

**City of New Braunfels
Edwards Aquifer Habitat Conservation Plan Year 1 Workplan
June 21, 2012**

The City of New Braunfels Workplan was developed through a collaborative process with input from other Implementing Committee members, resource agencies, knowledgeable scientists, and interested parties. City of New Braunfels staff began to brainstorm implementation methods and workplan goals late in the fall of 2011 and ultimately contracted with the River Systems Institute (RSI) at TX State University to draft the City of New Braunfels Year 1 Edwards Aquifer Habitat Conservation Plan Workplan. Dr Thom Hardy from RSI was appointed principal for the contract.

The Draft Work Plan provided below has been shared with resource agencies, knowledgeable scientists, and interested parties.

Initial preparations included a meeting on December 20, 2011, with personnel from EAA and Texas State University to discuss planned water quality monitoring activities identified in the HCP and included the following:

- Dr. Thomas Hardy – Texas State University
- Melani Howard – City of San Marcos
- Dr. Weston Nowlin – Texas State University
- Dr. Benjamin Schwartz – Texas State University
- Geary Schindel – Edwards Aquifer Authority
- Jon Cradit – Edwards Aquifer Authority

This meeting was intended to provide input on technical approaches, spatial locations, timing, frequency, constituents, and related technical issues to guide work plan development and monitoring anticipated monitoring as required in the HCP.

A technical coordination meeting was then held on January 4, 2012, involving the following participants:

- Thomas Hardy – Texas State University
- Melani Howard – City of San Marcos
- Robert Doyle – Baylor University
- Ed Oborny - BioWest
- Jackie Poole – Texas Parks and Wildlife Department
- Dianne Wassenich – San Marcos River Foundation
- Ken Ostrand - National Fish Hatchery & Technology Center
- Kevin Connally – U.S. Fish and Wildlife Service
- Allison Land – Texas A&M Graduate Student

The purpose of the coordination meeting was to outline the direction RSI would take on the development of draft work plans, solicit input on specific methods and level of effort required for work elements and feasibility of alternative approaches, and gain additional scientific input to the

planning process. Based on this meeting, the preliminary draft work plans were revised to reflect input received.

The approach taken and status of the preliminary draft work plans were shared with the HCP Implementing Committee on January 30, 2012.

Additionally, City of New Braunfels staff met with EAA representatives Geary Schindel and Marcus Gary on February 7, 2012, to discuss initial concepts for workplan development.

RSI staff and City of New Braunfels staff met on February 10, 2012, to discuss the City of New Braunfels workplan specifically and initial concepts for drafting. This planning session was very productive, as it resulted in draft outlines for many mitigation measures.

Preliminary draft work plan development continued and a second technical meeting was held on February 13, 2012, involving the following participants:

- Thomas Hardy – Texas State University
- Melani Howard – City of San Marcos
- Nathan Pence – City of New Braunfels
- Tom Brandt – USFWS National Fish Hatchery and Technology Center
- Steve Bereyso – San Antonio Water Systems
- Ken Ostrand - USFWS National Fish Hatchery and Technology Center
- Ed Oborny - BioWest
- David Mahula – San Antonio Water Systems

This meeting reviewed the existing work plan elements and technical discussions on assumptions and budgets, level of effort, discussion on technical approaches and integration of work plan elements between Texas State University, City of San Marcos, City of New Braunfels, and the Edwards Aquifer Authority.

A third technical coordination meeting was then held on March 20, 2012, involving the following participants:

- Thomas Hardy – Texas State University
- Melani Howard – City of San Marcos
- Ed Oborny - BioWest
- Jackie Poole – Texas Parks and Wildlife Department
- Dianne Wassenich – San Marcos River Foundation
- Ken Ostrand - National Fish Hatchery & Technology Center
- Kevin Connally – U.S. Fish and Wildlife Service
- Allison Land – Texas A&M Graduate Student
- Pete Diaz - National Fish Hatchery & Technology Center
- Nathan Pence – City of New Braunfels
- Steven Bereyso – San Antonio Water Systems
- Ken Diehl - San Antonio Water Systems
- Rick Ilgner – Edwards Aquifer Authority

- Doyle Mosier – Guadalupe-Blanco River Systems consultant

The purpose of the coordination meeting was to review the revised work plans for City of San Marcos, New Braunfels and EAA. The City of San Marcos work plan was completely reviewed and a portion of the New Braunfels plan was discussed.

A technical meeting was held on March 28, 2012 involving the following participants:

- Ken Diehl – San Antonio Water Systems
- Brad Littrell – BioWest
- Ed Oborny – BioWest
- Ken Ostrand - U.S. Fish and Wildlife Service
- Robert Doyle – Baylor University
- Jenna Cantwell – Independent Contractor
- Robert Gulley – Independent Contractor
- Nathan Pence – City of New Braunfels
- Thom Hardy – Texas State University
- Steve Bereyso – San Antonio Water Systems

The purpose of this meeting was to continue review of the City of New Braunfels Work Plans and the EAA work plans. The City of New Braunfels work plans were reviewed with additional discussions on the Old Channel work plan between the City of New Braunfels, Ed Oborny, and Thom Hardy needed. Follow-up conversations were conducted the following day, resulting in finalized language for Section 5.2.2.1 and 5.7.1.

A technical meeting was held on April 5, 2012 involving the following participants:

- Thom Hardy – Texas State University
- Ken Ostrand - USFWS National Fish Hatchery and Technology Center
- Rick Illgner – Edwards Aquifer Authority
- Ed Oborny – Bio-West
- Nathan Pence – City of New Braunfels
- Melani Howard – City of San Marcos
- Tom Brandt - USFWS National Fish Hatchery and Technology Center
- Jenna Cantwell – Independent Contractor
- Ken Diehl – San Antonio Water System
- Robert Gulley – Edwards Aquifer Authority

The purpose of this meeting was to discuss the EAA work plans and Year Zero work elements. The EAA work plans were reviewed and discussed. Consensus was reached on all work plans, with Mr. Ed Oborny tasked with making the requested edits to reflect the group consensus. The ad hoc committee also discussed the Year Zero work plans and after discussion requested two additional items to be included covering technical coordination for the design of the experiments and experimental channels at the US Fish and Wildlife Service National Fish Hatchery and Technology Center as well as technical coordination for the ecosystem modeling work plan.

Additional technical coordination has continued through one-on-one contact with various agency personnel, city staff and scientists during further work plan development.

The draft work plan was presented to City of New Braunfels staff on April 4th. Staff presented to include:

- Michael Morrison – City Manager
- Robert Camareno – Asst City Manager
- Steve Ramsey – Public Works Director
- Stacey Dicke – Parks Director
- Nathan Pence – Watershed Manager
- BoJack Jalloway – Park Operations Manager
- Chad Donegan – Golf Course Superintendent
- Jason Wiedeman – Golf Course Operations

City of New Braunfels staff met with SAWS on May 31, 2012 and continued to refine workplan methodology and budget estimates. Attending that meeting were:

- Michael Morrison
- Nathan Pence
- Calvin Finch
- Steve Bereyso
- Lou Lendman

The following workplan represents a collaboration of all ideas, concerns, and methodologies discussed throughout the previous year of planning with all Implementing Committee members, scientists and stakeholders.

