since 2006, local volunteers from the Master Naturalist program have participated in weekly data collection activities.
- An extensive knowledge of the aquatic biota and ecological relationships of the Comal River/Springs Ecosystem. BIO-WEST scientists have been conducting continuous monitoring and research related to the endangered species in the Comal System (including Landa Lake) for over 12 years. As a result, study team biologists are acutely familiar with the endangered species and associated aquatic vegetation within the project area.
- ❖ BIO-WEST has mapped aquatic vegetation and sampled for fountain darters via drop net, dip net, and SCUBA in Landa Lake at least twice a year since 2001.
- BIO-WEST contributed significantly to the development and writing of the HCP.
  - ❖ BIO-WEST developed the biological goals for the Habitat Conservation Plan which include the aquatic vegetation restoration goals (Table 4.6 of the HCP specifically referenced in the RFP).
  - ❖ BIO-WEST used the Variable Flow Study aquatic vegetation mapping and 2009 River Systems Institute mapping described in the RFP to write the HCP Chapter on estimated take in the HCP relative to aquatic habitat and the fountain darter.
- Dr. Robert Doyle (Director of the Center for Reservoir and Aquatic Systems Research at Baylor University) is the foremost expert in aquatic vegetation restoration in the Comal and San Marcos rivers. Dr. Doyle mapped the entire Comal River aquatic vegetation in the late 1990s and he and his students subsequently conducted numerous experimental plantings in the Comal system with the majority of the aquatic vegetation they restored in Landa Lake still present in the system today.
- BIO-WEST has all the necessary federal and state endangered species permits to begin this work immediately upon award.
- Unparalleled scientific integrity. Both, Dr. Doyle and Mr. Oborny are active members of the Southern Edwards Aquifer Species Recovery Team.

Finally, BIO-WEST clearly understands the vital importance of Aquatic Vegetation Restoration in the context of the HCP. Many assumptions were made regarding the development of the flow regime for the Comal System that was incorporated into the final HCP. The uncertainty embedded in those assumptions is the very reason that so much applied research and restoration is being conducted during Phase 1 of the HCP. During Phase 1 and beyond, the Aquatic Vegetation Restoration in Landa Lake is vital to provide the protection necessary to support the species while questions and uncertainty are being addressed. As such, a well defined workplan, scope of work and associated \$154,100 budget was assigned to the 2013 Landa Lake aquatic vegetation restoration effort. BIO-WEST thoroughly understands the EARIP approved scope and budget. As discussed on the Old Channel proposal, this is simply NOT a project that someone can come in, tear out some vegetation, re-plant some vegetation, bid half or two-thirds the price to pretend it is a cost savings and meet the intent of the HCP. The high profile nature and critical importance to the fountain

darter and Comal Springs invertebrates in Landa Lake requires highly qualified professionals, careful design and implementation, and understanding and achieving the level of intent of the HCP.

The BIO-WEST project team meets these qualifications and because of our intimate knowledge of the HCP and presence in the Comal system, we can legitimately provide cost savings as follows. Our bid to conduct this project as a stand-alone project and meet the intent of the HCP is \$145,622. The reason we are under the \$154,100 approved budget is that as part of the Variable Flow Study we will already be mapping the aquatic vegetation in the entire Comal system in January 2013, so we can use that data rather than conduct a separate vegetation assessment as outlined in the RFP. Additionally, our same project team bid on the Old Channel Restoration project (RFP 12-026) and with D&M Owens as the prime, also bid on the Sediment Island removal project (RFP 12-033). Those two projects along with this Aquatic Vegetation Restoration in Landa Lake (RFP 12-028) require detailed planning, vegetation cultivation, extensive field efforts and subsequent monitoring. All these activities have costs that if combined allows for efficiency in project management, travel, supplies, and resources. As such, should the BIO-WEST project team be awarded all three projects, a cost savings of nearly \$55,000 collectively is possible.

We are pleased to submit this proposal and cost estimate to the City of New Braunfels. It will become evident as you explore this proposal that project team personnel have extensive experience and expertise in aquatic vegetation restoration and the ecology of the Comal River System. Examples of relevant experience are included along with an overview of the proposed technical approach. Information on key team members is included and costs are detailed by task in the proposal pricing.



**ABOVE** - Melissa Fontenot (BIO-WEST) showing area middle school teachers the differences between native and non-native aquatic vegetation of Comal Springs.



### III. DEGREE OF COMPLIANCE

All services quoted in this proposal are in full accord with the general requirements of the RFP (12-028). The BIO-WEST project team has all the resources necessary to perform the services outlined in the RFP.

### IV. PROPOSAL PRICING

The total costs for the 2013 Aquatic Vegetation Restoration in Landa Lake as described in RFP (12-028) and consistent with the level of effort and intent of the approved EARIP workplan is \$145,622. As described in the Executive Summary, it is important to note that BIO-WEST was heavily involved in the development of the biological goals (that provide the foundation for the Habitat Conservation Plan [HCP]), subsequent preparation of the HCP and associated mitigation and applied research measures. As such, BIO-WEST is thoroughly familiar with the questions being asked and the level of work necessary to meet the intent of the approved EARIP workplans and budgets. Other bidders may considerably under bid the approved \$154,100 EARIP workplan budget for this specific effort, not truly understanding the intent of the EARIP workplan and critical nature of this project. A detailed cost breakdown designed to meet the needs of the HCP is presented on the following page.

The costs have been divided into five primary tasks including 1) Project Management, Meetings, Work Plan and Reporting, 2) Vegetation Assessment, Modeling, and Design; 3) Vegetation Cultivation; 4) Removal, Re-vegetation, Channel adjustments, and 5) Monitoring and Aquatic Gardening. Details are provided in the General Methodology discussion in the next section.

As described in the Executive Summary, the BIO-WEST project team can legitimately provide cost savings as follows. The reason our bid is under the \$154,100 approved budget is that as part of the Variable Flow Study we have mapped the Landa Lake study reach *6 times since 2009 (most recently in a few weeks - October 2012)* and will already be mapping the aquatic vegetation in the entire Comal system in January 2013. As such, both complete data sets will be available in early January so we can use that data rather than conduct a separate vegetation assessment as outlined in the RFP. Additionally, our same project team bid on RFP 12-026, RFP 12-028, and RFP 12-033 all of which require detailed planning, vegetation cultivation, extensive field efforts and subsequent monitoring. All these activities have costs that if combined allows for efficiency in project management, travel, supplies, and resources. As such, should the BIO-WEST project team be awarded all three projects, a cost savings of nearly \$55,000 collectively is possible.



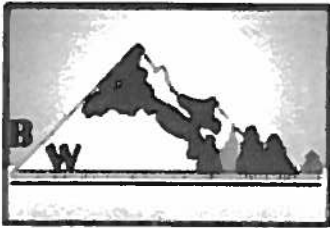
# Detailed Cost Breakdown by Task.

RFP - 12-028 Aquatic Vegetation Restoration - Landa Lake								
Position	Rate	Project Management, Meetings, Work Plan, Reporting (Task 1)	Vegetation Assessment / Modeling / Design (Task 2)	Vegetation Cultivation (Task 3)	Removal, Re-vegetation, Channel (Task 4)	Aquatic Gardening / Monitoring (Task 5)	Total Hours	Cost
Project Principal	136.23	28	12	12	24	6	82	\$ 11,170.86
Landscape Architect	136.23	26	4	24	48	16	118	\$ 16,075.14
Senior Engineer	145.73	12	12		36		60	\$ 8,743.80
Senior Researcher	105.18	26	20	46	72	16	180	\$ 18,932.40
Senior Plant Ecologist	95.42	18	16	38	90	48	210	\$ 20,038.20
Senior Ecologist	92.34				36		36	\$ 3,324.24
Ecologist / GIS specialist	87.80	4	12		36		52	\$ 4,565.60
Aquatic Technicians	59.03				240		240	\$ 14,167.20
Administrative	55.25	32					32	\$ 1,768.00
Technician I	43.27			40	240	120	400	\$ 17,308.00
Technician II	26.42			22	240	120	382	\$ 10,092.44
Total Labor		146	76	182	1,062	326	1792	126,185.88
TRAVEL								
Per diem / Travel / etc.		50	425	650	3,875	1,050		\$ 6,050.00
Mileage (\$.555 per mile)	0.555	225	175	1,300	2,400	650	4750	\$ 2,636.25
Total Travel								\$ 8,686.25
OTHER DIRECT COSTS:								
Equipment				4,500	3,500	475		\$ 8,475.00
Supplies		15	10	425	1,025	525		\$ 2,000.00
Phone / Fax / Copies		65	50	50	55	55		\$ 275.00
Total Other Direct Costs		\$ 80	\$ 60	\$ 4,975	\$ 4,580	\$ 1,055		\$ 10,750.00
Total Estimated Cost							Total	\$ 145,622.13
	Subtasks	15,931.50	9,194.49	22,027.06	78,380.44	20,088.65		
	TASKS							\$145,622.13



## V. DESCRIPTIVE LITERATURE

### PROJECT TEAM



**BIO-WEST, Inc.**

BIO-WEST, Inc. is a multi-discipline, environmental consulting firm with a permanent core staff of senior level scientists and an experienced support staff. Established in 1976, BIO-WEST conducts research, inventories, and assessments of natural resource systems throughout the United States. The firm is a leader in environmental consulting and problem solving, and has earned a widely acknowledged reputation for providing objective, credible services and superior products to a wide variety of agencies, organizations, and private clients. BIO-WEST strives to maintain an outstanding reputation for fisheries, aquatic

vegetation, and endangered species investigations throughout the United States. BIO-WEST has extensive knowledge of the aquatic biota and ecological relationships of the Comal River/Springs ecosystem as they have conducted continuous monitoring and research related to the endangered species in the Comal System for over 12 years. This includes extensive work in Landa Lake and immediate project area. Finally, BIO-WEST has all state and federal endangered species permits necessary to conduct this work upon award.



the focus for almost four decades has been on understanding the basic scientific principles that control the structure and function of aquatic environments. Dr. Robert Doyle is the Director of the CRASR and he and his students continue to explore novel ideas and creative techniques to maximize aquatic vegetation restoration in spring ecosystems.

