

City of New Braunfels
2017 Work Plan

2017 City of New Braunfels Work Plan Budget

| HCP Section | Conservation Measure | Table 7.1 | Estimated 2017 Budget | Difference |
|---------------------|---|------------------|------------------------------|-------------------|
| 5.2.1 | Flow Split Management | \$0 | \$44,150* | (\$44,150)* |
| 5.2.2.1 | Old Channel Restoration | \$125,000 | \$135,000 | (\$10,000) |
| 5.2.2.2/ 5.2.2.3 | Comal River Aquatic Vegetation Restoration & Maintenance | \$100,000 | \$100,000 | \$0 |
| 5.2.3 | Management of Public Recreation | \$0 | \$0 | \$0 |
| 5.2.4 | Decaying Vegetation Removal and Dissolved Oxygen Management | \$15,000 | \$15,000 | \$0 |
| 5.2.5/5.2.9 | Non-native Animal Species Control | \$75,000 | \$55,000 | \$20,000 |
| 5.2.6/6.3.6 | Monitoring and Reduction of Gill Parasites | \$75,000 | \$30,000 | \$45,000 |
| 5.2.7 | Prohibition of Hazardous Material Transport Routes | \$0 | \$0 | \$0 |
| 5.2.8 | Native Riparian Habitat Restoration (Riffle Beetle) | \$25,000 | \$25,000 | \$0 |
| 5.2.10 | Litter and Floating Vegetation Management | \$0 | \$30,000 | (\$30,000) |
| 5.2.11 | Golf Course Management | \$0 | \$0 | \$0 |
| 5.7.1 | Native Riparian Habitat Restoration | \$100,000 | \$50,000 | \$50,000 |
| 5.7.5 | Management of Household Hazardous Waste | \$30,000 | \$30,000 | \$0 |
| 5.7.6 | Impervious Cover/ Water Quality Protection | \$100,000 | \$10,000 | \$90,000 |
| | Totals | \$645,000 | \$524,150 | \$120,850 |

*Unexpended funds previously approved and allocated for 2016 (\$44,150) are included in the 2017 Workplan to purchase and install back-up flow control gates and floating vegetation booms associated with the flow-split management task. Engineering design work associated with the installation of the back-up flow-control gates was completed in 2016.

5.2.1 Flow Split Management

Long-term Objective:

To sustain flow rates in the Old Channel of the Comal River that compliment Old Channel aquatic vegetation restoration efforts, prevent channel scouring, and maximize the quality of fountain darter habitat.

Assumptions:

Flow-split management is contingent upon reliable and continued access to USGS real-time streamflow data for the Old Channel, New Channel, and Comal River.

Target for 2017:

Maintain flow rates in the Old and New Channels of the Comal River to meet objectives specified in the revised Table 5-3 of the EAHCP (Figure 1). Table 5-3 was revised based on recommendations set forth in the Submerged Aquatic Vegetation Analysis and Recommendations report dated June 2016. These recommendations were made primarily to prevent channel scouring and displacement of target aquatic native vegetation in the Old Channel of the Comal River. Secondly, the recommendations ensure a balance between maintaining water levels in Landa Lake (to prevent potential dewatering of riffle beetle habitat in the Spring Island area) and optimizing flow rates in the Old Channel.

Priority will be given to achieving target flow rates in the Old Channel and, secondly, to flow rates in the New Channel. City of New Braunfels staff will monitor streamflow conditions via USGS streamflow gages and operate the flow-control gate between Landa Lake and the Old Channel to achieve flow targets. Maintenance activities associated with the flow-control gate will be conducted as needed to ensure continued operability.

Install additional flow-control gates at the two 14” culverts, currently closed with threaded caps, to be utilized as a back-up to the existing primary 48” culvert and gate. The gates will allow for controlled flow into the Old Channel during maintenance activities required for long-term functionality. The 14” culverts and gates will also serve as a back-up to divert flow into the Old Channel during emergency situations in which the primary 48” culvert is unable to provide adequate flow rates. Install floating vegetation barrier booms in Landa Lake in front of each flow control gate to prevent materials from building up on culvert intake screens and therefore allow more precise flow control in accordance with revised Table 5.3 of the HCP.