5.2.1 Flow split management

Flow-split management is intended to complement the ecological restoration of native aquatic vegetation in the Old Channel, by reducing long-duration high flows, meeting flow split management targets specified in the HCP, and allowing for more seasonal variability in the flow regime that mimics a more natural flow pattern. Presently, the culverts governing flow from Landa Lake into the Old Channel are inoperable. As a result, a constant level of springflow proceeds through the culverts and into the Old Channel. There are two main objectives for this Work Plan: 1) restore operability of the flow control structures, and 2) flow split management.

Flow Control Structures

Long-term Objective: Construct and maintain appropriate flow control structures to manage discharges entering the old channel to optimize conditions for fountain darter habitat.

Assumptions: Prior to 2013, the City of New Braunfels intends to place a pipe in one of the smaller culverts (there are two) that connects Landa Lake with the old river channel. Plugs will be placed at both ends of the new pipe and the annulus will be grouted between the outside of the pipe and inside of the culvert. The inside of the other culvert will also be grouted along with all

voids around both culvert pipes. This will reduce the risk of dam/culvert failure and allow for flexibility in the future if the new pipe is needed to accomplish flow split management or aeration. This action is anticipated to be completed in 2012 by the City of New Braunfels and is estimated to cost \$50,000.

Additionally, the City of New Braunfels is in the process of restoring the original elevation of Landa Dam and removing accumulated sedimentation from the Landa Lake spillway. This will restore functionality of these two structures as originally designed, while reducing stress and damage to the gates, culverts, and associated infrastructure during high water events. The Landa Lake Spillway connects Landa Lake to the Old Channel of the Comal River approximately 100 ft downstream of the gates and culverts. This action has been designed and is currently undergoing the permitting process. Construction will begin when the permitting process is complete, at an estimated cost of \$847,000.

EAHCP Science Committee – After repair/restoration work has been designed and prior to actual construction, the Science Committee will be consulted to ensure that designs maximize benefit to the species and allow for flexibility as flow regimes may change through the Adaptive Management process.

As part of the 2013 action, the City of New Braunfels will undertake an assessment of the existing four flow control structures (two small culverts, the one large culvert, and the Springfed Pool inlet) used to divert water into the Old Channel. The assessment will determine if any or all of these flow control structures should be replaced, decommissioned, and/or repaired in order to meet flow split objectives outlined in Table 5-3 of the HCP and the prevention of sustained high flows in the Old Channel that may result in scouring of restored native aquatic vegetation or channel substrates. The assessment will also incorporate adequate design of trash racks necessary for protection of the structures and ensure continued aeration of the water entering the Old Channel. In the event that the two small culverts are not necessary, these will either be removed or plugged. The assessment, design and permitting may be integrated with existing City of New Braunfels restoration efforts in Landa Lake for efficiency and cost savings.

Target 2013/Performance Measure: Completed engineering assessment and design of the flow control structures and necessary permits. Assuming the necessary permits are obtained, the successful replacement or repair of the flow control structures. Based on design and permitting timing, it is possible that gate functionality may not be restored in 2013.

Methods: An engineering evaluation of the existing control structures will be undertaken to determine the most cost-effective measure(s) between repair, replacement, or decommissioning of the control structures. This will include an evaluation of hydraulic capacity under different Comal Springs flow rates to ensure the design can meet target flow splits specified in the HCP by Table 5.3. The assessment will also consider maintaining proper aeration of flows into the Old Channel. This work plan will include preparation of the necessary engineering designs; identify methods to minimize environmental impacts within the Old Channel; and supporting

documentation necessary to obtain any required permits. Repair and/or replacement of the control structures will be initiated upon completion of assessment, design and receipt of the required permits.

Monitoring: See Flow Split Management below.

Flow Split Management

Long-term Objective: Manage flows entering the Old Channel as specified in the HCP to optimize conditions for fountain darter habitat based on operational flow control structures and real time gage data.

Assumptions: Flow-split management is contingent on operational flow control structures and access to real time gage data.

Target 2013/Performance Measure: Maintenance of target flow splits as allowed by status of operation and repair. Although gates are currently inoperable, City of New Braunfels staff will make an effort to exercise the gates and achieve as close to as possible, the desired flow-split regime.

Methods: Upon completion of instillation of real time flow gauges in the Old and New Channels of the Comal River by EAA, the City of New Braunfels staff will monitor the real time gages in the Comal River system and adjust the flow control structures to meet the required flow split targets. The City of New Braunfels staff will manipulate the flow control structures for the Old Channel and New Channel of the Comal River at least once monthly based on EAA's real-time flow gauges in these channels and as often as appropriate for the maintenance of beneficial hydrologic conditions of the Old Channel habitat. When total Comal springflow flows drop to 150 cfs, the flow split will be shifted to protecting the maximum amount of habitat within the Old Channel year-round, while continuing to provide flow in the New Channel at all times (*see* Table 5-3). Additionally, when total Comal springflow drops below 100 cfs, if necessary, the City of New Braunfels staff will manipulate the flow control structures more frequently to maintain the flow split ratio as detailed in Table 5-3.

**TABLE 5-3
FLOW-SPLIT MANAGEMENT FOR OLD AND NEW CHANNELS**

Total Comal Springflow (cfs)	Old Channel (cfs)		New Channel (cfs)	
	Fall, Winter	Spring, Summer	Fall, Winter	Spring, Summer
350+	80	60	270+	290+
300	80	60	220	240
250	80	60	170	190
200	70	60	130	140
150		60		90
100		60		40
80		50		30
70		50		20
60		40		20
50		40		10
40		30		10
30		20		10

Monitoring: Monitoring of the daily flow split volumes will be tied to the real time gages in the Comal River. Proper function of the control structures will be assessed each time changes in flow splits are undertaken as outlined in the HCP and after any major runoff event. Repairs will immediately be undertaken as necessary. Trash racks at the flow control structures will be monitored on a weekly basis and cleaned as necessary to prevent operational problems. Trash racks will also be cleaned in response to major runoff events.

Allocated funds for 2013: \$ 150,000

Estimated Budget: \$ 287,500

- \$100,000 Design
- \$145,000 Construction
- \$5,000 Operational expenses
- \$37,500 15% Contingency

5.2.2.1 Old Channel Restoration

The City of New Braunfels will remove problematic non-native vegetation, restore native habitat, undertake limited channel modification to enhance fountain darter habitat, implement bank stabilization and erosion control structures and remove a sediment island, all above Elizabeth Street. Sediment removal in the Old Channel is covered under Work Plan 5.7.1.

Old Channel Non-native Vegetation Removal and Maintenance

In addition to reestablishment of native vegetation after the sediment island removal, restoration will include portions of the Old Channel bordered on both sides by City of New Braunfels’ property above Elizabeth Street.

Long-term Objective: Control of non-native vegetation with a target to establish favorable native vegetation species to the maximum extent possible.

Assumptions: Restoration of native aquatic vegetation will be undertaken in the Old Channel upstream of the Elizabeth Street Bridge and involve the removal of non-native vegetation, planting of native vegetation and repeated gardening or supplemental plantings. This effort will continue until the proportional native and non-native targets outlined in Table 4-6 of the HCP are met or funds are expended.