The Center for Reservoir and Aquatic Systems Research (CRASR) is a research and education partnership

between Baylor University and the City of Waco focused on aquatic resources. This Center is a natural outflow of many years of collaboration between these institutions as over the years Baylor and the City have each developed significant water-related expertise and capabilities. At Baylor,



D&M Owens, Inc. has been in the construction industry for over thirty eight years. Established by David Owens Sr. and wife Mary in 1972, D&M was soon known in New Braunfels and the surrounding areas for their quality workmanship and excellent reputation. D&M Owens, Inc. specializes in a wide variety of commercial and residential construction services which include site

work, excavation, detention and sedimentation ponds, underground storm drainage systems, asphalt paving, concrete curbing, and flat work. D&M is equipped with a Topcon HiPerlite GPS System which ensures the accuracy of elevations and jobsite layout as per engineered plan specifications. D&M has the equipment and personnel to handle a wide range of construction projects. D&M now employs approximately twenty five employees. D&M believes that the keys to success are strong faith, determination, honesty, and family support.

Additionally, BIO-WEST has enlisted the services of Mr. Tim Osting (RPS-Espey Consultants) who specializes in 2-D hydraulic modeling associated with designing environmental restorations projects. BIO-WEST has worked in close association with Mr. Osting to conduct water quality modeling in Landa Lake, and jointly to conduct 2-D hydraulic modeling to evaluate aquatic habitat on the San Antonio River, Cibolo Creek, and Colorado River. Specific information highlighting key team members experience and expertise are provided in the Key Team Members section below and attached resumes.

## GENERAL METHODOLOGY

As shown in the cost estimate, the project has been divided into five primary tasks including 1) Project Management, Meetings, Work Plan and Reporting, 2) Vegetation Assessment, Modeling, and Design; 3) Vegetation Cultivation; 4) Removal, Re-vegetation, Bed adjustments, and 5) Monitoring and Aquatic Gardening.

**Task 1** includes all project management, meetings, and reporting associated with the project. Project and task management, and internal and external communication will be critical to ensure coordination amongst on-going EARIP activities. In Landa Lake alone, 2013 EARIP projects will be conducted to repair the culverts to the Old Channel, enhance riffle beetle habitat in spring run 3 and the western shoreline, and to install water quality equipment for continuous monitoring. The BIO-WEST project team is very familiar with the scope and schedules of each of these activities, as we participated in the development of the mitigation measures for the HCP. Secondly, monthly progress reporting will be provided to the City with each invoice. Monthly progress reports will include summaries of the work accomplished to date, remaining tasks, support anticipated to be required from the City, upcoming activities to be coordinated with other contractors and project activities, and any expected deviations from the work plan. Additionally, when appropriate, progress reports will include results and photographs.

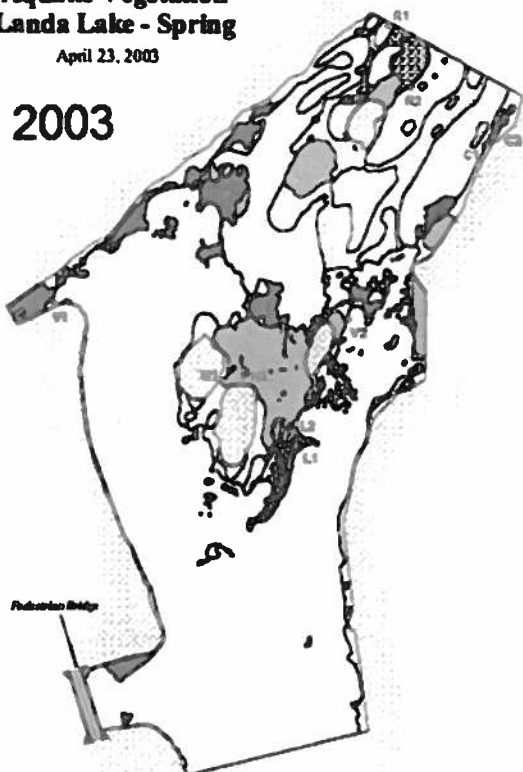
For Task 1, the BIO-WEST project team will also integrate the vegetation assessment and hydraulic model evaluation to be conducted during Task 2 and prepare a work plan for submittal to the City. This initial report will describe the results of vegetation assessment and proposed methodologies for the work plan. Specifically, the work plan will outline the costs and methodologies recommended to remove non-native vegetation and plant native vegetation in its place. The proposed work approach will be submitted to the City of New Braunfels by March 1, 2013.

**Task 2** involves a reassessment of the 2009 full-system vegetation survey as specified in the RFP. In the RFP, on-the-ground activities are proposed for this activity with an associated cost. However, BIO-WEST feels this aspect of the scope can be reduced for the following reasons. Starting in 2001, BIO-WEST has mapped the aquatic vegetation in the Landa Lake Variable Flow Study representative reach 25 times prior to the RFP mentioned 2009 full survey. Subsequent to the 2009 full survey, BIO-WEST has mapped the Landa Lake Variable Flow Study representative study reach 7 times. A sample of aquatic vegetation maps from Spring 2003, 2006, 2010, and 2011 are presented on the next page.



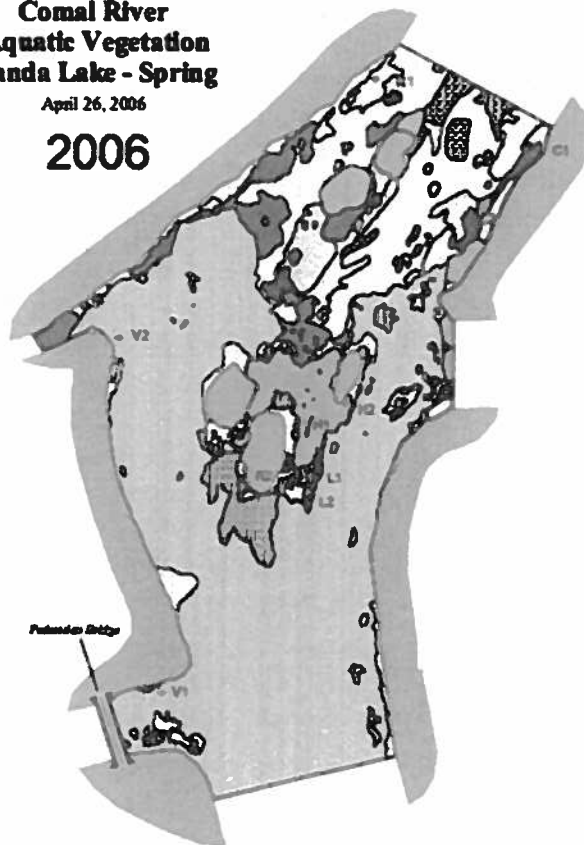
**Comal River  
Aquatic Vegetation  
Landa Lake - Spring**  
April 23, 2003

**2003**



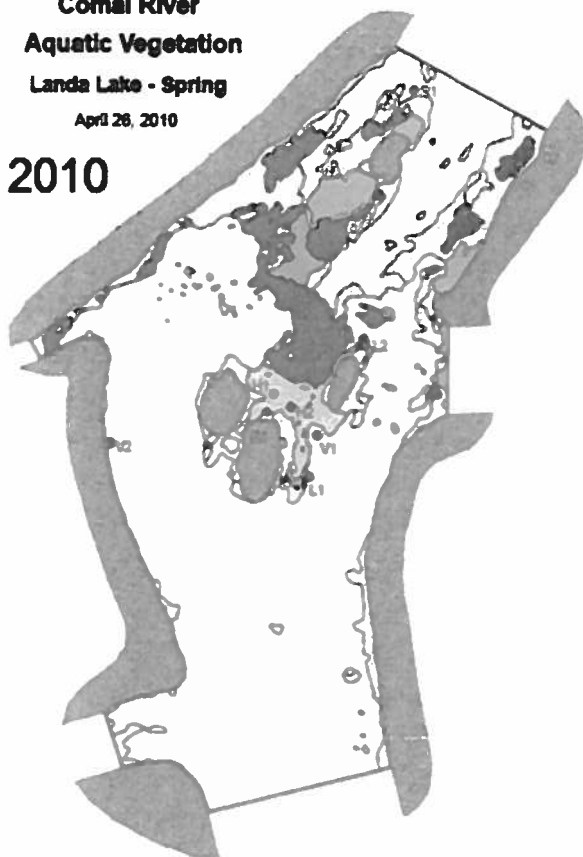
**Comal River  
Aquatic Vegetation  
Landa Lake - Spring**  
April 26, 2006

**2006**



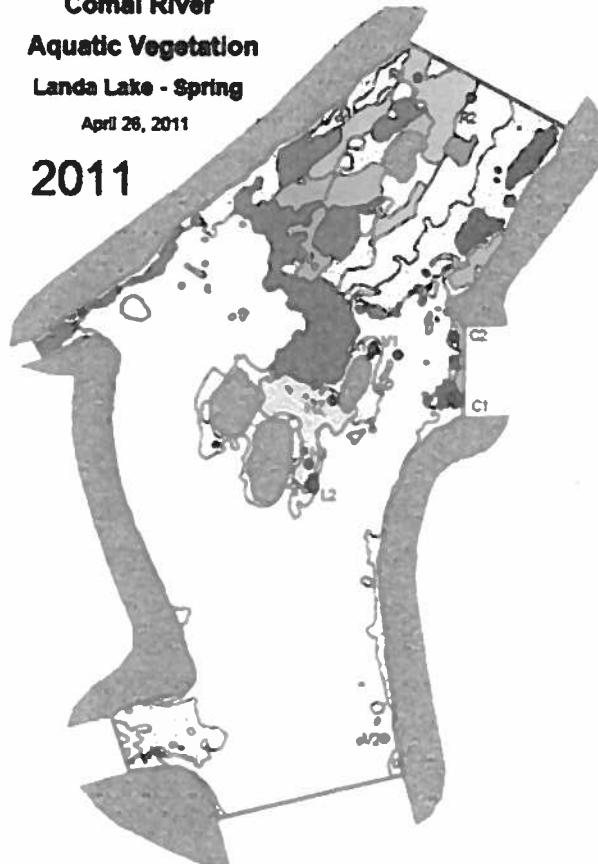
**Comal River  
Aquatic Vegetation  
Landa Lake - Spring**  
April 28, 2010