Figure 1. Revised Table 5-3

| Total Comal Springflow (cfs) | Old Channel (cfs) | | New Channel (cfs) | |
|------------------------------|-------------------|----------------|-------------------|----------------|
| | Fall, Winter | Spring, Summer | Fall, Winter | Spring, Summer |
| 350+ | 65 | 60 | 280+ | 290+ |
| 300 | 65 | 60 | 235 | 240 |
| 250 | 60 | 55 | 190 | 195 |
| 200 | 60 | 55 | 140 | 145 |
| 150 | | 55 | | 95 |
| 100 | | 50 | | 50 |
| 80 | | 45 | | 35 |
| 70 | | 40 | | 30 |
| 60 | | 35-40 | | 25 |
| 50 | | 35-40 | | 15 |
| 40 | | 30 | | 10 |
| 30 | | 20 | | 10 |

Methods:

The City of New Braunfels will manage the flow-split program according to flow rates specified in revised Table 5-3. A standard operating procedure has been developed by the City of New Braunfels to guide adjustments to the flow-control gate and to achieve flow-split targets. City of New Braunfels staff will monitor real-time streamflow conditions at USGS gages in the Comal River system and adjust the flow-control gates, as needed, to meet flow-split targets. The primary 48” culvert gate and the new back-up culvert gates (to be installed in early 2017) will be operated conjunctively to meet target flow rates. City of New Braunfels staff will monitor and adjust the flow control structures more frequently, and as needed, when total Comal springflow declines below 150 cfs in order to meet the flow-split guidelines defined in the revised Table 5-3. Gates will be kept free of debris, to the extent practicable, and will be exercised routinely to maintain functionality of the gate.

Installation of flow-control gates at the 14” culverts will occur according to the design specifications completed by Freese and Nichols in 2016. The 14” culverts are located approximately 100 feet north of the primary 48” culvert and control gate. Two separate vegetation barrier booms will be installed, with a proper anchoring system, in front on the existing 48” culvert control gate and the 14” culverts.

Monitoring:

Monitoring of streamflow in the Old Channel, New Channel, and Comal River will be based on real-time streamflow data provided by the USGS gages in the Comal River. Adjustments to the flow-control gate will be made on an on-going basis, and after major runoff events, to meet flow-spilt management objectives. When required, trash racks and vegetation barrier booms will be cleaned to prevent build-up of vegetation and debris which may present operational problems and may restrict flow to the culverts.

Budget:

Table 7.1

\$0

Estimated 2017 budget

\$44,150*

*Funding amount was previously allocated and approved as part of the 2016 City of New Braunfels' HCP Work Plan. Funding is being reallocated to 2017 in order to purchase and install flow-control gates and floating vegetation booms in 2017.

Install additional flow-control gates at the two 14" culverts, currently closed with threaded caps, to be utilized as a back-up to the existing primary 48" culvert and gate. The gates will allow for controlled flow into the Old Channel during maintenance activities required for long-term functionality. The 14" culverts and gates will also serve as a back-up to divert flow into the Old Channel during emergency situations in which the primary 48" culvert is unable to provide adequate flow rates. Install floating vegetation barrier booms in Landa Lake in front of each flow control gate to prevent materials from building up on culvert intake screens and therefore allow more precise flow control in accordance with Table 5.3 of the HCP.

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5.2.2.1/ 5.2.2.3 Old Channel Restoration and Maintenance

Long-term Objective:

To decrease the density of invasive, non-native aquatic vegetation and increase the coverage of native aquatic vegetation that has been demonstrated to provide suitable fountain darter habitat.

Assumptions: Aquatic vegetation restoration in certain locations of the Old Channel will be contingent upon the removal of non-native riparian vegetation that currently prohibits sunlight from reaching portions of the channel. Removal of non-native riparian vegetation in targeted locations will allow additional sunlight to penetrate to portions of the channel that currently do not favor native aquatic species due to limited solar exposure associated with shading effects. Riparian restoration along the Old Channel will be conducted as part of Task 5.7.1: Native Riparian Habitat Restoration. Riparian restoration work will be coordinated with Old Channel aquatic vegetation restoration efforts.

Target for 2017:

In 2016, an analysis of the submerged aquatic vegetation (SAV) within the Comal River system, including the Old Channel, was completed. The SAV analysis includes revisions to the Long-Term Biological Goals (LTBG's) for aquatic vegetation and also includes goals for newly defined restoration reaches located outside of the LTBG reaches. The SAV analysis establishes a restoration timeline, including annual restoration goals, for achieving the goals in these reaches. The revised goals for the individual reaches are included in Figures 2 and 3. Annual targets for aquatic restoration to be completed in 2017 are specified by reach and vegetation type in Figure 4.