**TABLE 4-6
GOALS—FOUNTAIN DARTER HABITAT (AQUATIC VEGETATION) (m²)**

Study Reach	<i>Bryophytes</i>	<i>Hygrophila</i>	<i>Ludwigia</i>	<i>Cabomba</i>	<i>Fil. Algae</i>	<i>Sagittaria</i>	<i>Vallisneria</i>
Upper Spring Run Reach	1,850	650	150			600	
Landa Lake	4,000	250	900	500		1,250	13,500
Old Channel	150	200	1,500		300		
New Channel	150	1,350		350			
TOTAL	6,150	2,450	2,550	850	300	1,850	13,500

**Bold/italics indicate a restoration activity that deviates from the Maximum observed.*

Target 2013/Performance Measure: Reestablishment of native aquatic vegetation and reduction of non-native aquatic vegetation in proportion to the areas identified in Table 4-6

Methods: The target locations for *Hygrophilla* removal will be based on a review of historical vegetation mapping data to identify areas in which high value native vegetation has historically occurred and taking into consideration possible adverse affects from other mitigation actions. Two-dimensional hydraulic models will be used to evaluate the potential for success of the native vegetation restoration. This evaluation will consider the depth, velocity, and substrate conditions present in the proposed areas along with what non-native vegetation is thriving in these areas. In areas that are bare of vegetation, the reason vegetation is absent (e.g., recent flood scour, or unsuitable depth, velocity or substrate conditions) will be evaluated prior to final selection of target areas.

Selected locations will first be sampled to remove fountain darters. Sampling will employ appropriate methods such as fanning and/or seining depending on local conditions. Non-native vegetation will then be removed and placed on a tarp adjacent to the stream where qualified personnel will examine the plants for fountain darters (eggs through adults). Fountain darter life stages will be returned to the stream. If native vegetation is not available from the SMNFHTC, it will be harvested from Landa Lake and planted to cover approximately 20 percent of the denuded area. A variety of target native vegetation (e.g., *Ludwigia*, *Bryophytes*, and filamentous algae) will be used in order to assess effectiveness of the native species planting and to meet targets outlined in Table 4-6 of the HCP.

Monitoring: Each area in which non-native vegetation has been removed will be monitored for the reestablishment of non-native vegetation and effectiveness of the native vegetation planting two weeks after treatment and then weekly thereafter. Once native aquatic vegetation is established in an area, monitoring will be conducted on an annual basis.

Specific attention will be paid to the amount re-suspended solids in the Old Channel resulting from recreation in the Springfed Pool. It is possible that sediment removal from the Springfed Pool may need to occur in late 2013 or early 2014 to protect newly restored areas of the Old Channel.

As noted in the HCP (Section 5.2.2.3), following natural disturbances such as floods, periods of limited recharge, and/or herbivory, as well as anthropogenic disturbances such as recreation or vandalism, the monitoring/maintenance schedule will be modified temporarily in order to provide the stability for the native vegetation re-establishment. Monitoring will include estimated aerial coverage of native and non-native vegetation within the treated area. Any reestablished non-native vegetation will be removed during each monitoring visit and if deemed necessary, additional native vegetation will be planted. Removal of non-native vegetation will follow the same protocols as the original removal methodology. Removed vegetation will be transported to an off-site composting facility.

Allocated funds for 2013: \$ 400,000

Estimated Budget: \$ 400,000
\$400,000 Vegetation Restoration

5.2.2.2/5.2.2.3 Comal River Aquatic Vegetation Restoration and Maintenance

The City of New Braunfels will undertake a program of native aquatic vegetation restoration within key, sustainable reaches of the Comal River by planting native vegetation in unoccupied areas and in areas where non-native aquatic vegetation is removed. Restoration and maintenance represent two different Workplan elements within the HCP as noted below. The amounts and types of vegetation removed and restored in this program will follow the targets provided in Table 4-5 and 4-6 of the HCP.

Native Aquatic Vegetation Restoration

Long-term Objective: Control of non-native vegetation and establishment of target native vegetation preferred by fountain darters. The City of New Braunfels will continue to coordinate with the TPWD on the establishment of the SSA in the Comal River.

Assumptions: Native vegetation restoration will include the Landa Lake Variable Flow Study Reach. Restoration efforts will also include establishing additional *Cabomba* along the eastern shoreline of Landa Lake and along the New Braunfels' golf course property. Locations in the Comal River proper will not be considered until establishment of SSA by TPWD. Restoration of native aquatic vegetation in the Old Channel is covered under Work Plan 5.2.2.1.

Target 2013/Performance Measure: Identification of target non-native aquatic vegetation removal areas and implementation of native aquatic restoration of 1000 m².

Methods: The target locations for non-native plant removal will be based on a review of historical vegetation mapping data to identify areas in which high value native vegetation has historically occurred. Two-dimensional hydraulic models will be used to evaluate the potential for success of the native vegetation restoration including areas of existing bare substrate. This evaluation will consider the depth, velocity, and substrate conditions present in the proposed areas along with what non-native vegetation if any are thriving in these areas. In areas that are bare of vegetation, the reason vegetation is absent (*e.g.*, recent flood scour, or unsuitable depth, velocity or substrate conditions) will be evaluated prior to final selection of target areas. Target restoration areas will be selected within the various identified locations noted above.

Selected locations will first be sampled to remove fountain darters. Sampling will employ appropriate methods such as fanning and/or seining depending on local conditions. Non-native vegetation will then be removed and placed on a tarp adjacent to the stream where qualified personnel will examine the plants for fountain darters (eggs through adults). Fountain darter life stages will be returned to the stream. If native vegetation is not available from the SMNFHTC or available from vendors, it will be harvested from Landa Lake and planted to cover approximately 20 percent of the denuded area. A variety of target native vegetation (*e.g.*, *Ludwigia*,

Bryophytes, and filamentous algae) will be used in order to assess effectiveness of the native species planting and to meet targets outlined in Table 4-6 of the HCP.

Monitoring: Each area in which non-native vegetation has been removed will be monitored for the reestablishment of non-native vegetation and effectiveness of the native vegetation planting two weeks after treatment, then every two weeks for 3 months and then quarterly thereafter. Once native aquatic vegetation is established, monitoring will be conducted on an annual basis. However, if monitoring suggests continued gardening and/or supplemental planning is required, this will continue on a bi-weekly or monthly basis as needed.

However, as noted in the HCP (Section 5.2.2.3), following natural disturbances such as floods, periods of limited recharge, and/or herbivory, as well as anthropogenic disturbances such as recreation or vandalism, the monitoring/maintenance schedule will be modified temporarily in order to provide the stability for the native vegetation reestablishment. Monitoring will include estimated aerial coverage of native and non-native vegetation within the treated area. Any reestablished non-native vegetation will be removed during each monitoring visit and if deemed necessary, additional native vegetation will be planted. Removal of non-native vegetation will follow the same protocols as the original removal methodology. Removed vegetation will be transported to an off-site composting facility.

5.2.2.3 Native Aquatic Vegetation Maintenance

The City of New Braunfels will conduct yearly maintenance of native aquatic vegetation restoration in Landa Lake and the Old Channel, and the flow-split management discussed above in Section 5.2.1. 5-15 sites in Landa Lake and the Old Channel, and the flow-split management discussed in Section 5.2.1.

Long-term Objective: Maintenance of restored native aquatic vegetation and minimization of invasive non-native aquatic vegetation.

Assumptions: This activity in FY2013 is covered under Work Plan Element 5.2.2.2.

Target 2013/Performance Measure: Establishment of native aquatic vegetation in target restoration locations within the Comal River system.

Methods: Monitoring will include estimated aerial coverage of native and non-native vegetation within the treated area. Any reestablished non-native vegetation will be removed during each monitoring visit and if deemed necessary, additional native vegetation will be planted. Removal of non-native vegetation will follow the same protocols as the original removal methodology. Removed vegetation will be transported to an off-site composting facility.