**2010**

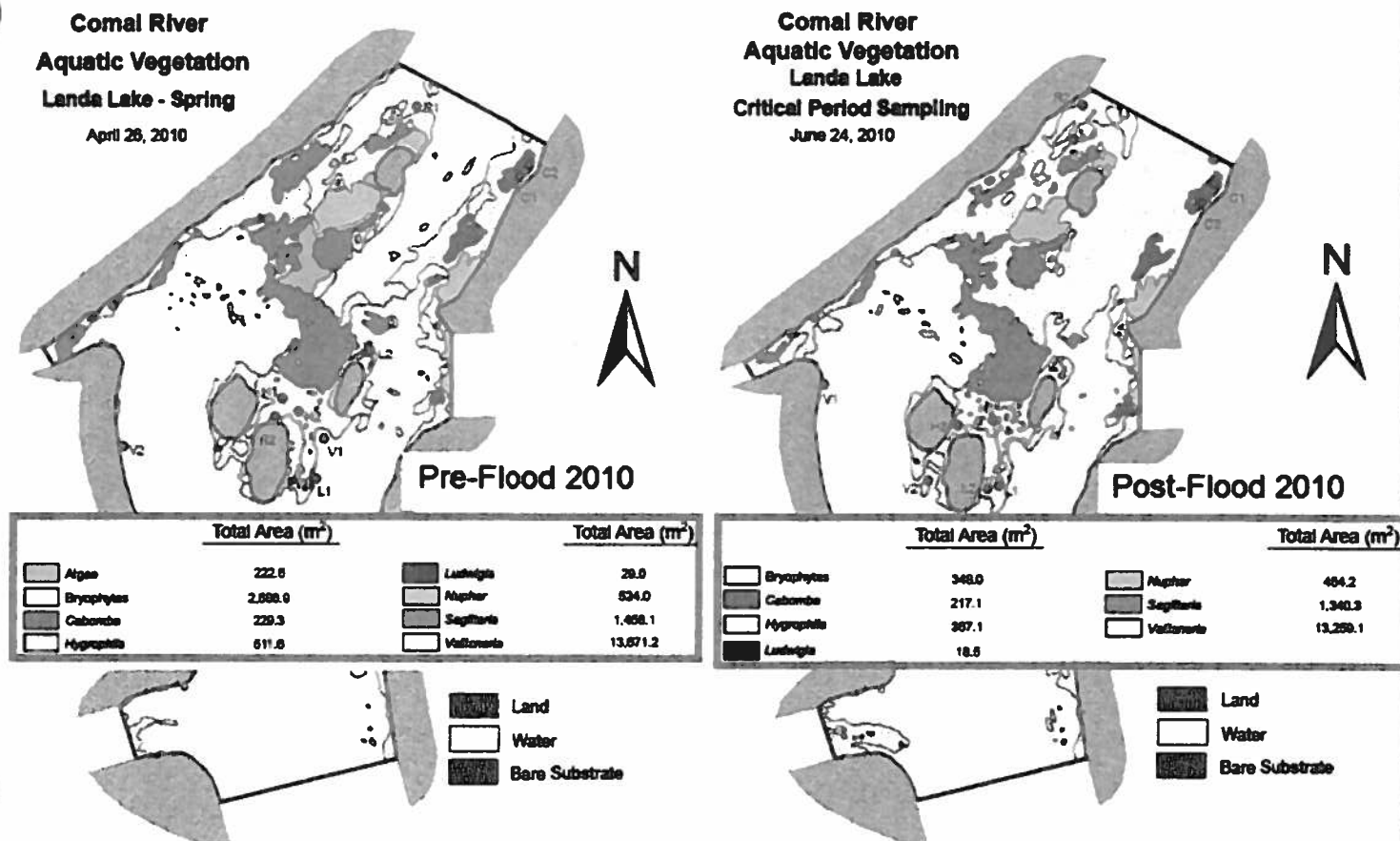


**Comal River  
Aquatic Vegetation  
Landa Lake - Spring**  
April 28, 2011

**2011**



This includes pre- and post-flood mapping in 2010 as shown below.



Finally, starting January 1, 2013, BIO-WEST will be mapping the aquatic vegetation in the entire Comal system as per the Variable Flow Study. As the contractor for that effort, we will remap the slough arm near the Golf Course and have updated maps for use at no cost to this project in early January. As such, no additional on-the-ground activities are proposed for the reassessment of aquatic vegetation per the RFP.

Task 2 will also include a hydraulic model evaluation of the project area using the 2-D hydraulic model to be provided by the Meadows Center for Water and the Environment. As discussed throughout this proposal, BIO-WEST is extremely familiar with the hydraulics of Landa Lake through our work investigating restoration opportunities in the Comal system as well as in our assisting the preparation of long-term biological goals and mitigation measures for the HCP. Additionally, Mr. Osting is an expert in 2-D hydraulic modeling and has conducted this very modeling for numerous complex instream flow studies in Texas. As such, Mr. Osting will be able to smoothly use and update to the degree necessary, the original 2-D modeling developed for the EARIP. The focus of the hydraulic modeling will be to assess the depth, velocity and substrate conditions of Landa Lake in a means of understanding where to plant certain aquatic vegetation types based on their habitat requirements. *Contractors not familiar with the system, will most likely leave out one of the most critical uses of the model. As the Landa Lake reach is predominantly covered with Vallisneria, a key aspect will be identifying velocity shelters or pockets within the Vallisneria suitable for the establishment and protection of certain types of aquatic vegetation (bryophytes, Cabomba, etc.) that are highly utilized by the fountain darter.*

BIO-WEST will use the existing Fall 2012 aquatic vegetation map of the Landa Lake Variable Flow study and update to the slough in January 2013 (both conducted under separate contract thus, reducing costs) and the hydraulic model evaluation to develop the work plan described in Task 1. Careful planning, a series of project team scoping meetings, and detailed landscaping plans are envisioned as this step is critical to the success of the overall project.

**Task 3** involves obtaining and providing the necessary plant material for restoration activities in Landa Lake. As previously mentioned, Dr. Doyle through his continued research over the years at the USACE Lewisville Aquatic Vegetation Station; University of North Texas Aquatic Laboratory; and presently as Director of Baylor University's Aquatic Vegetation Laboratory is the foremost expert on aquatic vegetation restoration in spring ecosystems. Coupled with his extensive experience and working history specifically in Landa Lake, Dr. Doyle will serve as Principal Researcher relative to design and restoration activities. However, prior to restoration, the source material for the project must be available. As described in the RFP, a couple of local sources (USFWS NFH&TC and Texas State) are available for purchasing aquatic vegetation. We concur that this is a viable option for some of the source material, but in Dr. Doyle's opinion, purchasing material is not the most efficient or effective way to accomplish a project of this magnitude. Ms. Rachel Bormann and Dr. Doyle just finished several years of work on establishment of native aquatic plants in the San Marcos River. For the vast majority of their work, they initially established propagules in the greenhouse at the USFWS NFH&TC in San Marcos. Although these techniques worked well, they were very labor-intensive. In addition, Dr. Doyle believes that the initial establishment of propagules in the low-flow environments of the recirculating tanks in a greenhouse or within ponds produces propagules that may be sub-optimally adapted for survival and expansion under field conditions. Specifically, he felt that the long "stringy" propagules (see picture to right) of *Heteranthera* and *Ludwigia* which were produced were not well-adapted for the flowing water conditions into which they were planted. Additionally, the *Sagittaria* plants cultured off-site were robust, but always emergent (picture below). When planted in deeper areas of flowing water, the emergent leaves were not advantageous to these plants. Another



consideration for culturing in the greenhouse of the USFWS NFH&TC and especially at Texas State University is the need to quarantine any plant materials brought from the field and especially anything brought from the Comal River. This has been accomplished for many years at the NFH&TC so we know it is doable but with an associated expense.

Therefore, as part of the Landa Lake restoration project, our goal is to develop in-situ culturing racks directly in Landa Lake. Racks will be constructed and put in areas of the lake currently devoid of vegetation (to eliminate impacts on plants currently in the river). Pots will be secured and it is anticipated that viable propagules will be cultured within 2-3 months. Pre-culturing under flow and light conditions approximately similar to where plants will be planted has the advantage of increasing initial survival and enhance short-term expansion once planted in the lake. In addition, this eliminates the need for quarantine and allows for culturing of more genetically diverse propagules. For the Landa Lake restoration, all vegetation types excluding *Ludwigia* will be grown or harvested for use within the Comal system. As *Ludwigia* is



limited in the system at present time, it will be purchased and brought in for cultivation from the NFH&TC. BIO-WEST has a long-standing working relationship with the NFH&TC and has secured *Ludwigia* plants to be used to supplement seed stock for restoration efforts. The number of plants to be purchased will be determined during the work plan development phase. However, all seed stock will be from original Comal springs populations following NFH&TC quarantine protocol.

**Task 4** starts by thoroughly understanding the importance of aquatic vegetation to the fountain darter. BIO-WEST's long-term monitoring has shown that discharge related impacts to the aquatic community in the Comal system have clearly taken place over the past decade. A specific case-study for the Old Channel was shown in BIO-WEST's Old Channel Restoration proposal. All data discussed in that case study and below was collected by BIO-WEST during the Variable Flow Study. It is exciting how the Variable Flow monitoring program has allowed the determination of these key ecological linkages:

#### **Discharge ---- Aquatic Vegetation ---- Fountain Darter population dynamics**

Through the physical habitat, the fountain darter dynamics can be linked directly to discharge. Discharge is driven by both drought and flooding which have both occurred over the course of the Variable Flow Study. It is also clear from our work that aquatic vegetation is a key indicator. With knowledge of the habitat to fountain darter dynamics linkage, potential impacts to the fountain darter population can be detected early via aquatic vegetation monitoring.

Task 4 involves the active removal of non-native vegetation and subsequent planting of native vegetation within Landa Lake. The RFP specifies four polygons of high priority for evaluation during the vegetation assessment and hydraulic modeling evaluation. These polygons will serve as the foundation for the work but may need adjustment based on all the existing data on aquatic vegetation within Landa Lake. As discussed above, BIO-WEST has mapped the aquatic vegetation in the Variable Flow Study Reach (specific RFP project area) over 30 times since the inception of the study in 2000. This includes 25+ mapping efforts prior to the 2009 mapping referred to in the RFP and again 7 times since the referenced 2009 mapping. As previously mentioned, BIO-WEST played a major role in the development of the long-term biological goals for the fountain darter, which includes the habitat-based goals of aquatic vegetation referenced in the RFP (Table 4-6 of the HCP).