Figure 2. Revised EAHCP Long-Term Biological Goals for fountain darter habitat, in meters squared (m²), within Old Channel LTBG reach

| Study Reach | Bryophytes | <i>Ludwigia</i> | <i>Cabomba</i> | <i>Sagittaria</i> |
|-------------|------------|-----------------|----------------|-------------------|
| Old Channel | 550 | 425 | 180 | 450 |

Figure 3. EAHCP Management Objectives for fountain darter habitat, in meters squared (m²), within the Old Channel restoration reach

| Study Reach | Bryophytes | <i>Potamogeton</i> | <i>Ludwigia</i> | <i>Cabomba</i> | <i>Sagittaria</i> | <i>Vallesneria</i> |
|--------------------------------|------------|--------------------|-----------------|----------------|-------------------|--------------------|
| Old Channel Up ^A | 1,250 | 100 | 850 | 200 | 750 | 750 |

^A Old Channel from LTBG reach upstream to Landa Lake Dam

Figure 4. Annual aquatic vegetation restoration goals, in meters squared (m²), within Old Channel LTBG reach and newly defined restoration reach

| Reach | Aquatic Vegetation Species | Meters squared of aquatic vegetation (m ²) | | Annual Restoration Goal |
|----------------------------|----------------------------|--|------|-------------------------|
| | | Existing Coverage | Goal | 2017 |
| LTBG Reaches | | | | |
| Old Channel | <i>Ludwigia</i> | 7 | 425 | 75 |
| | <i>Cabomba</i> | 0 | 180 | 50 |
| | <i>Sagittaria</i> | 0 | 450 | 150 |
| Restoration Reaches | | | | |
| Old Channel ERPA | <i>Ludwigia</i> | 618 | 850 | 100 |
| | <i>Cabomba</i> | 119 | 200 | 25 |
| | <i>Sagittaria</i> | 591 | 750 | 75 |
| | <i>Vallisneria</i> | 715 | 750 | |
| | <i>Potamogeton</i> | 73 | 100 | 10 |

Monitoring:

Areas where non-native vegetation removal has occurred will be routinely monitored for the re-establishment of non-native vegetation. Previously planted areas will be monitored to assess expansion, die-off, and competition by non-native species. Once native aquatic vegetation is established in an area, monitoring will be conducted on a less frequent basis. Vegetation mapping will be conducted to assess progress of aquatic vegetation restoration efforts.

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 adjusted temporarily in order to provide stability for the re-establishment of native vegetation. Monitoring will include aerial coverage mapping of native and non-native vegetation within the Old Channel between Landa Lake and the Old Channel index reach. Any re-established 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 disposed of according to TPWD Invasive Species Removal permit requirements.

Budget:

Table 7.1:

\$125,000

Estimated 2017 budget:

\$135,000*

*\$10,000 transferred from 2017 Impervious Cover/Water Quality Protection to fund an increase in Old Channel Restoration.

5.2.2.2/5.2.2.3 Comal River Restoration and Maintenance

Long-term Objective:

To decrease density of invasive, non-native aquatic vegetation and establish favorable native aquatic vegetation within Landa Lake and select portions of the Comal River to increase useable fountain darter habitat.

Target for 2017:

In 2016, an analysis of the submerged aquatic vegetation (SAV) within the Comal River system was completed. The SAV analysis includes revisions to the Long-Term Biological Goals (LTBG's) for aquatic vegetation and also includes goals for newly defined restoration reaches located outside of the LTBG reaches. The SAV analysis establishes a restoration timeline, including annual restoration goals, for achieving the goals in these reaches. The revised goals for the individual reaches are included in Figures 5 and 6. Annual targets for aquatic restoration to be completed in 2017 are specified by reach and vegetation type in Figure 7.

Figure 5. Revised EAHCP Long-Term Biological Goals for fountain darter habitat, in meters squared (m²), within LTBG reaches

| Study Reach | Bryophytes | <i>Potamogeton</i> | <i>Ludwigia</i> | <i>Cabomba</i> | <i>Sagittaria</i> | <i>Vallesneria</i> |
|------------------|------------|--------------------|-----------------|----------------|-------------------|--------------------|
| Upper Spring Run | 1,750 | | 25 | 25 | 850 | |
| Landa Lake | 3,950 | 25 | 900 | 500 | 2,250 | 12,500 |
| New Channel | 150 | | 100 | 2,500 | | |