Monitoring: Monitoring of restored native aquatic vegetation will be conducted on annual basis. However, as noted in the HCP (Section 5.2.2.3), following natural disturbances such as floods, periods of limited recharge, and/or herbivory, as well as anthropogenic disturbances such as

recreation or vandalism, the monitoring/maintenance schedule will be modified temporarily in order to provide the stability for the native vegetation reestablishment.

Allocated funds for 2013: \$ 200,000

Estimated Budget: \$ 149,500

\$109,000 Aquatic Vegetation Restoration

\$21,000 Monitoring/Maint

\$19,500 15% Contingency

5.2.3 Management of Public Recreation

Public recreational use of the Comal River ecosystems include, but are not limited to swimming, wading, tubing, boating, canoeing, kayaking, golfing, scuba diving, snorkeling and fishing. To minimize the impacts of incidental take resulting from recreation, the City of New Braunfels will continue to implement their existing recreation control measures as specified in Section 5.2.3.(1) of the HCP. The City of New Braunfels will enforce these measures (as covered in various sections of the HCP) to ensure their success.

Long-term Objective: To establish a voluntary Certificate of Inclusion Program for all outfitters utilizing the Comal River; while utilizing opportunities to educate the public about the Covered Species and importance of their protection.

Assumptions: This measure was not specifically funded for FY 2013. The COI is voluntary but the goal is for 100 percent participation.

Target 2013/Performance Measure: Development of the COI application process, inform Outfitters of the benefits to their businesses from participating in the COI program and initiation of the program.

Methods: The City will utilize its existing public input process to develop the COI application, criteria and program administration. The COI will include the minimum requirements as specified in Section 5.2.3 (2) a-h.

Monitoring: City of New Braunfels staff will monitor compliance of all COI participants and report on the program annually.

Allocated funds for 2013: \$ 0

Estimated Budget: \$ 0

5.2.4 Decaying Vegetation Removal and Dissolved Oxygen Management

To minimize and mitigate the impact of incidental take from low-flow events, based on real time monitoring of DO levels in Landa Lake indicating a water quality concern created by decaying

vegetation, the City of New Braunfels will implement a dissolved oxygen management program. The program will be focused on ensuring adequate DO levels for the ecosystem regardless of the initiating circumstances.

Long-term Objective: Maintain acceptable levels of DO within Landa Lake and the Old Channel and minimize the impacts associated with decaying vegetation (or other factors).

Assumptions: Section 5.2.4 of the HCP implied the initiation of these actions when total Comal River discharges fall below 80 cfs. However, it is assumed that whenever low dissolved oxygen is evident regardless of the flow Comal River flows, remedial actions identified below will be undertaken. It is also assumed that forecasting conditions that may indicate deleterious water quality conditions are critical for preemptive near real time management.

Target 2013/Performance Measure: Deployment of real time water quality monitoring devices in Landa Lake and purchase/testing of emergency equipment to assist in Dissolved Oxygen management.

Methods: Real time water quality monitoring system will be installed in Landa Lake. The monitoring system will measure dissolved oxygen, temperature, pH, conductivity and turbidity. It is anticipated that the real time water quality monitoring station will be established in the main body of Landa Lake in the vicinity of the Old Channel flow control structure. Real time telemetry data will be connected to a computer system at the City of New Braunfels for monitoring of conditions. This will be accomplished using wireless technology. The Comal River website will display data being collected in real time within the Comal River. Two solar powered aeration systems will be purchased and tested in Landa Lake for effectiveness, including whether an additional unit(s) may be required. The solar powered aeration system is based on a target area of approximately 10 acres (i.e., ~ 70 percent of Landa Lake). Testing will involve an initial measurement of the diel oxygen profiles for several days during the summer period to establish a baseline and then running the units for several days and monitoring the effective changes in the oxygen profiles. Based on these tests, a determination of whether additional units or change in location may be necessary. The units will then be stored for deployment in the event conditions warrant it.

If predicted or observed dissolved oxygen diel patterns are trending toward less than 4 mg/l (or other trigger/criteria as established through the Adaptive Management Process) the solar powered aeration units will be deployed. Vegetation conditions will then be evaluated via visual observations for signs of stress or decay on a weekly basis. If vegetation decay is evident and the aeration system is not able to keep oxygen levels above target thresholds, then mechanical removal of decaying vegetation will be initiated or other comparable management strategy developed based on specific conditions. In the event of mechanical vegetation removal, vegetation will systematically be examined for covered species, species salvaged, and returned to the system. Removed vegetation will be disposed offsite at a compost facility.

Monitoring: Real time dissolved oxygen and temperature will be monitored to evaluate projected trends indicative of problematic temperature or oxygen levels. Vegetation in Landa

Lake will be monitored on a monthly basis during the May to September period to assess overall conditions and apparent stress levels (i.e., leaf coloration and condition). In the event projected trends of problematic oxygen levels are observed, then vegetation conditions will then be evaluated via visual observations for signs of stress or decay on a weekly basis.

Allocated funds for 2013: \$ 750,000

Estimated Budget: \$ 139,600

\$65,000 Real Time WQ

\$44,000 Aeration

\$12,400 Monitoring/Maint

\$18,200 15% Contingency

5.2.5/5.2.9 Non-native Animal Species Control

The City of New Braunfels will conduct non-native animal species control on an annual basis and include annual maintenance and monitoring. The non-native animal species that will be addressed include the suckermouth catfish, tilapia, nutria, and ramshorn snail. Since this Work Plan has two components identified within the HCP, each component has been broken out to facilitate the development of the work plan and budgets.

Control of Harmful Non-Native Animal Species

Long-term Objective: Eliminate or maintain the density of non-native animal species at suppressed levels to minimize their impact to the Comal River ecosystem.

Assumptions: This will initially focus on the intensive effort to reduce non-native species and the assessment of removal techniques. Additionally, City of New Braunfels Park Dept staff have identified that Nutria populations are at an all time high in 2012 and specific efforts will focus on Nutria removal.

Target 2013/Performance Measure: Evaluate the efficacy of removal techniques and cost benefit of these efforts, focusing efforts on the suckermouth catfish; and expanding current Nutria control.

Methods: Seasonal concentration of tilapia and other non-native fish into localized areas will be exploited for removal through seining techniques utilizing mesh sizes that are selective against fountain darters and other Covered Species. Each seining effort will involve salvage of native species, which will be returned to the system. The City will increase its nutria poisoning program, while considering possible additional physical removal methods and other methods such as relocation. A major focus of non-native removal will target suckermouth catfish given their overall destructive capacity on habitats within the system. Given the anticipated difficulties in control of suckermouth catfish, several different removal techniques will be attempted that include trapping with hoop nets and gigging with divers. These efforts will initially focus on Landa Lake in 2013 to evaluate effectiveness and the cost benefit of these efforts. During these

combined efforts, any ramshorn snails encountered will be removed. All non-native species removed will be disposed of offsite following City of New Braunfels policies.

Monitoring: It is expected that the planned EAA biomonitoring program will accomplish this.

Reduction of Non-Native Species Introduction and Live Bait Prohibition

The City of New Braunfels will undertake measures to stop or substantially reduce the introduction of non-native species from aquarium dumps and establish the range of prohibition of live bait species.

The City of New Braunfels will prohibit by Ordinance introductions of domestic and non-native aquatic organisms, targeting specifically the practice of releasing aquarium trade species into the Comal system.