This first-hand knowledge of the HCP goals along with our extensive experience in Landa Lake will allow the BIO-WEST project team to design a restoration pattern to maximize the success of the restoration efforts. The success of the Landa Lake restoration is NOT based on how many plants get taken out or put in, but rather on the creation of habitats that can be protected for the enhancement of the fountain darter. Simply pulling out exotic plants and slapping back in a bunch of native plants does not meet the intent of the restoration. Rather, we propose a carefully thought out plan for establishing high quality fountain darter habitat in a fashion that will allow for continued protection and preservation of this high-quality habitat during all flow conditions.

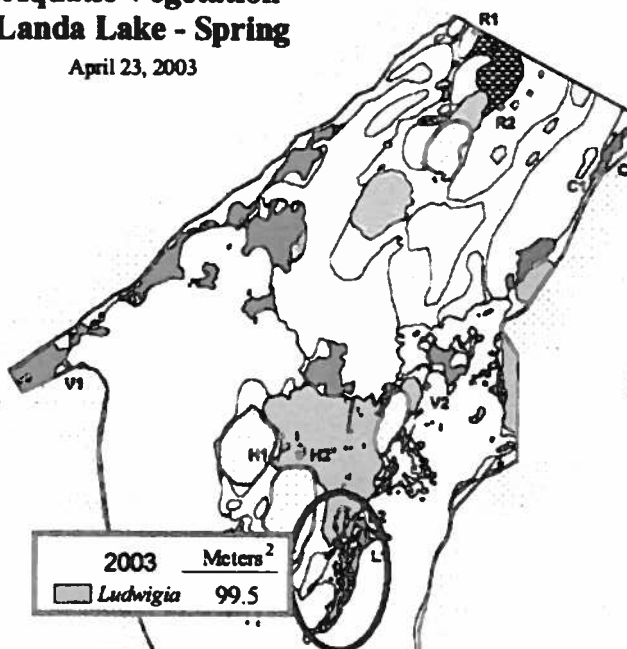
This will involve using the existing configuration of the Lake to create habitat conditions that maximize the success of certain vegetation types. For instance, *Cabomba* needs slower velocity areas with finer substrates to thrive. Areas of the Lake that meet these criteria will be targeted for *Cabomba*. This will include areas along the eastern shoreline as discussed in the RFP, but also potentially in the slough and in the middle of the Lake within pockets of *Vallisneria* beds. Bryophytes are not rooted and thus, restoration and protection of bryophytes will require a design to create velocity shelters within existing vegetation types allowing for pockets of high quality bryophyte habitat. Bryophytes are also carbon dioxide (CO<sub>2</sub>) obligates and thus, placing them near upwellings or high concentrations of CO<sub>2</sub> will be mandatory for their continued health. This is an example of another nuance that most bidders simply



will not know. However, BIO-WEST and Dr. Doyle are aware of these nuances because of our extensive work and experience in the system. Another example will be the replacement of *Hydrophila* with *Ludwigia* in the center portion of Landa Lake. Recognized as a priority site in the RFP, this center area continues to be important habitat for fountain darters within Landa Lake. As a native plant, *Ludwigia* provides better conditions and supports greater densities of fountain darters than does *Hydrophila*. Over the years, the amounts of *Ludwigia* in Landa Lake has dwindled (see figures below) and thus, fountain darter populations have also declined in this section. With the faster than average flow conditions in this middle stretch of Landa Lake, a conscientious design to allow for protection and maintenance of *Ludwigia* in this area will be required.

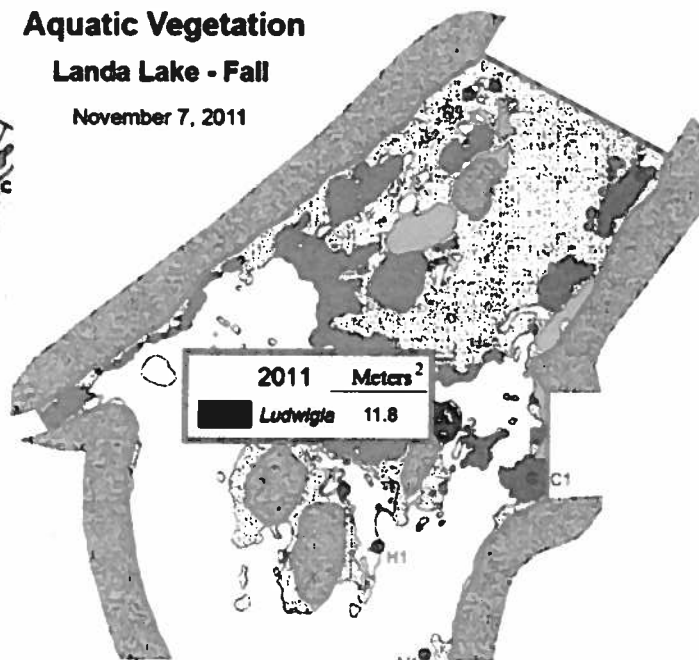
**Comal River  
Aquatic Vegetation  
Landa Lake - Spring**

April 23, 2003



**Comal River  
Aquatic Vegetation  
Landa Lake - Fall**

November 7, 2011



Areas containing vegetation will first be sampled to remove fountain darters and then any vegetation removed will be placed on tarps adjacent to the Lake (or on one of the islands within the Lake) where permitted biologists will examine plants for fountain darter life stages, including eggs. Additionally, visual searches for Comal Springs riffle beetle adults and larvae will be conducted as floating leaf litter and bryophytes have the potential to house these endangered species as well. Any darters captured will be immediately returned to the lake downstream of the area being restored. Any riffle beetles collected will be returned to the western shoreline. D&M Owens will haul all non-native vegetation to the City of New Braunfels composting facility.

Several additional components are also important to this removal and re-planting effort. First, it is understood that prior to removal activities, the BIO-WEST project team will have to obtain proper Texas Parks and Wildlife Department (TPWD) permits (i.e. Sand and Gravel permit, non-native species), as well as the appropriate City permits to conduct these activities. It is also acknowledged that the work will be conducted under the Nationwide permit for the HCP, so no additional permit will be needed from the USACE regarding sediment removal activities. BIO-WEST already has all necessary state and federal scientific collection permits for the endangered species in the Comal system. It is important that both the fountain darter and Comal invertebrates be covered as bryophytes and leaf litter floating within Landa Lake have the potential to house endangered Comal invertebrates. Additionally, it is understood that this Task is linked to other HCP work items as discussed above, all of which are being completed

under separate contracts. As such, the schedule for Task 4 will be flexible to allow for coordination with those activities. Finally, it is acknowledged that should total Comal discharge fall below 150 cfs, no removal or re-planting activities would be performed.

As specified in the RFP, non-native vegetation removal and replacement with natives will occur simultaneously, but will not involve more than 100ft of Lake bottom being denuded of vegetation at any one time. It is anticipated that some minimal sediment removal and bed configuration will be required to enhance conditions for aquatic vegetation establishment. As such, D&M Owens, who specializes in sediment removal in the Comal River, was added to the BIO-WEST project team. Should any sediment work be necessary, the use of retaining structures such as containment booms, aquatic silt curtains, and/or fencing to collect floating vegetation will be installed as deemed necessary.

**Task 5** involves aquatic gardening to ensure the survival and expansion of transplanted vegetation, as well as subsequent long-term monitoring. As per the RFP, monitoring will assess the reestablishment of non-native vegetation and effectiveness of the native vegetation plantings two weeks after the treatment and then bi-monthly thereafter through 2013. Additionally, maintenance through aquatic gardening will take place as necessary during the monitoring period. This will include but is not limited to removal of invasive non-native plants, removal of dense vegetative mats, removal of trash, and potential modification of substrate if necessary. During the aquatic gardening period it may be necessary to re-plant native vegetation to ensure successful recolonization of plants during 2013.



## VI. CONTRACTOR BACKGROUND INFORMATION

### **Comal and San Marcos Springs Variable Flow Monitoring Program (2001 to Present)**

Beginning in 2001, BIO-WEST contracted with the Edwards Aquifer Authority (EAA) to conduct a multi-year applied research effort with the goal of augmenting the available data on population dynamics of threatened and endangered species in the San Marcos and Comal Rivers/Spring Ecosystems and its relationship to springflow. Over the past 12 years, BIO-WEST biologists have collected and analyzed data on a variety of components within these systems including: aquatic vegetation, exotic species, water quality, Texas wild-rice, fountain darters, salamanders, and invertebrates.



This study incorporates regular quarterly sampling in several locations in the two systems, with flow dependent sampling conducted when the discharge in one or both of the rivers falls below or rises above specified “trigger” levels. The primary goal is to establish baseline data for each of the endangered species’ populations and track habitat usage and population dynamics as spring flow decreases during drought conditions. Specialized techniques such as drop netting, drift netting, in-situ water temperature loggers, and SCUBA surveys, are being used to sample these unique ecosystems.

Through this extensive multi-component monitoring program BIO-WEST personnel have become very familiar with the Comal River/Springs Ecosystem (in particular the Old Channel and immediate project area) and the ecological interactions which influence endangered species and their habitat.



## Comal River Aquatic Vegetation Restoration (1997 to Present)

In 1997, Dr. Robert Doyle was invited by the USFWS to visit the Comal River and provide expert opinion on the die-off of native plants in the Comal River. At the time there was widespread concern about Marisa snail damage to native plants. From that initial visit, a contract from USFWS was obtained that resulted in mapping the aquatic plant communities of both the Comal and San Marcos rivers - a task which resulted in complete vegetation maps of both rivers for 1998, 1999 and

2000. While working at the US Army Corps of Engineer's Waterways Experiment Station and University of North Texas, Dr. Doyle conducted applied research focused on investigating and developing novel ideas about native plant community restoration and enhancement.

Contracted through the USFWS, Dr. Doyle conducted numerous experimental plantings of native species in both the Comal and San Marcos River.



### *Sagittaria platyphylla*

6-12 months

1-6 weeks

Planting day

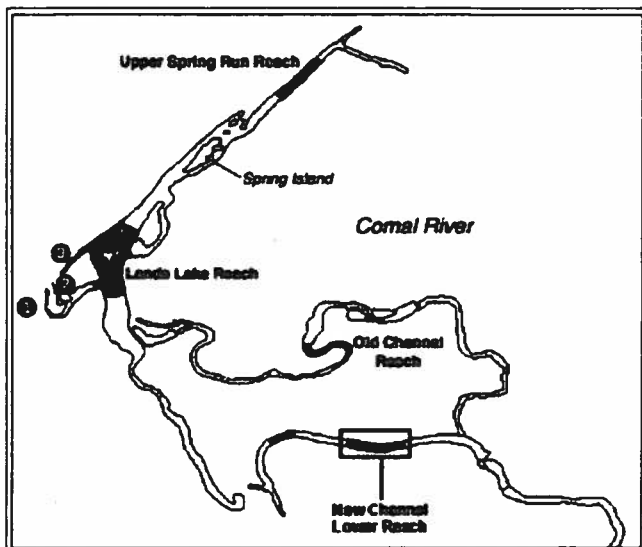
Very large colonies can be established

As the Director for the Center for Reservoir and Aquatic Systems Research at Baylor University, one of Dr. Doyle's key duties is mentoring graduate students who are evaluating new and exciting techniques for establishing native aquatic plant species in spring-fed ecosystems.