Figure 6. EAHCP Management Objectives for fountain darter habitat, in meters squared (m²), within restoration reaches

| Study Reach | Bryophytes | <i>Potamogeton</i> | <i>Ludwigia</i> | <i>Cabomba</i> | <i>Sagittaria</i> | <i>Vallesneria</i> |
|------------------------------|------------|--------------------|-----------------|----------------|-------------------|--------------------|
| Landa Lake Up ^A | 5,500 | | 25 | 250 | 250 | |
| Landa Lake Down ^B | 500 | | 50 | 125 | 100 | 22,500 |
| Total | 7,250 | 100 | 925 | 575 | 1,100 | 12,500 |

^A Landa Lake LTBG reach to downstream boundary of Spring Island

^B Landa Lake LTBG reach to weir across from City of New Braunfels Park Office

Figure 7. Annual aquatic vegetation restoration goals, in meters squared (m²), within LTBG reaches and restoration reaches

| Reaches | Species | Meters squared of aquatic vegetation (m ²) | | Annual Restoration Goal |
|----------------------------|--------------------|--|--------|-------------------------|
| | | Existing Coverage | Goal | 2017 |
| LTBG Reaches | | | | |
| Landa Lake | <i>Ludwigia</i> | 474 | 900 | 75 |
| | <i>Cabomba</i> | 240 | 500 | 50 |
| | <i>Sagittaria</i> | 2,759 | 2,250 | |
| | <i>Vallisneria</i> | 12,012 | 12,500 | 100 |
| | <i>Potamogeton</i> | 0 | 25 | 5 |
| New Channel | <i>Ludwigia</i> | 31 | 100 | |
| | <i>Cabomba</i> | 2,397 | 2,500 | |
| | <i>Sagittaria</i> | 0 | 0 | |
| Upper Spring Run | <i>Ludwigia</i> | 1 | 25 | |
| | <i>Cabomba</i> | 2 | 25 | |
| | <i>Sagittaria</i> | 825 | 850 | |
| Restoration Reaches | | | | |
| Landa Upper | <i>Ludwigia</i> | 0 | 25 | |
| | <i>Cabomba</i> | 150 | 250 | |
| | <i>Sagittaria</i> | 50 | 250 | |
| Landa Lake Lower | <i>Ludwigia</i> | 5 | 50 | |
| | <i>Cabomba</i> | 100 | 125 | |
| | <i>Sagittaria</i> | 7 | 100 | |
| | <i>Vallisneria</i> | 24,500 | 22,500 | |

Monitoring:

Each area in which non-native vegetation has been removed will be routinely monitored for the re-establishment of non-native vegetation and effectiveness of the native vegetation

plantings. Once native aquatic vegetation is established, monitoring will be conducted on a less frequent basis. However, if monitoring suggests continued gardening and/or supplemental planning is required, this will continue as needed. Vegetation mapping will be conducted to assess progress of aquatic vegetation restoration efforts.

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 adjusted temporarily in order to provide stability for the native vegetation reestablishment. Where possible, landowners immediately adjacent to Landa Lake and the Upper Spring Run area will be informed of aquatic restoration efforts in order to promote awareness and minimize negative impacts associated with recreation and/or maintenance. Any re-established non-native vegetation will be removed during each monitoring visit and if deemed necessary, additional native vegetation will be planted.

Budget:

Table 7.1:

\$100,000

Estimated 2017 budget:

\$100,000

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 existing recreation control measures as specified in Section 5.2.3.(1) of the HCP and will seek voluntary participation in the Certificate of Inclusion (COI) program from outfitters who facilitate recreation activities within the Comal River system.

Long-term Objective:

To minimize and mitigate the impacts of recreation on endangered species habitat within the Spring Runs, Landa Lake and the Comal River.

Assumptions: The success of this program will be contingent on the cooperation of river outfitters and their willingness to participate in the COI program.

Target for 2017:

Inform river recreation Outfitters on the benefits of the EAHCP COI program. Recruit Outfitters who conduct their operations in the Comal River system and wish to participate in the COI program. Monitor the status of participating outfitters to comply with the minimum outfitter standards and requirements set forth in the HCP. Continue to enforce existing restrictions that limit recreational access to Landa Lake, Spring Runs, and the Old Channel of the Comal River.

Methods:

The City will continue to work in conjunction with EAHCP program staff to develop COI program documents and program administration. The City will contact river outfitters to inform them of the COI program. The COI will include the minimum requirements as specified in Section 5.2.3 (2) a-h.