The City of New Braunfels will ban the use of certain non-native species as live bait for fishing. The City of New Braunfels will additionally consult with relevant resources (at a minimum TPWD and USFWS) to determine which native species may be used as bait for fishing locally that do not present a threat to the Endangered Species through introduction of pathogens or other mechanisms. This information will be used to compile a preferred listing of native bait species to be used.

These preferences and prohibitions will be communicated to the public through signage at key entrance points to parks on Landa Lake and the Comal River. Educational materials for outreach purposes will be developed for distribution.

Long-term Objective: Reduce the introduction of non-native species to the Comal River ecosystem.

Assumptions: This effort is primarily a public outreach and education effort.

Target 2013/Performance Measure: Enforcement and signage based on the existing State regulation prohibiting the introduction of exotics; priority signage locations would include entrance points to Landa Lake, the fishing pier, and popular fishing locations on the Comal River. TPWD has education programs that might be considered.

Consultation with scientific resources identifying native species that pose no threat to the Endangered Species when used as live bait.

2014 would involve possible Adoption of a City ordinance that would prohibit the introduction of domestic and non-native aquatic organisms, prohibiting specific bait species and aquarium trade dumps.

Methods: An analysis will be undertaken to identify locations providing access to Landa Lake and the Comal River where signage will be installed. Educational materials and outreach materials will be designed and produced for distribution to the public. TPWD has education programs that should be considered. Design of the educational content and construction material

for signage will follow existing specifications in use by the City. Signage will be installed according to existing City criteria.

Solicit information, relevant studies, and opinion from Science expertise regarding potential threats or lack thereof to the Endangered Species by use of native species as live bait; compile into a useable format to assist in identifying native species to be used as bait.

In 2014, the City will follow its normal process for creation and adoption of ordinances. This will involve public meetings, stakeholder input, drafting of the ordinance and possible adoption by the City.

Monitoring: It is anticipated that the biomonitoring program will detect the presence of new introduced species. Signage will be inspected annually for repair or replacement as necessary as well as identification of other locations that may need signage.

Total Allocated funds for 2013: \$ 135,000

Total Estimated Budget: \$ 135,700

\$19,000 Signage

\$99,000 Species Control (10,000 for Nutria)

\$17,700 Contingency

5.2.6/6.3.6 Monitoring and Reduction of Gill Parasites

The City of New Braunfels will retain and oversee the work of a contractor to establish gill parasite (Asian trematode - *Centrocestus formosanus*) monitoring and reduction measures. This may involve control of the non-native first host (snail - *Melanooides tuberculatus*). However, additional research on the most effective means of gill parasite control will be conducted as part of the AMP as discussed in Section 6.3.6 to determine the most effective method of gill parasite control that will actually be implemented.

Long-term Objective: Effective control of gill parasite concentrations to minimize their threat to the fountain darters and other Covered Species within the Comal system.

Assumptions: The initial focus will be the evaluation of alternative methods for snail removal to determine the most effective, yet least destructive methodology to affect cercariae concentrations in the water column. This includes the assessment of the temporal effectiveness of control measures on sustained reductions of cercariae in the water column. The following conservation measures were also identified in the HCP:

- A system-wide survey of snail population density and cercarial concentrations will be conducted to provide a baseline condition;
- Based on that system-wide survey, a decision will be made following the process set out in the AMP Agreement as to whether an initial system-wide removal effort is necessary, and if so, how to facilitate the performance of that effort;
- Based on the system-wide survey, a gill parasite monitoring program will be designed and implemented. Cercarial concentrations will be monitored in multiple areas along the

Comal River on at least a semi-annual basis, and more frequently when spring flow initially drops below 150 cfs or other springflow triggers that are developed.

Corresponding fountain darter sampling to examine correlations between cercariae densities and fountain darter impacts in the wild will also be part of that monitoring effort.

Target 2013/Performance Measure: System-wide snail distribution and density estimates, evaluation of alternative snail control measures and temporal effectiveness of cercarial density reductions, development of a gill parasite monitoring program.

Methods: *Baseline* – An initial visual examination of the complete system will be made to assess overall apparent *Melanoides* distribution and densities. Relative abundance will be marked on existing substrate/vegetation maps. This preliminary survey will focus on identification of areas with apparent high density of *Melanoides*.

Existing substrate/vegetation maps for the system will be used to implement a stratified sampling regime to subsample snail densities by substrate/vegetation polygons within delineated reaches. Reaches will be composed of the following sections (or up to 8 locations based on current conditions and observations):

- Upper Landa Lake,
- Middle Landa Lake,
- Lower Landa Lake,
- New Channel above the Power House,
- Old Channel above Schlitterbahn,
- Old Channel above the confluence,
- New Channel above the confluence with the Old Channel, and
- Comal River below the Confluence.

Wadeable areas will be sampled with a dip net while non-wadeable areas will be sampled via scuba. In both instances, three replicates of a 1 square meter area will be sampled and *Melanoides* counted. Three random replicates of each substrate/vegetation type will be sampled in each reach. These data will then be used to extrapolate snail locations and densities for the system. Three random replicates of each substrate/hydrodynamic type within each reach will then be sampled for validation of the extrapolation methodology. Identified high density *Melanoides* areas will also be systematically sampled with three 1 square meter replicates.

Water column cercarial concentration sampling will be conducted across the channel at the downstream boundary of each reach segment. Sampling locations along each cross section will be determined from an examination of the hydraulic model simulations to ensure an adequate stream-wide distribution accounts for the hydraulic flow net at that location (i.e., slack water versus stronger velocity fields). A total of 10 samples will be targeted at each cross section unless complex hydraulics suggests a higher spatial sampling. All water samples will be collected based on the existing NFHTC protocol. Sampling will proceed from downstream to upstream reaches. Samples will be collected between 9 and 11 am on sunny days to minimize

temporal variance in the sampling. Each water sample will be filtered using an apparatus described in Cantu (2003). The cercariae will then be stained on the filters with a 10% Rose Bengal solution. Filters will then be transported to the NFHTC laboratory where the number of cercariae on each filter will be counted with the aid of a dissecting microscope.

Gill Parasite Monitoring – Results from the baseline assessment will be used to establish a comprehensive gill parasite monitoring program. Cercarial concentrations will be monitored at the reach boundary locations (and potentially specific hotspot areas) twice per year, and monthly when total Comal discharge drops below 150 cfs. Gill parasite monitoring will be coordinated with the fisheries biological monitoring.

Snail Removal Methods – A literature review will be conducted to identify potential snail removal techniques such as dipnetting, suction dredging, baited traps, etc. Based on this review, field testing will be conducted in selected areas to evaluate the effectiveness and cost benefits to achieve desired outcomes of snail density reductions.

Temporal Effectiveness – As an initial test, sampled areas selected for the baseline assessment, including sampled high density areas will be monitored monthly for colonization rates of *Melanoides*. Each area will be examined and snail counts in each sampled area noted.

In the event that the cercarial monitoring detects elevated levels, snail removal will target high density areas using the method(s) identified. Cercarial monitoring will then be repeated a few days after completion of snail removal and then monthly up to 6 months following removal efforts. In this instance, snail removal will be conducted in an upstream to downstream manner.

Monitoring: Cercarial concentrations will be monitored in multiple areas along the Comal River on at least a semi-annual basis, and more frequently when spring flow initially drops below 150 cfs or other springflow triggers that are developed. Monitoring protocols will be established as part of the developed gill parasite monitoring program.