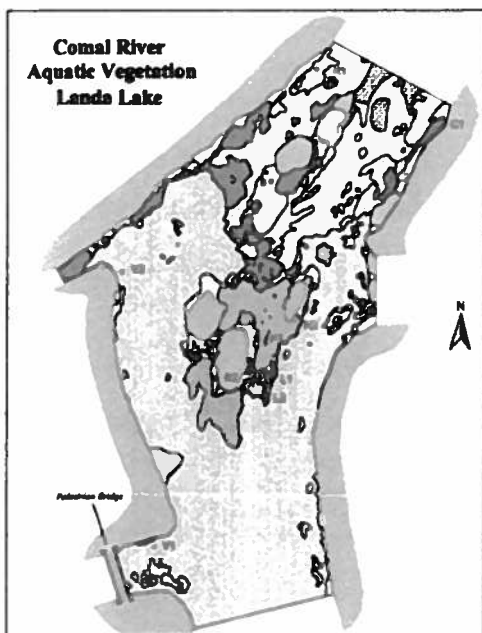
## AQUATIC VEGETATION Mapping

**Objective:** Aquatic vegetation plays a key role in governing the health of spring-fed aquatic ecosystems. Mapping of this resource continues to assist in the evaluation of changes to the system over time relative to physical habitat and organism populations.

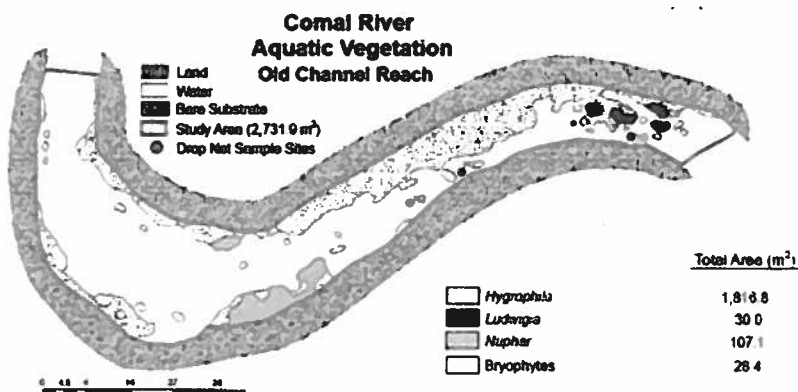
**Location:** Four reaches in the Comal system; three reaches in the San Marcos system.



One fact is clear, the aquatic vegetation in the Comal system is directly related to the health and population of the fountain darter. Certain types of aquatic vegetation provide better cover and food supply than others.



**Data Analysis and Results:** From Fall 2000 through Fall 2012, the project team mapped the same reaches in the Comal and San Marcos systems. Two example figures are presented on this page with figures of the aquatic vegetation observed during each sample effort found in each of the annual reports (BIO-WEST 2002-2011). It is difficult to make sweeping generalizations about seasonal and other trip-to-trip characteristics, since most changes occurred in fine detail; however, overall trends are discussed in each annual report.



A second fact is that native vegetation is preferred to non-native vegetation by the fountain darter.

**Task Description:** Aquatic vegetation mapping was conducted using a global positioning system (GPS) unit with real-time differential correction capable of submeter accuracy. The receiver was linked to a Windows CE device with specialized software that displays field data as it is gathered and improves efficiency and accuracy. The GPS unit was placed in a kayak with the GPS antenna mounted on the bow (see photo at top).



## SPECIAL STUDY

### Aquatic Vegetation Lab Study

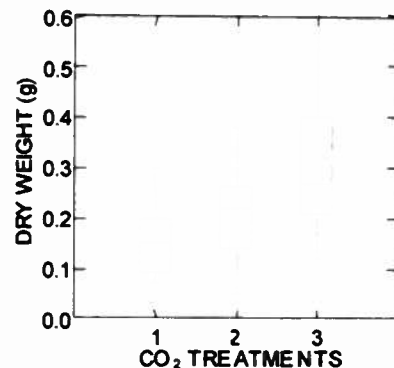
**Objective:** Submerged aquatic vegetation provides extremely important habitat for the endangered fountain darter. Therefore, understanding factors that influence aquatic vegetation growth and reproduction is critical to maintaining fountain darter populations. Objectives of this study were to evaluate the effects of varying spring flows and resulting water quality parameters on the growth of several aquatic plant species which occur in the Comal and San Marcos Rivers, including endangered Texas wild-rice *Zizania texana*.

**Task Description:** This study was conducted in two phases. In Phase 1, *Vallisneria sp.* and *Ludwigia repens* plants in outdoor raceways were exposed to varying flows of Edwards Aquifer water. Under each flow level water quality parameters were closely monitored and growth of both species was measured at the end of the study and compared between treatments. In Phase 2, flow levels and temperature were held constant, and carbon dioxide (CO<sub>2</sub>) concentrations were manipulated between treatments to examine effects on growth of Texas wild-rice, *Ludwigia repens*, *Vallisneria sp.*, *Hydrocotyle umbellata*, *Riccia sp.*, and *Amblystegium sp.*



**Location:** This study was conducted at the aquatic nursery/greenhouse facilities of the San Marcos National Fish Hatchery and Technology Center.

*Zizania* Below Ground Biomass



**Data Analysis and Results:** Results from Phase 1 of this study showed that growth of both aquatic plant species tested were greatest under higher flow conditions, mainly as a result of higher CO<sub>2</sub> concentrations. Therefore, in Phase 2 the impact of CO<sub>2</sub> concentrations were tested. When flow and temperature were held relatively constant most plants exhibited increased growth in the higher CO<sub>2</sub> treatment. In summary, dissolved CO<sub>2</sub> concentrations appear to be important in shaping the aquatic plant communities of the San Marcos and Comal Rivers, and therefore, play an important role in maintaining populations of Texas wild-rice and in maintaining quality habitat for fountain darters.



## Recent Instream Flow Studies using complex 2-Dimensional Hydraulic Modeling to assess aquatic habitat conditions.

Within the last 10 years, BIO-WEST has completed or is presently working on instream flow studies using 2-D hydraulic modeling to assess aquatic habitat conditions in the San Antonio River, Colorado River, Brazos River, Guadalupe River, Cibolo Creek, and the Clear Fork of the Brazos. Many of these efforts have involved collaboration with Mr. Tim Osting of RPS Espey, and thus our confidence is his abilities to use the existing EARIP hydraulic model developed for the Comal River system. A few recent projects are highlighted below.

### *San Antonio River and Cibolo Creek Instream Flow Study*

The San Antonio River Authority (SARA) hired BIO-WEST to conduct a comprehensive instream flow study that integrates biology, hydrology, geomorphology, and water quality concerns within the basin while addressing input from a variety of stakeholders. BIO-WEST and SARA are conducting this study in collaboration with state environmental agencies through the Texas Instream Flow Program (TIFP). Five representative study sites were selected to model aquatic (fish) and riparian habitat under a range of flow conditions. Approximately three years later, a wealth of hydrological, biological, geomorphological, and water quality information has been collected and analyzed in support of the SB2 instream flow study. The impact of various flow regimes on fish habitat were assessed by combining habitat suitability criteria generated for several fish-habitat use guilds with output from a state-of-the-art, two-dimensional hydrodynamic model.



### *Colorado River Flow Relationships to Aquatic Habitat*

The purpose of this project was to determine instream flow requirements necessary to preserve aquatic resources in the lower Colorado River in Texas. The Lower Colorado River Authority contracted BIO-WEST to assess potential impacts/benefits on the aquatic resources with and without a water diversion project and to quantify the condition of the aquatic environment under different flow scenarios to ensure minimal environmental impact of the proposed project. This study integrates biology (aquatic and riparian), hydrology, water quality, and fluvial geomorphology to conduct a comprehensive assessment of water development and instream flow strategies. BIO-WEST conducted field investigations to develop a two-dimensional hydraulic model of habitat availability. These data were analyzed to characterize the flow-habitat and flow-ecological relationships within the lower Colorado River from just downstream of Austin, Texas to the Gulf of Mexico (292 river miles).



## **Recent Stream Restoration Projects involving endangered species throughout the Western United States**

BIO-WEST has completed numerous stream restoration projects throughout the U.S. specific to endangered fishes. We welcome the opportunity to provide more detailed project descriptions, sample work products, and additional client reference information upon request.

### ***Lower Provo River Delta Restoration***

The purpose of the project is to restore, re-create, and enhance the ecological character of the historic Provo River delta and Utah Lake interface to support survival of June sucker. This would be accomplished by developing a new river channel to provide suitable instream habitat and sufficient slope to transport young fish to a developed bay, or delta, at Utah Lake with depths and vegetation cover suitable for June sucker rearing and recruitment. The project is intended to recover the June sucker by re-establishing essential habitat through restoration of the lower Provo River ecosystem to a more natural condition, as has been identified in the June Sucker Recovery Plan. BIO-WEST is under contract with the Utah Reclamation Mitigation and Conservation Commission (Mitigation Commission), the U.S. Department of the Interior's Central Utah Project Completion Act Office, and the Central Utah Water Conservancy District, on behalf of JSRIP, to assist with conceptual designs and the NEPA process for the proposed restoration of the lower Provo River and its Utah Lake interface. 2009–present.