The City will continue to enforce existing recreational access restrictions on Landa Lake, Spring Runs, and the Old Channel utilizing trained Park Rangers.

Monitoring:

The City of New Braunfels staff will collaborate with all COI participants and report on the program annually.

Budget:

Table 7.1:

\$0

Estimated 2017 budget:

\$0

5.2.4 Decaying Vegetation Removal and Dissolved Oxygen Management

Long-term Objective:

Maintain acceptable levels of DO within Landa Lake and minimize the impacts associated with decaying vegetation (or other factors).

Assumptions: It is assumed that the Edwards Aquifer Authority will calibrate and maintain an index site(s) for monitoring and observing real-time dissolved oxygen levels at strategic locations within Landa Lake. DO data collected by the EAA will be shared with the City of New Braunfels to help inform management decisions. The continued dislodging of floating vegetation mats from Landa Lake is dependent on continued funding of Task 5.2.10: Litter Collection and Floating Vegetation Management.

Target for 2017:

Develop a comprehensive DO management plan for Landa Lake. The management plan will include an evaluation of existing DO data and research and will identify feasible mitigation strategies that can be implemented in Landa Lake during periods of depressed DO. The City of New Braunfels will continue to operate existing aerators when DO concentrations, as measured in Landa Lake, fall below 4 mg/l. The efficiency and suitability of the existing aerators to increase DO concentrations during periods of low springflow will also continue to be evaluated in 2017.

Methods:

The City of New Braunfels will solicit professional assistance for, and engage in, the development of a comprehensive DO management plan for Landa Lake. The plan will include the analysis of all existing DO data and research to help predict DO concentrations during low-flow periods based on the minimum total Comal discharge management objectives set forth in Table 4-2 of the HCP. The plan will also include an evaluation of the linkage between observed fountain darters and DO measurements collected as part of the EAHCP Biological Monitoring Program and EAA Variable Flow Study. Feasible and cost-effective DO mitigation strategies will also be researched, evaluated, and included in the management plan. The management plan will be intended to guide the City of New Braunfels in achieving compliance with Task 5.2.4 of the HCP. If predicted or observed dissolved oxygen diel patterns are trending toward less than 4 mg/l the solar-powered aeration units will be deployed by City of New Braunfels staff.

Aquatic vegetation conditions and floating vegetation mats will be visual observed for signs of stress or decay on a weekly basis. If vegetation decay is evident and floating vegetation mat coverage reaches critical levels, then removal of decaying vegetation will be considered or other comparable management strategies will be developed based on specific conditions.

Monitoring:

Real-time dissolved oxygen and temperature will be monitored to evaluate projected trends indicative of problematic temperature or oxygen levels. Vegetation and floating vegetation mats in Landa Lake will be monitored on a weekly basis during the May through

September period to assess overall conditions and apparent stress levels (i.e., leaf coloration and condition).

Budget:

Table 7.1:

\$15,000

Estimated 2017 budget:

\$15,000

5.2.5/5.2.9 Non-Native Animal Species Control

The City of New Braunfels will continue to implement a program to reduce non-native animal species in the Comal River system. The non-native animal species that will be targeted include the suckermouth armored 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.

Long-term Objective:

Reduce populations of non-native animal species to minimize their direct and indirect impacts to the Covered Species and the Comal River ecosystem.

Assumptions: The HCP Biological Monitoring program will continue to track populations of targeted invasive, non-native species. Data collected as part of this program will be utilized to guide and refine invasive species removal efforts.

Target for 2017:

Continue existing program to remove non-native invasive species, including tilapia, nutria, and suckermouth armored catfish from the Comal River system utilizing removal methods proven successful in previous years. Continue to record counts and biomass of removed species.

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 impacting fountain darters and other Covered Species. Each seining effort will involve salvage of native species, which will be returned to the system. The City of New Braunfels will continue its nutria trapping program. A major focus of non-native removal will target suckermouth catfish given their overall destructive impacts 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. All removed non-native species will be disposed of offsite following City of New Braunfels policies.

Monitoring:

The HCP Biological Monitoring program will assess the status of non-native species populations and the impact of non-native removal to the Covered Species.

Reduction of Non-Native Species Introduction and Live Bait Prohibition

Long-term Objective:

Minimize the introduction of non-native species to the Comal River system.

Assumptions: The City of New Braunfels will explore the potential for implementing an education and outreach program aimed at educating and informing residents and visitors on the negative impacts of aquarium dumping and live bait usage. It is assumed education

methods will provide more benefit than the implementation of ordinances and prohibitions regarding aquarium dumping and live bait usage.