Allocated funds for 2013: \$ 175,000

Estimated Budget: \$ 178,250.00

- \$50,000 Snail Distribution
- \$35,000 Parasite Monitoring
- \$10,000 Snail Removal Method Testing
- \$60,000 Evaluation of Temporal Effectiveness
- \$23,250 15% contingency

5.2.7 Prohibition of Hazardous Materials Transport Across the Comal River and Its Tributaries

The City of New Braunfels will coordinate with the Texas Department of Transportation (TDOT) to prohibit transportation of hazardous materials on routes that cross the Comal River

and its tributaries. This effort may include legislation, City of New Braunfels ordinances, additional signage, and TDOT approval.

Long-term Objective: Eliminate hazardous materials transport across the Comal River and its tributaries.

Assumptions: The primary effort will involve stakeholder engagement, public meetings, and coordination with TDOT. This work plan element is contingent on TDOT participation and support.

Target 2013 Performance Measure: Identification of roadways and routes that cross the Comal River and its tributaries that pose a threat to the endangered species and development of a plan to coordinate with TDOT through a public process to prohibit Hazardous Material transport across the Comal River and tributaries.

Methods: Identification of all transport routes that cross the Comal River and its primary tributaries that require protection and therefore prohibition. This information will be used to initiate public meetings, drafting and approval of City ordinances, and coordination with TDOT.

Monitoring: Annual monitoring of all installed signage will be undertaken and repair or replacement as necessary.

Allocated funds for 2013: \$ 10,000

Estimated Budget: \$ 10,000
\$10,000 Facilitation of Public Process

5.2.8 Native Riparian Habitat Restoration (Comal Springs Riffle Beetle)

The City of New Braunfels will restore native riparian zones, where appropriate, to benefit the Comal Springs riffle beetle by increasing the amount of usable habitat and food sources (i.e., root structures and associated biofilms). The method of riparian zone establishment will include the removal of non-natives and replanting of native vegetation representative of a healthy, functioning riparian zone. Trees and plants with extensive root systems will be given preference to create the maximum beetle habitat. Fine sediment covering exposed roots and springs will also be removed. The riparian zone will be monitored (at least annually) for continued success and removal of reestablished non-natives. Riparian zones will be protected until the preferred riparian zone is established. Riparian habitat zones will be created along Spring Run 3 and along the portion of the western shoreline that is owned by City of New Braunfels. In addition, riparian restoration also benefits the system through bank stabilization and nutrient and sediment processes. The City of New Braunfels will develop a program to incentivize private landowners on the Comal River and its tributaries to establish riparian zones along the western shoreline. This program will be accomplished through work plan element 5.7.1.

Long-term Objective: Removal of non-native vegetation and fine sediments from the target area of Landa Lake and hillside adjacent to Spring Run 3. Establishment of beneficial native riparian species for Comal Springs riffle beetles.

Assumptions: It is assumed that this effort will focus on the identification of target native riparian species most beneficial for Comal Springs riffle beetles that also meet erosion control requirements and the subsequent removal and establishment of native vegetation in the upstream 100 meters of target areas of Landa Lake and Spring Run 3 followed by the selective removal of fine sediments adjacent to these areas within Landa Lake. It is assumed that the effort will be split between the bluff and Spring Run 3 given the different characteristics in these locations and therefore differences in approaches are anticipated. Restoration of the remaining area will be accomplished in future years and incorporate revisions based on monitoring of the 2013 efforts. The short term objective will be to evaluate the effectiveness of the proposed methods.

Target 2013/Performance Measure: Identification of target native vegetation, restoration of 100 meters of non-native vegetation in the upstream 100 meters of target areas of Landa Lake and Spring Run 3 and removal of fine sediments along the upper 100 meters of the western shoreline in Landa Lake. Work with landowners other than the City to gain access and cooperation

Methods: Technical workshops will be undertaken with riparian ecologists and aquatic biologist to identify target native vegetation for use in the restoration. A technical assessment of the removal of non-native vegetation and bank stabilization will be used to produce a specific work plan to accomplish this effort. This will include establishment of sediment control structures to eliminate sediment input to Landa Lake and Spring Run 3 during restoration activities. Given the sensitive nature of beetle habitats, removal of fine sediments will be accomplished via hydrosuction that targets fine silt removal. As specified in the HCP, hydrosuction will be used to remove accumulations of sediment. Divers will be trained on equipment operations, diving safety protocols, and to recognize all stages of listed species from larval to adult. Sediment will be vacuumed using a hose that has a screen to prevent suctioning biota greater than 0.25 inches in diameter. The divers doing the hydrosuctioning will take the following measures to minimize loss/harm of biota in the area. Divers will fin the area to be suctioned to encourage darters and other biota to move out of the area. The nozzle of the vacuum will be kept down in the soil and not allowed to swing through the water column during the operation. One worker will be stationed by the air compressor and sediment bag to ensure diver safety, monitor operations, and answer public questions. Based on discussions with the RSI Diving Control Officer, it is assumed that sediment removal will be accomplished through a maximum of three 2-hour dive cycles each day with a one hour surface interval between dives. Disposal of removed sediment will be at a composting facility. Sediment samples will be sent to TCEQ for testing prior to sediment removal. Initial efforts will include testing the hydrosuction methods outside beetle habitat areas to refine suction nozzle size and mechanics of the removal process.

Monitoring: The effectiveness of establishing native riparian vegetation will be assessed near the end of 2013 with sufficient lead time to inform efforts in the revision of work plans to be

implemented in 2014. Accumulation of fine sediments will be assessed in the restoration area at the same time based on visual inspection. In the event of heavy rainfall, the accumulation of fine sediments will be assessed in the following week.

Allocated funds for 2013: \$ 100,000

Estimated Budget: \$ 123,050

\$3,000 Selection of Area
\$50,000 Assessment and Design
\$30,000 Riparian Restoration
\$24,000 Fine Sediment Removal
\$16,050 15% Contingency

5.2.10 Litter and Floating Vegetation Control

The City of New Braunfels will perform activities to manage floating vegetation and litter removal to enhance habitats for Covered Species. Management activities will include dislodging of vegetation mats, to allow continued movement downstream, that form on top of the water surface, particularly during low flows, and removal of litter for the littoral zone and stream bottom. The City of New Braunfels will manage aquatic vegetation in Landa Lake by removing floating vegetation that is entrained on the flow control structures, fishing piers, Spring Island, Landa Park drive bridge and other areas where mats collect. Litter removal in Landa Lake and the Comal River will continue under the existing City of New Braunfels program.

Long-term Objective: Minimize impacts of floating vegetation and litter on the overall aquatic community within the Comal River.

Assumptions: Litter and floating vegetation mat removal will follow the existing protocol and schedules currently employed by the City of New Braunfels as described below under Methods.

Currently the City of New Braunfels contracts with a private contractor for removal of litter and dislodging of floating weedmats from Landa Lake, the Comal River and the Guadalupe River. Those contracts are renewed annually and in 2012 were set at a cost not to exceed \$160,000 and include numerous mechanisms by which to reduce cost and scope mid season. SCUBA collections on the Comal River were added in 2007 as a pilot program and in 2008 as part of the contracts. SCUBA was added to protect the underwater habitat in the Comal River. Also in 2008, litter collection in Landa Lake was added to specifically protect species habitat. The City of New Braunfels cooperated with the USFWS to implement litter collections in Landa Lake. These additional expenditures have been voluntary on the part of the City of New Braunfels in past years, but now are mandatory based on requirements in the EAHCP Section 5.2.10. It is possible that without funding from the EAHCP, this mitigation action would be unfunded in 2013. Funds previously committed for litter collection by the City of New Braunfels will be allocated for flow control work in 2013.