***Client contact:*** Mark Holden, 801.524.3146



### ***Hobble Creek Stream Restoration***

In 2007 the June Sucker Recovery Implementation Program (JSRIP) retained BIO-WEST to develop a stream channel design and perform environmental clearances for the lower Hobble Creek restoration project in Utah County. Efforts for this project involved a 21-acre parcel (owned by the JSRIP) between I-15 and Utah Lake. The primary objective of the project was to restore a naturally functioning interface with Utah Lake that would enable spawning access and provide high-quality rearing habitat for June sucker. Post-construction monitoring indicates that this objective has been met and that fish are now readily accessing the creek to spawn. Modification of the stream channel necessitated a full environmental analysis under NEPA guidelines. Public and agency involvement were included and potential partnerships with local communities and state and Federal agencies were pursued. BIO-WEST's efficient project team helped enable this project to proceed through design, environmental compliance, and construction within a rapid 17-month time period. Under contract with the Central Utah Water Conservancy District. 2007–2008. ***Client contact:*** Michael Mills, 801.226.7132



### ***Bureau of Reclamation Bernalillo and Sandia Rio Grande Restoration***

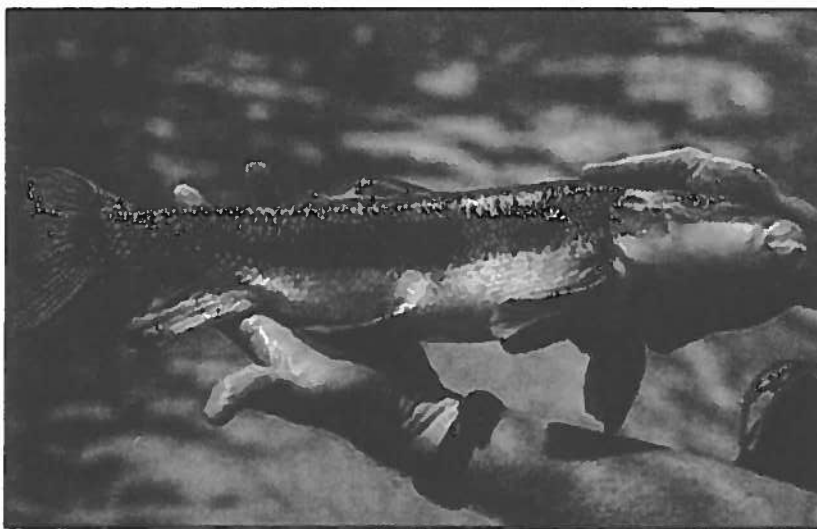


BIO-WEST provided design alternatives and analysis of habitat restoration for the Rio Grande silvery minnow (*Hybognathus amarus*) and southwestern willow flycatcher (*Empidonax traillii extimus*) along an 11-mile reach of the Rio Grande in New Mexico. Alternative analysis, detailed construction plans, and Biological Assessments and Environmental Assessments (EAs) were prepared for two priority sites covering nearly 2 river miles. As required by NEPA, public meetings were held to gather comments on the projects, and these comments were addressed in the Final EAs. The design included additional flood protection for the Rio Grande levee system while restoring channel

dynamics, and riparian and instream habitat for native species, including willow and cottonwood recruitment. Native materials, (e.g., root wads and woody debris piles) were part of the design. The channel was permanently moved away from the levee system by creating a new floodplain. 2005–2006.  
**Client contact:** Nancy Umbreit, 505.462.3599

### ***Provo River Restoration Project (in collaboration with Allred Restoration)***

This project involves design and construction management for a large-scale river restoration project (approximate budget: \$40 million) on the Provo River near Heber City, Utah. Tasks include the following: hydrologic, hydraulic, and geomorphic analyses; restoration design; and construction oversight of a complete floodplain/riparian/aquatic restoration of approximately 10 miles of Provo River, which was straightened and leveed in the 1950s. Tasks also included review of available biological data and



integration of biological conclusions into finished designs, followed by construction oversight to ensure that all aspects of the design were properly incorporated on the ground. The project is one of the premier river restoration projects in the western United States, providing habitat benefits for native fish species and sensitive frog species, as well as recreation and terrestrial habitat benefits. The project restored more than 12 miles of the Provo River and its floodplain. This project provides environmental mitigation for the U.S. Department of Interior's Central Utah Water Project. **Client contact:** Mark Holden, 801.524.3146



## Recent Riparian Restoration and Long-term Monitoring Projects

Additionally, BIO-WEST has completed numerous river/stream/creek restoration projects throughout the U.S. to enhance aquatic and riparian habitat. These projects often involve detailed landscape architect designs and subsequent vegetation establishment to ensure success.

### *Red Butte Creek Oil Spill Restoration Design, Riparian Evaluation*

BIO-WEST is working with EarthFax Engineering to assess and conduct remediation efforts related to the 2010 pipeline leak. Efforts have involved participating in repeat field evaluations of instream contamination levels as part of multiagency assessment teams; evaluating the impacts of the spill and associated clean-up activities on stream channel, physical habitat, and riparian vegetation; participating in post-spill macroinvertebrate monitoring; and developing and implementing site-specific recommendations for weed control, revegetation, and streambank repairs to remedy damage from the spill and cleanup efforts. BIO-WEST also conducted site surveys, developed conceptual designs and revegetation plans, prepared construction documents, and oversaw construction of stream channel and streambank restoration at the immediate spill site. BIO-WEST staff prepared a complete set of construction documents for the spill site.

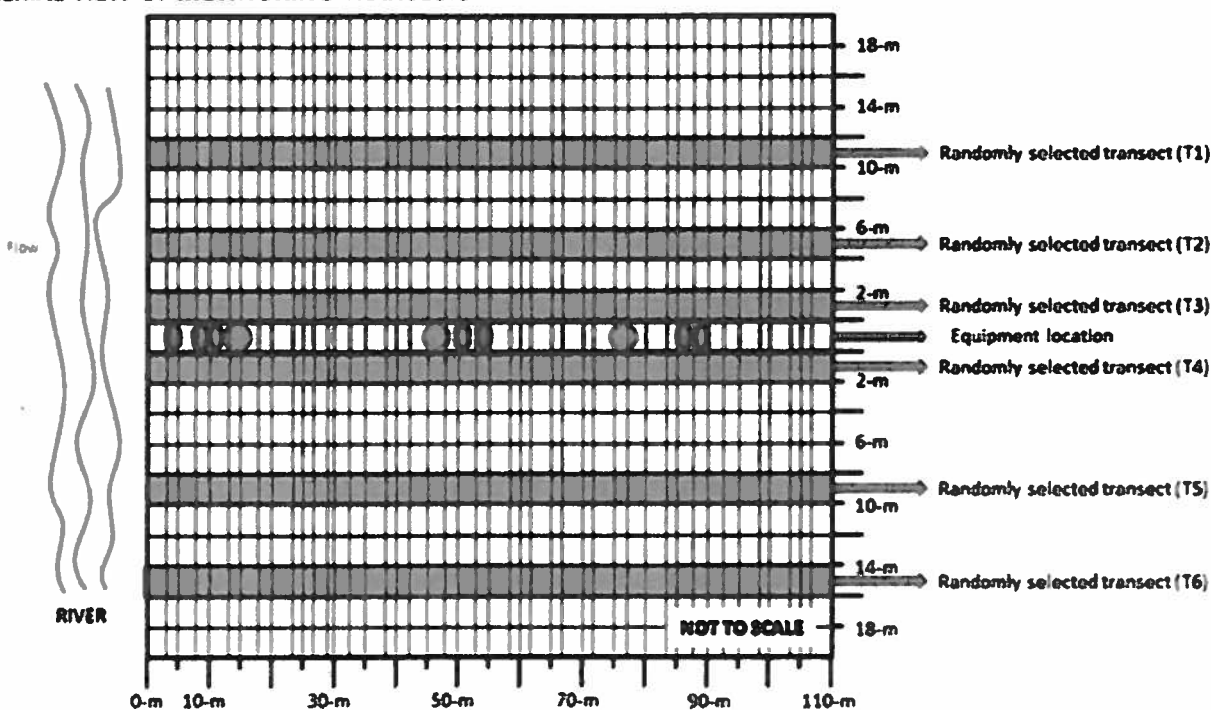
These included project feature layout, grading, erosion control, planting, and irrigation plans and details. Stream channel and streambank design elements included bioengineered bank stabilization, creation of a low floodplain shelf to promote development of diverse herbaceous wetland and riparian shrub habitats, construction of rock weir grade-control structures, and use of deep-aeration techniques to decompact the soil and establish native understory plants in a high-use, shady area. BIOWEST was also responsible for providing construction cost estimates and facilitating contractor bidding and selection.



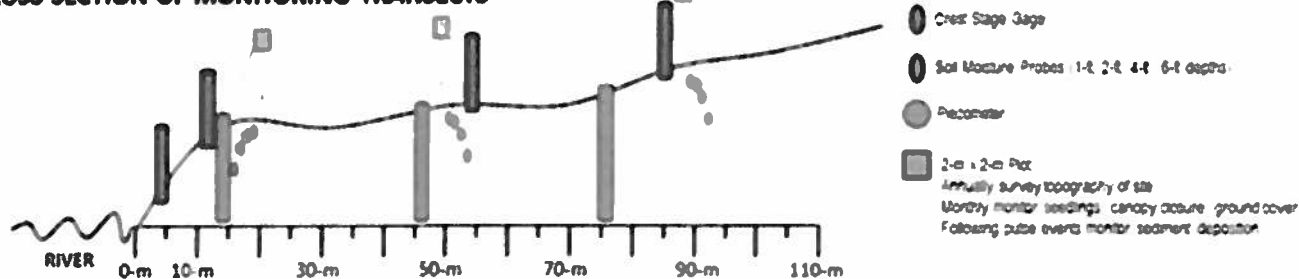
## San Antonio River Riparian Recruitment Study

The San Antonio River Authority (SARA) is currently collaborating with scientists and resource agency personnel to study environmental flows of the San Antonio River. An interim recommendation based on biology, water quality, geomorphology and hydrology components was compiled by the Senate Bill 2 Texas Instream Flow Program (TIFP) study team, SARA, and BIO-WEST in 2011. From that initial work, it was determined that additional information was needed to characterize the riparian communities response to varying flow regimes. Two key problems in identifying the flow needs of riparian trees are the physical and hydrological complexity of this transitional zone in the landscape and the differing germination and growth requirements of the diverse group of taxa that occur in it. In order to enhance the riparian study component, SARA contracted BIO-WEST to monitor seedling recruitment at two sites on the San Antonio River to determine the influence of environmental flows on germination and survival. The extent of inundation of the riparian zone by pulse and overbank flows, in addition to microhabitat characteristics, will be assessed in relation to recruitment areas and seedling survival between spring 2012 through 2014.

