

**Edwards Aquifer Authority 2014  
Applied Research Work Plan**

Section 6.3.4 of the Edwards Aquifer Habitat Conservation Plan (EAHCP) includes applied research as a “valuable” component of the Phase I package and states that the “Edwards Aquifer Authority (EAA) will contract for the research activities.” The main focus of the applied research is to evaluate the effects of low-flows on Covered Species and their habitats. As described in the HCP § 6.3.4.2, applied research for Phase I will focus on the fountain darter relative to Comal Springs (although research should be transferable to the San Marcos system) and the Comal Springs riffle beetle, as these are the two species with the greatest potential for impact relative to the Phase I package.

**Long Term Objective:** The experimentation done through the applied research program of the EAHCP will evaluate the effects of low-flows on Covered Species and their habitats. The information gathered through this program will be used to inform the Adaptive Management Process, identify strategies for improved mitigation in the Spring cities, and help in the development of the ecological model.

**Target Performance Measures for 2014:** After consultation with the Science Committee at its meeting on February 13, 2013, the following list of five studies are proposed for completion in 2014.

Comal Springs Riffle Beetle Habitat Associations and Movement (6.3.4.2)

1. Establishment of riffle beetle baseline population distribution and refinement of riffle beetle collection methods.
2. Determination of limitations of riffle beetle plastron<sup>1</sup> use during low-flow.
3. Extended low-flow period effects on riffle beetles.

Low-flow Effects on Fountain Darter Movement, Survival, and Reproduction (6.3.4.2)

4. When and where do fountain darters move as vegetation decays and water quality deteriorates?
5. What is the relationship between turbidity and feeding success of the fountain darter?

Each of these studies are described in detail in subsequent pages of this work plan.

In the event that all five studies initially identified by the Science Committee are bid out and funds in totality are not allocated, the following list of contingency studies were identified by the Science Committee at its April 3, 2013, meeting.

Low-flow Effects on Fountain Darter Movement, Survival, and Reproduction (6.3.4.2)

6. When does fountain darter reproduction stop? or does it?
7. Does fountain darter compensatory reproduction get triggered, and if so when and what causes it?
8. What is the effect of predation on fountain darter population size?

<sup>1</sup> The layer of air held on the riffle beetles body and used for gas exchange

**Comment [n1]:** Subject to change per Science Committee recommendation and action.

**Assumptions:** Completion of all 2013 applied research projects.

**Methodology:**

There is one fundamental difference in approach between 2013 and 2014 applied research. In 2013, the RFP's put out to bid included very detailed methodology to accomplish the research questions; however in 2014, the approach will be to state the end results and goals to be accomplished and then allow proposers to submit the methodologies they would utilize to reach the goals. The Science Committee will continue to review final methodologies proposed by contractors who are awarded the research projects.

At the conclusion of the research projects, all Covered Species collected and utilized for applied research may be accepted by the Service for Refugia operations.

1. Establishment of riffle beetle baseline population distribution and refinement of riffle beetle collection methods.

Currently, riffle beetle distribution throughout Landa Lake and the Comal system is unknown. Additionally, collection methods have been somewhat successful, but can be improved. This study will establish a distribution of spring orifices that are serving as riffle beetle habitat, while testing the success rate of varying collection methods. Riffle beetles collected shall be made available for use in the riffle beetle research to be conducted through the 2014 applied research program<sup>2</sup>. This project will be conducted in Landa Lake with a duration of up to three months.

2. Determination of limitations of riffle beetle plastron use during low-flow.

Riffle beetles utilize a plastron for the purposes of respiration. It is unknown what effect reduced flows or reduced water quality may have on the ability/efficiency of the plastron to function. This study will establish plastron efficiency and functionality as water quality and flow decrease. It is anticipated that this project will be conducted in an indoor laboratory setting (aquarium or other small experimental unit) with a duration of up to three months.

3. Extended low-flow period effects on riffle beetles.

Effects of drought on riffle beetles are not currently known. Low flows could affect riffle beetles as a result of water quality (temperature, dissolved oxygen, pH,) flow, availability of food, loss of, or degradation to habitat and other factors. This study will identify the factors of low flow that effect the riffle beetle and establish the level at which a factor becomes limiting or lethal. Recovery after exposure to low flow conditions will also be documented. It is anticipated that this project will be conducted in an indoor laboratory setting (aquarium or other small experimental unit) or possibly small troughs with a duration of up to three months.

4. When and where do fountain darters move as vegetation decays and water quality deteriorates?

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<sup>2</sup> If space is available and facility conditions/responsibilities allow for, any collected Covered Species may be accepted by the Service and distributed to other researchers when needed.

As water flow decreases causing a change in type or amount of suitable fountain darter habitat, it is unknown how fountain darters respond or relocate. This research will establish what fountain darter habitat is preferred/utilized at varying low flow conditions. Additionally, if possible, this study will also identify why fountain darters respond as they do to the varying levels of available habitat. Recovery after exposure to low flow conditions will also be documented. It is anticipated that this project will be conducted in outdoor troughs, raceways or ponds with a duration of up to three months.

5. What is the relationship between turbidity and feeding success of the fountain darter?

The fountain darter is a visual predator. Stormwater run-off and recreation activities are known to cause turbidity that could limit or decrease feeding success of the fountain darter. This research will establish what impacts to fountain darter feeding success are experienced at changed turbidity levels and durations of turbidity. It is anticipated that this project will be conducted in an indoor laboratory setting (aquarium or living streams) or possibly troughs or raceways with a duration of up to three months.