All litter removal and weedmat dislodging in Landa Lake is associated with protection of resource (species habitat), as there is no tubing recreation in Landa Lake. Underwater collection (SCUBA) in the Comal River is associated with resource protection (species habitat), however above water collection on the Comal River is a direct result of tubing activities. Collections on the Guadalupe River have no relevance to the EAHCP or species protection. Therefore only costs associated with Landa Lake and underwater Comal River collections will be included in EAHCP activities and budgets.

Target 2013/Performance Measure: Continued implementation of the established protocols.

Methods: *Landa Lake* - Each week or as necessary, floating vegetation mats will be dislodged from flow control structures and other locations.

Comal River – Floating vegetation will be pushed downstream and inorganic litter will be picked up weekly from the substrate, surface and littoral zone of the Comal River in the Old Channel and from the New Channel downstream to below the last tuber takeout point during the recreational season (May 1st to September 30th). Vegetation maintenance and liter pickup during the non-recreation season is on an as needed basis.

Monitoring: City of New Braunfels staff will monitor the contractor for compliance and initiate additional action when deemed necessary.

Allocated funds for 2013: \$ 0

Estimated Budget: \$40,419

\$37,963 Underwater Litter Collection (22 weeks, Comal River and Landa Lake)

\$2,456 Weed Mat Clearing (34 weeks)

5.2.11 Golf Course Mgmt and Planning

The City of New Braunfels will draft and implement an Integrated Pest Management Plan (IPMP) for Landa Park Golf Course. This process will incorporate public input and the Golf Course Advisory Board. The golf course IPMP will incorporate environmentally sensitive techniques to minimize chemical application, improve water quality, and reduce negative effects to the ecosystem. Expanded water quality sampling targeted at Golf Course operations will be conducted as described in Section of 5.7.2 of the HCP.

Long-term Objective: Management of the golf course and grounds to minimize and reduce negative effects to aquatic ecosystem in Landa Lake and the Comal River.

Assumptions: The Landa Park Golf Course will develop a IPMP.

Target 2013 or 2014/Performance Measure: Development of the IPMP. Depending on length of Public Input process, it is possible the IPMP will not be complete and implemented until 2014.

Methods: The golf course and grounds will be maintained in an aesthetically pleasing, yet environmentally sensitive manner. It is the responsibility of the Golf Course Manager to maintain the course and grounds in accordance with the new IPMP. The IPMP will describe the activities and materials to be used to control pests (i.e. insects, weeds, and other living organisms requiring control) on the golf course in a way that minimally impacts the environment.

Monitoring: Each year the City of New Braunfels Watershed Manger in cooperation with the Golf Course Manager will report to the HCP detailed information on all pertinent activities during the year.

Allocated funds for 2013: \$ 0

Estimated Budget: \$0

5.7.1 Native Riparian Habitat Restoration

The City of New Braunfels will undertake a program to increase the area of the riparian zone along the Old Channel, the golf course, and in the vicinity of Clemens Dam. As plans take shape for the reestablishment of the riparian zone, private and public landowners will be asked to participate in the plan. Reimbursement for the price of native plants will be provided to private and public landowners. Criteria to qualify for reimbursement will be established along with a list of preferred natives to replant developed in consultation with the NB forester.

Long-term Objective: Restore the native riparian vegetation and encourage private landowners to utilize native plants when landscaping.

One specific area of targeted sediment removal is an island that has formed just behind the Springfed Pool and immediately downstream of Landa Lake. This sediment island continues to grow due to riparian erosion, has established destructive non-native cane, and has displaced/destroyed fountain darter habitat. A contributing factor to the sediment problem is the erosion from the unstable north bank along the upper reach of the Old Channel. Bank stabilization will be conducted in conjunction with native riparian restoration. Sediment removal will be followed by native vegetation restoration that will contribute to establishment of aerial targets that are favorable for fountain darters.

Assumptions: Sequencing will start with bank stabilization and riparian vegetation restoration along the north bluff of the Old Channel and then be followed by subsequent removal of the existing sediment island and giant cane removal below the Springfed Pool. Sediment removal will be followed by native vegetation restoration that will contribute to establishment of aerial vegetation targets for native species that are favorable for fountain darters.

Target 2013/Performance Measure: Design and implementation of bank stabilization and riparian restoration. Based on methodology and equipment used for bank stabilization, it is probable that bank stabilization and sediment removal may occur simultaneously.

Methods: An engineering assessment of the northern bluff of the Old Channel to identify the best approach for stabilization will be undertaken. This assessment will give preference to methodologies that are least disruptive to habitat and are supportive of archeological preservation. The assessment will also include preparation of the necessary engineering designs; identify methods to minimize environmental impacts within the Old Channel; and supporting documentation necessary to obtain any required permits. Riparian Restoration at a minimum will include the removal of giant cane and other non-native riparian vegetation species and planting of appropriate native species. Bank stabilization and riparian restoration will be initiated upon receipt of the required permits.

Once the bank stabilization is completed, the sediment island will be removed either using a suction dredge or if feasible by 'backhoe'. Removed sediment will be transported offsite for disposal. Prior to initiation of sediment removal, the area will be sampled to remove any fountain darters (all life stages) using fanning or other sampling methods as dictated by site characteristics. After sediment removal, native vegetation will be planted over approximately 20 percent of the exposed area with a mixture of bryophytes, *Ludwigia* and filamentous algae harvested from Landa Lake.

EAHCP Science Committee: Prior to actual expenditure for Bank Stabilization, the EAHCP Science Committee will be consulted to establish that Bank Stabilization in the identified area results in a net benefit to the species and their habitat. Original logic was that the Bank Stabilization project needed to occur to prevent additional erosion, which would result in having to continually remove the sediment island and additional expenditure on more frequent/intensive gardening of restored vegetation. As removal of the sediment island and planting of native vegetation are identified in the HCP, they would not be included in the evaluation by the EAHCP Science Committee.

Monitoring: Sediment buildup will be monitored on an annual basis or after flood events. In the event that sediment buildup is detected, then remedial sediment removal will be initiated followed by native vegetation restoration. The area will be monitored for the reestablishment of non-native vegetation and effectiveness of the native vegetation planting two weeks after treatment and then quarterly thereafter. However, as noted in the HCP (Section 5.2.2.3), following natural disturbances such as floods, periods of limited recharge, and/or herbivory, as well as anthropogenic disturbances such as recreation or vandalism, the monitoring/maintenance schedule will be modified temporarily in order to provide the stability for the native vegetation re-establishment. Monitoring will include estimated aerial coverage of native and non-native vegetation within the treated area. Any reestablished non-native vegetation will be removed during each monitoring visit and if deemed necessary, additional native vegetation will be planted. Removal of non-native vegetation will follow the same protocols as the original removal methodology. Removed vegetation will be transported to an off-site composting facility.