### AERIAL VIEW OF MONITORING TRANSECTS



### CROSS SECTION OF MONITORING TRANSECTS

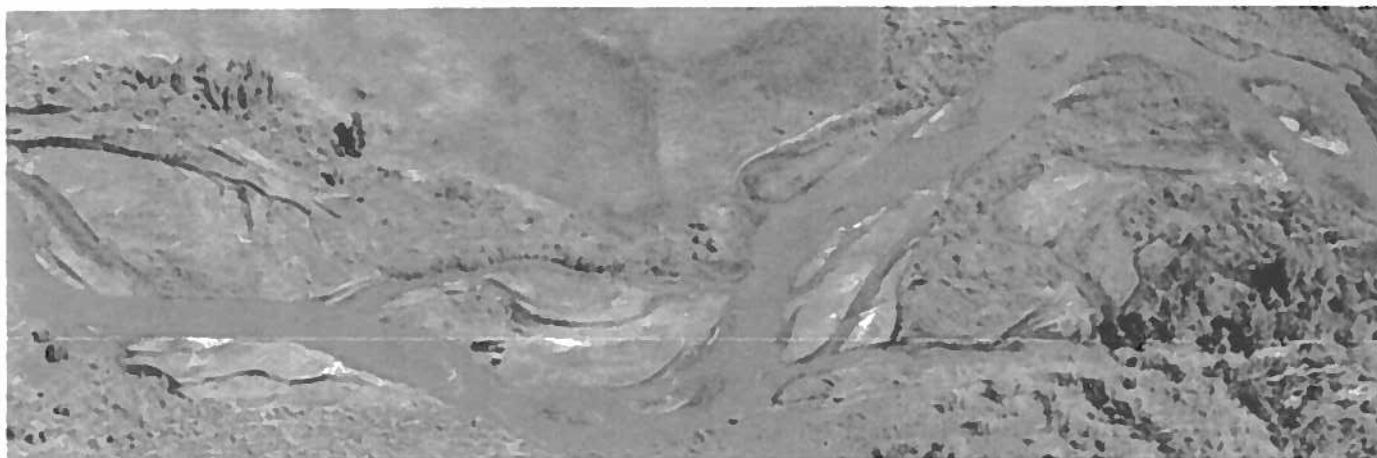




### ***Diamond Fork and Sixth Water Creeks Monitoring***

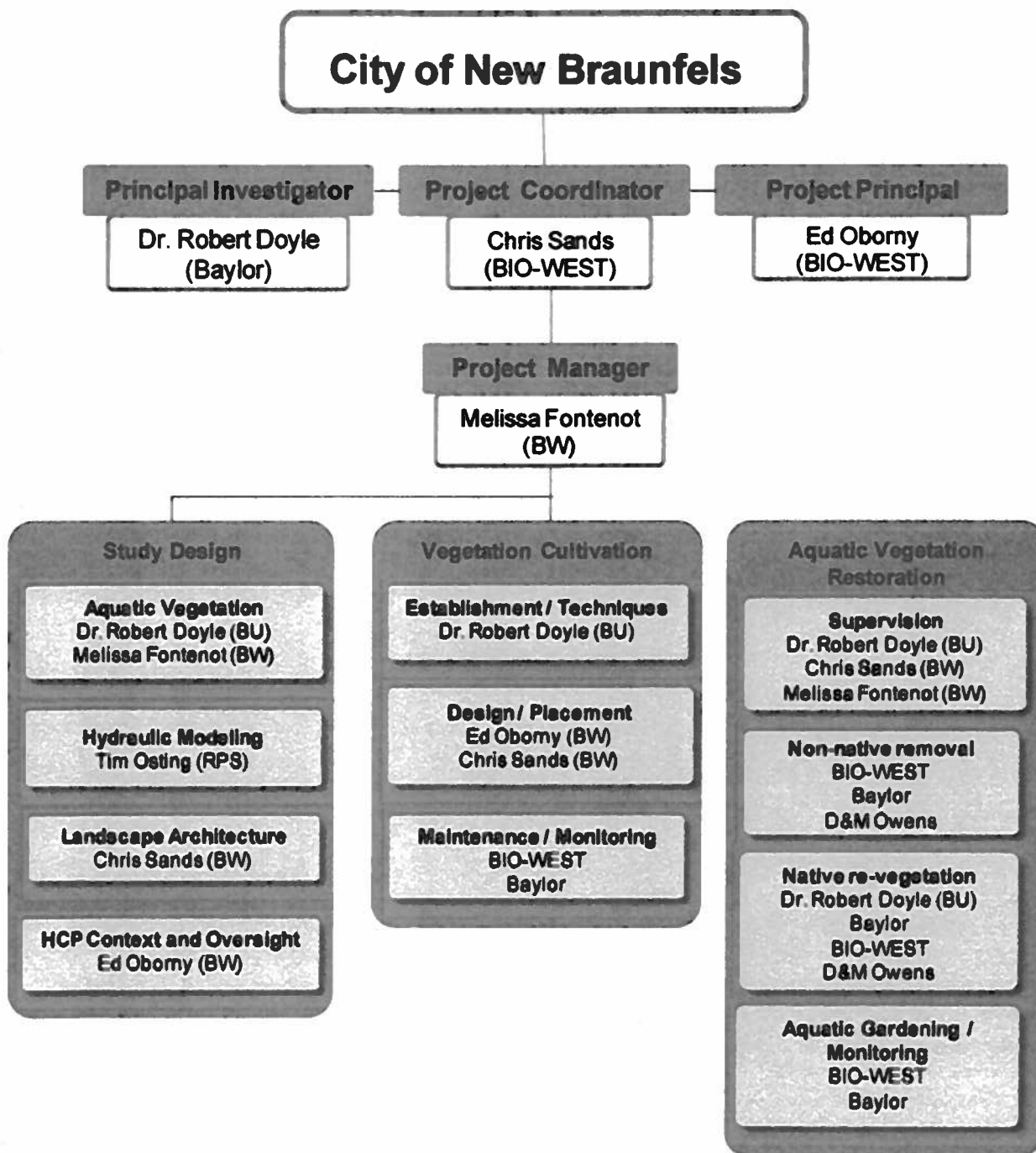
This project involves conducting long-term channel geomorphology, sediment transport, benthic macroinvertebrate, and riparian vegetation monitoring of Diamond Fork and Sixth Water Creeks. Historically, these two streams have been significantly altered by water imports from Strawberry Reservoir and the Central Utah Project. A pipeline was recently constructed to carry excess imported water that was previously conveyed through the Diamond Fork and Sixth Water channels.

The Utah Reclamation Mitigation and Conservation Commission is interested in collecting data on how the channel adjusts to the re-naturalized hydrology to help determine whether active channel restoration efforts will be necessary in the watershed. Specific monitoring activities include: establishing permanent channel monitoring sites/transects; annually surveying channel cross-sections and longitudinal profiles at the monitoring sites; annually mapping channel substrate composition; collecting bedload and suspended sediment samples during the spring runoff period; collecting spring and fall macroinvertebrate samples; and mapping riparian vegetation including monitoring permanent transects across different floodplain surfaces to quantify change in species composition, density, and structure (i.e., habitat) following implementation of the Diamond Fork System. This task also includes monitoring the Ute Ladies'-tresses (*Spiranthes diluvialis*), an endangered plant known to exist along Diamond Fork Creek. Under contract with the Bureau of Reclamation. 2005–present.





## ORGANIZATIONAL CHART



## KEY TEAM MEMBERS

### Dr. Robert Doyle – Principal Researcher



Dr. Robert Doyle currently serves as the Director for the Center for Reservoir and Aquatic Systems Research, Professor, and Department Chair in Biology at Baylor University. Dr. Doyle has nearly 30 years of experience specializing in aquatic plant ecology and community dynamics (year-to-year variability, impacts of disturbance, etc), impacts and control of non-native species (*Hydrilla* & *Hygrophila*), and aquatic vegetation restoration and establishment of native species. Dr. Doyle has worked in the Comal River since the 1990s when he first completed aquatic vegetation maps for the entire Comal

System. Following, that initial mapping Dr. Doyle conducted numerous experimental plantings of native species in both the Comal and San Marcos River. Many of these activities were completed in Landa Lake with the majority of plantings still viable today. Since those initial transplants, Dr. Doyle together with colleagues and students have actively researched the ecology of native and non-native aquatic vegetation as well as transplant methodologies. In 2012, an MS student under Dr. Doyle's supervision completed a 2-year evaluation of techniques for establishing native aquatic plant species in the San Marcos River. Like Mr. Oborny, Dr. Doyle also serves on the USFWS Recovery Team for the endangered species in the Comal ecosystem. Dr. Doyle's extensive knowledge of aquatic vegetation in the Comal River, and unparalleled expertise in aquatic vegetation restoration in spring ecosystems provides an outstanding compliment to the project team.



### Christopher Sands – Project Coordinator

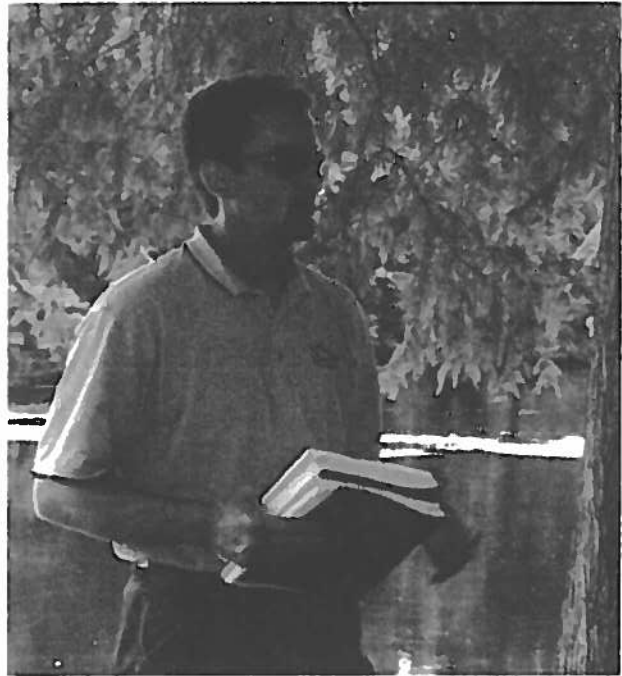
Mr. Sands is a BIO-WEST Principal and serves as project manager, senior planner, landscape architect, environmental analyst, and resource management specialist. He has 24 years of professional experience and holds a M.S. degree in Landscape Architecture and Environmental Planning. Under EARIP directions, Mr. Sands is presently project manager providing third-party assistance to the USFWS and is assisting with the successful publishing of the Environmental Impact Statement associated with the EARIP HCP. Mr. Sands is no stranger to high profile, complex endangered species restoration efforts as six of his recent projects involved stream restoration affecting endangered fish species., including his role as senior landscape architect on the priority site designs for enhancement of endangered Rio Grande silvery minnow (*Hybognathus amarus*) habitat along the Middle Rio Grande; and with design and coordination associated with restoring, re-creating, and enhancing the ecological character of the historic Provo River delta and Utah



Lake interface to increase survival of the endangered June sucker (*Chasmistes liorus*). For that project, Mr. Sands was instrumental in designing a new river channel with suitable instream habitat and sufficient slope to transport young fish to a developed bay or delta at Utah Lake, which has depths and vegetation cover suitable for June sucker rearing and recruitment. Mr. Sands is a Licensed Landscape Architect and his studies emphasize natural resource management and environmental restoration throughout western North America.