6. When does fountain darter reproduction stop or does it?

Fecundity is important to long term survival of any species. It is unclear at this point what effect low flows may have on fountain darter fecundity. This study will establish fountain darter reproductive success or limitations based on low flow conditions such as, habitat availability and type, water quality conditions, darter density, food availability, and other factors. It is anticipated that this project will be conducted in an indoor laboratory setting (aquarium or living streams) or possibly troughs or raceways with a duration of up to six months.

7. Does fountain darter compensatory reproduction get triggered, and if so when and what causes it?

Compensatory reproduction during low flow scenarios could be beneficial to recovery in the wild or for breeding in a Refugia setting. This study will determine if fountain darters exhibit compensatory reproduction, and if so, what triggers the compensatory reproduction and what is the compensatory reproductive rate based on identified triggers. It is anticipated that this project will be conducted in an indoor laboratory setting (aquarium or living streams) or possibly troughs or raceways and with a duration of up to three months.

8. What is the effect of predation on fountain darter population size?

It is assumed that fountain darter predation increases with decreased flows as a result of increased fountain darter density. This study will quantify predation at varying flow levels and attempt to estimate the overall effect on fountain darter population size. It is anticipated that this project will be conducted in raceways or ponds with a duration of up to six months.

**Monitoring:** EAHCP staff will receive monthly status reports from selected contractors and will visit with selected contractors on-site to evaluate the progress and methodology compliance of applied research projects.

**Science Committee Review:** The Science Committee discussed the proposed applied research studies for 2014 at their February 13, 2013, establishing the initial 5 studies slated for 2014. At their next meeting on April 3, 2013, the SC approved the additional three contingency studies to be implemented in the event there are funds remaining following the initial five studies. After the selection of a contractor for each RFP, the contractors will present final detailed methodologies to the Science Committee for each individual study, to solicit input before beginning research.

**Comment [n2]:** Subject to change based on SC input and review

**Research Facility:**

To date, no experimental channel facility has been constructed for applied research. This is due primarily to input from the Science Committee that concluded that a laboratory research facility with infrastructure allowing for diverse size and type of experimental unit would logistically be better suited for the research identified in the EAHCP. EAHCP staff continues to explore appropriate laboratory research facilities that may be available for EAHCP research.

Should a research facility be secured prior to the issuing of RFP's, the facility and criteria will be made available to potential contractors. Additionally, EAHCP staff will coordinate the projects for timing and availability of resource needed (tank, living stream, trough, raceway, or pond). Should a facility not be secured for 2014 research, contractors will be responsible for providing a facility/location appropriate for conducting the research awarded to them. Such selected facility will consider at a minimum: source water, quarantine capabilities, endangered species handling, and infrastructure/resource needs.

Funds designated for the facility component of the 2014 Applied Research may be used for, but are not limited to, the following: design of appropriate facilities, repair and restoration of existing facilities, ensuring priority access to preferred facilities, the purchase of equipment (such as heaters, chillers, other necessary equipment) and actual construction costs.

**Budget**

<i>Table 7.1 Applied Research Budgeted Amount:</i>	<i>\$1,785,000<sup>3</sup></i>
<i>Proposed 2014 Applied Research Work Plan Budget</i>	<i>\$485,000</i>
<i>2014 Applied Research Facility Budget</i>	<i>\$1,300,000</i>

After consultation with the Science Committee, the estimated budget for the five research projects identified by the Science Committee is \$250,000-\$375,000. Assuming these estimates are accurate, this would leave \$110,000-\$235,000 remaining in the budget to conduct applied research. For this reason, an additional three contingency projects were identified by the Science Committee, with an estimated budget of \$100,000-\$250,000. The approach would be to conduct as much research in 2014 as the allocated budget in Table 7.1 would allow for, to ensure conductance of all needed research in the time frame allowed prior to Phase II decisions.

**Comment [n3]:** Actual prices will change based on input from the Science Committee.

<sup>3</sup> Table 7.1 allocates \$1,785,000 (\$1,750,000 + 2%) to Applied Research (\$1,300,000 Facility Construction and \$485,000 Research)

Research contracts will be awarded in the order listed below, until funds are fully utilized and expended.

Research Project Budget Breakdown

Establishment of riffle beetle population and collection methods.	\$25,000-\$50,000
Limitations of riffle beetle plastron use during low-flow.	\$50,000-\$100,000
Extended low-flow period effects on riffle beetles.	\$100,000
When and where do fountain darters move?	\$25,000-\$75,000
Relationship between turbidity and feeding of darter?	\$50,000
<b>Research Projects</b>	<b>\$250,000-\$375,000</b>

When does fountain darter reproduction stop or does it?	\$25,000-\$75,000
Does fountain darter compensatory reproduction get triggered?	\$25,000-\$75,000
What is the effect of predation on fountain darter population size?	\$50,000-\$100,000
<b>Contingency Projects</b>	<b>\$100,000-\$250,000</b>

The Edwards Aquifer Authority will develop an RFP with expected deliverables and experimental design criteria for each applied study approved by the Implementing Committee. Where possible, all efforts will be made to match similar studies to allow for shared facility and expertise in an effort to promote fiscal stewardship.

These RFP's will each be put out through a competitive bid process that will include publication in five print newspapers and distribution to an email contact list of potential qualified contractors.