Allocated funds for 2013: \$ 200,000

Estimated Budget: \$411,125

\$275,000 Bank Stabilization and Design
\$23,500 Riparian Restoration
\$11,000 Sediment Removal
\$42,000 Vegetation Planting
\$6,000 Monitoring and Maint
\$53,625 15% Contingency

5.7.5 Management of Household Hazardous Wastes

The City of New Braunfels will initiate a hazardous household waste (HHW) program that will include accepting prescription drugs and Freon, through the TCEQ and/or the waste disposal division of the City of New Braunfels. The City of New Braunfels will establish a four-times-a-year program that could be recognized in the City's anticipated MS4 compliance and storm water permit as a contributing activity.

Long-term Objective: Reduction in the improper disposal of hazardous wastes and incorporation of prescription drug and Freon drop off.

Assumptions: This effort will employ the existing program in place by the City of New Braunfels but include an expansion of public outreach, frequency and add additional scheduled efforts.

Target 2013/Performance Measure: Implementation of increased public outreach and education and addition of additional drop off event or events.

Methods: Public outreach and education will be increased in association with the increased scheduled drop off effort.

Monitoring: The amount and number of pickups will be noted and compared against historical efforts.

Allocated funds for 2013: \$ 30,000

Estimated Budget: \$ 31,625

\$2,500 Outreach
\$25,000 Additional Collection Events
\$4,125 15% Contingency

5.7.6 Impervious Cover/Water Quality Protection/LID

The City of New Braunfels will establish criteria related to desired impervious cover, provide incentives to reduce existing impervious cover on public and private property in New Braunfels, and implement BMP's associated with stormwater runoff in the area of Landa Lake and the Springruns. The City of New Braunfels will establish criteria and incentives for the program based upon the low impact development (LID)/Water Quality Work Group Final Report

(Appendix Q) recommendations for Implementation Strategies and best management practices (BMPs). This Work Plan element includes development of the program and an incentive program for implementation.

Long-term Objective: Reduction and control of non-point source runoff in the Comal River system.

Assumptions: The primary focus of the is effort will be the establishment of criteria, identification of specific BMPs, program guidance, and implementation strategy based on the LID/WQ Work Group Report. The efforts will focus on the identification of implementing the incentive program and identification of target program elements such as public education and outreach, rainwater harvest, reduction of impervious areas, and other BMPs that would qualify for incentives. This effort will involve a stakeholder process followed by public outreach and education that outlines the incentive program and mechanisms for its implementation. It should be noted that the existing HCP budgets assume no BMP dollars in Year Two. Given the public driven process, actual BMP implementation may in fact not begin until Year 2 or later.

Target 2013/Performance Measure: Development of the program and implementation strategy in conjunction with current MS4 process underway in the City of New Braunfels to incorporate a funded LID and impervious rebate/incentive program.

Methods: The LID/WQ Work Group Report will serve as a starting point to develop a draft program and implementation strategy. A public process will then be utilized to provide for stakeholder input, and finalization of the program elements and implementation strategy. Implement the program. As a public entity, the City of New Braunfels will utilize its own program to receive rebates for implementing BMP's associated with stormwater runoff in the area of Landa Lake and the Springruns.

Monitoring: It is assumed that the WQ monitoring program of the HCP covered under other work elements will provide data for assessing the effectiveness of this measure.

Allocated funds for 2013: \$ 300,000

Estimated Budget: \$ 300,150

- \$117,000 Program Development
- \$44,000 Outreach and Stakeholder Involvement
- \$100,000 Implement Program
- \$39,150 15% Contingency

Education

The Implementing Committee of the EAHCP should work together where appropriate to minimize costs associated with educating the public about EAHCP mitigation and activities. As an example, one sign template could be designed allowing for simple adaptation to the location and specific message to be communicated and then be utilized by all Implementing Committee

members. Also, one webpage about the EARIP and mitigation activities could be designed and maintained by one entity and then linked to by all other Implementing Committee members. Both of these examples would represent an overall cost savings and create continuity amongst messaging.

The following recommended education venues are examples of ways to educate the public on Covered Species and HCP measures:

- a. Signage. Post signage at various areas along the river and Landa Lake at sites with active mitigation. Signage will be simple, natural, and when possible the existing sign locations will be used (trying to avoid too many signs). Signs will have the same template and coloration so they are recognized up and down the river. Signs will educate the public on the importance of the resource. Where appropriate and space allows signs will be bilingual. Signs may include QR codes. Signage related to Section 5.2.2.1, 5.2.2, 5.2.3, 5.2.5, 5.2.4, 5.2.8, 5.7.1, 5.2.3, and 5.2.11 would be considered. \$8,000
- b. Incorporation of endangered species and resource management information on recreational information and signage (specifically on the large 4x8 signage at access and Outfitter locations). \$0
- c. Hold a training session for the park rangers and police officers specific to Endangered Species; geared towards facilitating dissemination of information to the public about endangered species in the Comal River. This training should include information about all mitigation efforts currently under construction and general habitat conservation regulations and techniques. \$5,000
- d. Production of stencils to be provided to outfitters to be used on rented tubes. Stencils will communicate natural resource management information. This stencil may be developed in cooperation with the City of San Marcos for cost savings. \$2,000
- e. Incorporation of HCP information and current mitigation efforts to City website. This cost would be for one time design of the actual webpage. This website should include information about all mitigation efforts currently under construction and general habitat conservation regulations. A central website that could be linked to should be considered. \$5,000
- f. If approved by the Convention and Visitors Bureau, the addition of environmental stewardship and Endangered Species information on WaterTheRules.com, the New Braunfels all inclusive water information web portal. Incorporation of QR codes directing to this website would be utilized on all signage and informational pieces. This process could be as simple as linking to the City website or one centrally hosted website and therefore cost could be significantly reduced. \$10,000
- g. Redesign of the Children's Reading Room at the New Braunfels Public Library in the theme of Endangered Species and the Comal River. This design is following programs and existing literature by the Edwards Aquifer Authority. \$0
- h. Periodic presentation of Endangered Species, EAHCP activities, and water conservation techniques to civic and community groups by New Braunfels staff. \$0

Allocated funds for 2013: \$ 0

Estimated Budget: \$30,000

Budget

HCP Section	Mitigation Action	HCP Budget	Estimated FY2013
5.2.2.1	Old Channel Restoration	\$400,000	\$400,000
5.2.1	Flow split management	\$150,000	\$287,500
5.2.2/5.2.3	Aquatic vegetation restoration	\$200,000	\$149,500
5.2.5/5.2.9	Non-native animal species control	\$135,000	\$135,700
5.2.4	Decaying vegetation removal	\$750,000	\$139,600
5.2.8	Riparian improvement - riffle beetle	\$100,000	\$123,050
5.2.6/6.3.6	Gill parasite control	\$175,000	\$178,250
5.7.1	Restoration of riparian zones	\$200,000	\$411,125
5.2.7	Prohibition of hazardous material routes	\$10,000	\$10,000
5.7.6	Incentive program for LID/BMP stormwater management	\$300,000	\$300,150
5.7.5	Household hazardous waste program	\$30,000	\$31,625
5.2.3	Management of public recreation use	\$0	\$0
5.2.10	Liter control and floating vegetation management	\$0	\$40,419
5.2.11	Golf Course Management Plan	\$0	\$0
	Education	\$0	\$30,000

Totals \$2,450,000 \$2,236,919

Permits

As permits can take up to 18 months or longer to obtain and this would impose an unacceptable delay in implementing HCP work plans if the process of obtaining permitting did not start until January of 2013, the Implementing Committee as a group will address permitting in 2012. The Program Manger will work with local, state and federal agencies to identify and obtain all necessary permits, so that work on HCP mitigation may begin as close to January 1, 2013 as realistically possible.