### **Edmund L. Oborny, Jr. – Project Principal**

Mr. Oborny is the Fisheries Section Leader and BIO-WEST's Vice-President. He specializes in aquatic ecology, threatened and endangered species, water quality, biological modeling, and instream flow issues and concepts. He has 18 years of professional extensive experience and expertise with fisheries investigations throughout Texas and the western United States. Mr. Oborny has been the project manager and principal aquatic resources investigator for the multi-discipline, multi-year Variable Flows and Water Quality Study for the Edwards Aquifer Authority since its inception. This large-scale applied research project involves intensive sampling, data analyses and interpretation regarding the importance of various flow regimes and associated impacts to the threatened and endangered species of the Comal and San Marcos Springs/River ecosystems.



Mr. Oborny's experience and expertise with complex ecological issues is also illustrated by the number of professional appointments that he has received in the past 5 years. These appointments are listed in their entirety in Mr. Oborny's resume, but are summarized below:

- ❖ **State wide Environmental Flows Science Advisory Committee Member: 2009-present**
- ❖ **Southern Edwards Aquifer Species Recovery Team Member: 2008-present.**
- ❖ **Special Consultant to the Biological Working Group (BWG) in Spring Valley, Nevada: 2007 – present.**
- ❖ **Blue Ribbon Science Advisory Panel Member (Aquatic Resources) in Owens Valley, California: 2009-present.**
- ❖ **Edwards Aquifer Recovery Implementation Program (EARIP) Science Subcommittee Member: 2008-2011.**
- ❖ **Third Party Independent Review of Mono Basin Stream Ecosystem Flows Recommendations: 2009.**
- ❖ **Edwards Aquifer Recovery Implementation Program (EARIP) Biological Modeling Team: 2008 – 2010.**

### **Melissa M. Fontenot – Project Manager**

Ms. Fontenot is a senior level ecologist at BIO-WEST with considerable experience in aquatic and riparian habitat assessment, vegetation monitoring and restoration, and ecological studies. Ms. Fontenot is highly involved in all aquatic vegetation activities associated ongoing long-term variable flow monitoring study on the San Marcos and Comal Rivers. Her focus has been on understanding interactions between native and non-native aquatic vegetation relative to the threatened and endangered species in both systems. Additionally, Ms. Fontenot has conducted aquatic vegetation mapping, monitoring and riparian habitat assessments across Texas from participating in riparian assessments as well as instream flow studies on the lower San Antonio River, Cibolo Creek, Martinez Creek, Salatrillo Creek, lower Colorado River, Hamilton Creek, and the upper Brazos River. Ms. Fontenot maintains professional certifications with the Ecological Society of America and the Society of Wetland Scientists, and has performed ecological studies, native and invasive vegetation surveys, water-quality assessments, wetland delineations, and habitat assessments for multiple projects. Ms. Fontenot is also well-versed in the use of GPS equipment and the principles and techniques of mapping and statistical software.



Currently, Ms. Fontenot is serving as the project manager and principal riparian investigator for a riparian monitoring study in collaboration with the San Antonio River Authority to collect valuable recruitment and growth information for native riparian tree species along the San Antonio River. This study incorporates environmental influences of river flow, pulse flow events, groundwater levels, precipitation, soil moisture, and sedimentation on vegetation within the riparian zone at two locations between San Antonio and the Gulf coast. BIO-WEST is also currently beginning a similar effort to study riparian responses to instream flows along the Guadalupe River. In addition to participating in and managing field data collection efforts, Ms. Fontenot also has considerable expertise in data analysis and report preparation. She has been heavily involved in spatial analysis of aquatic and riparian vegetation datasets to develop relationships between environmental parameters, topography, and vegetation maps. She is also proficient in analysis of ecological data using standard and multivariate statistical techniques.

### **Tim Osting – Senior Hydraulic Modeler**

Mr. Osting is Managing Engineer in the water resources / environmental section of RPS Espey in Austin, TX. His specialties include *multidimensional hydrodynamic modeling*, hydrology, water quality evaluation and modeling, habitat modeling, river-floodplain and riparian area interaction, GIS analysis and hydrographic field studies utilizing state-of-the-art, high-resolution data collection equipment. Mr. Osting has worked exclusively with BIO-WEST on several contracts involving these specific duties, and most recently assisted BIO-WEST with a detailed examination of the flow, water quality, and aquatic habitat dynamics of the Old Channel and Landa Lake.



## BIO-WEST REFERENCES

REFERENCES	
Edwards Aquifer Authority 1615 N. St. Mary's Street San Antonio, Texas 78215	Rick Illgner – Research Coordinator Phone: (210) 222-2204 Email: <a href="mailto:rillgner@edwardsaquifer.org">rillgner@edwardsaquifer.org</a>
Lower Colorado River Authority 3700 Lake Austin Blvd. Austin, Texas 78767	Leah Manning – Project Manager Phone: (512) 473-3589 Email: <a href="mailto:leah.manning@lcra.org">leah.manning@lcra.org</a>
San Antonio River Authority PO Box 839980 San Antonio, Texas 78283-9980	Steve Raabe – Director of Technical Services Phone: (210) 302-3614 Email: <a href="mailto:sraabe@sara-tx.org">sraabe@sara-tx.org</a>
Texas Parks and Wildlife Department Resource Protection, River Studies Program Aquarena Center, The Landing San Marcos, TX 78666	Kevin Mayes – Senior Aquatic Biologist Phone: (512) 754-6844 Email: <a href="mailto:kevin.mayes@tpwd.state.tx.us">kevin.mayes@tpwd.state.tx.us</a>
U.S. Fish and Wildlife Service National Fish Hatchery and Technology Center 500 E. McCarty Lane San Marcos, Texas 78666	Tom Brandt – Supervisor Phone: (512) 353-0011 ext. 224 Email: <a href="mailto:Tom.Brandt@fws.gov">Tom.Brandt@fws.gov</a>

Evaluation Criteria	Max point value	BIO-WEST / Baylor Highlights	Score
Experience with aquatic vegetation restoration, including non-native vegetation removal and re-vegetation projects. Experience with vegetation establishment monitoring.	15	BIO-WEST project team scientists have worked with aquatic vegetation and endangered species in the Comal system since the 1990s. Dr. Doyle has extensive experience with aquatic vegetation restoration in the Comal and San Marcos rivers. As shown throughout this proposal, BIO-WEST has extensive experience with vegetation establishment and river restoration monitoring in Texas and throughout the western U.S.	
Experience with environmental restoration and/or other projects of a similar type, especially projects assisted with public funds.	15	River restoration and endangered species is what BIO-WEST is known for throughout the U.S. BIO-WEST just completed a monitoring project associated with environmental restoration in Brackenridge Park in San Antonio funded with public funds, and is working for TPWD on a threatened species study on the lower Sabine River on public grant monies.	
Experience with interpreting two-dimensional hydraulic modeling.	10	Within the last 10 years, BIO-WEST has completed or is presently working on instream flow studies using 2-D hydraulic modeling to assess aquatic habitat conditions in the San Antonio River, Colorado River, Brazos River, Guadalupe River, Cibolo Creek, and the Clear	

		Fork of the Brazos. Many of these efforts have involved collaboration with Mr. Tim Osting of RPS Espey, and thus our confidence in his abilities to use the existing EARIP hydraulic model developed for the Comal River system.	
Experience with conducting a site assessment as part of work plan tasks.	10	Conducted hundreds of biological site assessments since our inception in 1976. BIO-WEST helped develop the biological goals and Take assessment in the EARIP HCP so we are thoroughly familiar with EARIP work plans.	
Demonstrate collaboration with other firms/entities to achieve work plan tasks.	10	During the decade plus of monitoring at Comal and San Marcos Springs, BIO-WEST has supported 5 M.S. degree students working collaboratively with TSU. Additionally, BIO-WEST is currently working collaboratively with the Texas Instream Flow Program (TPWD, TWDB, TCEQ) on instream flow studies in multiple river basins.	
Demonstrate capability to complete work plan tasks on time and within budget.	10	As a consulting firm, this is mandatory to ensure repeat work and client satisfaction. We have an exemplary record on both budget and schedule and encourage this question be asked of any of BIO-WEST's references.	
Demonstrate success on projects within region and knowledge of regional hydrology, geography, and environmental characteristics.	10	Extensive experience within the region starting with over a decade of work on Comal and San Marcos Springs. Additional river basins include San Antonio, Guadalupe, Colorado, Brazos, Trinity, and Sabine. Mr. Oborny is also an active member of the Science Advisory Committee for the SB 3 Environmental Flows process.	
Demonstrate ability to obtain or possess necessary permits within project time frame, including construction permits and endangered species handling.	5	BIO-WEST possesses federal and state endangered species collection permits for the Comal River allowing us to initiate work upon selection. BIO-WEST is aware of the necessary TPWD and City permits and is prepared to submit applications upon award.	
Demonstrate past performance confidence.	5	Please contact any BIO-WEST reference and/or state or federal agency scientist or stakeholder familiar with the Edwards Aquifer system.	
Competitive fee structure and valuation of 3 plots.	10	Detailed cost breakdown as shown above. Being a small business with lower overhead than large engineering firms, coupled with teaming with Baylor and their graduate student workforce, our structure is extremely competitive. Our knowledge of the EARIP and the Comal system, allows BIO-WEST to offer legitimate cost savings while still meeting the intent of the HCP.	
<b>Maximum Points</b>	<b>100</b>		



## **APPENDIX A: PAST AND PRESENT PERFORMANCE SURVEY**