Target for 2017:

Develop and implement a program to educate residents and visitors on the negative impacts of aquarium dumping and usage of specific live bait species. Education and outreach will be achieved by distributing educational information and installing signage at key locations at Landa Lake and the Comal River. TPWD education materials and programs will be consulted and utilized.

Methods:

Distribute education and outreach materials designed to inform the public of the impacts of invasive species on the Comal River ecosystem. TPWD programs regarding the introduction of non-native, invasive species will be assessed and potentially utilized.

Monitoring:

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

Budget:

Table 7.1:

\$75,000*

*\$20,000 transferred from the Non-Native Animal Species Control task to fund Bank Stabilization and Riparian Restoration project in 2016.

Estimated 2017 budget:

\$55,000

5.2.6/6.3.6 Monitoring and Reduction of Gill Parasites

The City of New Braunfels will continue to implement a monitoring program associated with the gill parasite (*Centrocestus formosanus*) and its intermediate host snail *Melanoides tuberculatus*.

Long-term Objective:

To conduct monitoring and acquire data regarding gill parasite cercariae water column concentrations, fountain darter infection rates, host snail density and distribution, and gill parasite hosts to determine potential threats to fountain darters and other Covered Species within the Comal system. Develop management measures, as needed, to minimize negative impacts to fountain darter populations caused by gill parasites.

Target for 2017:

Continue existing monitoring program including snail distribution and density monitoring, cercariae water column concentration monitoring and snail infection prevalence.

Methods:

It is anticipated that methods used in previous years (2014-2016) to conduct annual *Melanoides* distribution and density surveys will be utilized in 2017. Two fisheries biologist using dip nets will traverse the entire Comal System recording the location of dip net sweeps and number of snails collected within each sweep. Water column cercarial concentration sampling will be conducted annually across the channel at the established transects. A total of 10 samples will be targeted at each cross section unless complex hydraulics suggests a higher spatial sampling. 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 contractor's laboratory where the number of cercariae on each filter will be counted with the aid of a dissecting microscope. Cercarial concentrations will be monitored more frequently when spring flow declines below 100 cfs or other springflow triggers that are developed.

Budget:

Table 7.1

\$75,000*

*\$45,000 transferred from the Gill Parasite Control task to fund Bank Stabilization and Riparian Restoration project in 2016.

Estimated 2017 budget:

\$ 30,000

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

The City of New Braunfels will continue to promote the prohibition of the transport of hazardous materials on routes crossing the Comal River and its tributaries. This effort may include development of local ordinances, installation of additional signage, and TXDOT approval.

Long-term Objective:

To minimize the potential for accidental spills or releases of hazardous materials into the Comal River system that may cause negative impacts to the Covered Species.

Target for 2017:

Maintain signage installed in 2016 and monitor for the presence of trucks carrying hazardous cargo on routes crossing the Comal River and its tributaries.

Methods:

In 2016, the City of New Braunfels reviewed existing City ordinances and concluded that Ordinance No. 93-7 effectively restricts the transport of hazardous cargo within Loop 337 and IH-35 and therefore, over roadways crossing the Comal River. The installation of additional hazardous route prohibition signage at key roadways near the headwaters of Landa Lake and the Comal River is expected to have been completed by the end of 2016.

Monitoring:

The City of New Braunfels Police Department will monitor for trucks carrying hazardous cargo on prohibited routes.

Budget:

Table 7.1:

\$0

Estimated 2017 budget:

\$0

5.2.8 Native Riparian Habitat Restoration (Comal Springs Riffle Beetle)

The City of New Braunfels will continue to implement a program to restore and maintain native riparian zones along Spring Run 3 and the western shoreline of Landa Lake to benefit the Comal Springs Riffle Beetle. Upon establishment of riparian zones on City of New Braunfels property, the City may develop a program to provide funding and incentives to riparian landowners who wish to establish native riparian vegetation on privately-owned lots located along the Western shoreline of Landa Lake.

Long-term Objective:

Establish a healthy, functioning riparian area along Spring Run 3 and the western shoreline of Landa Lake to benefit the Comal Springs Riffle Beetle. Establish native riparian vegetation to increase the stability of the bank, decrease erosion/ sedimentation, and increase the amount of usable habitat and food sources.

Assumptions: It is assumed this effort will continue to focus on the identification of target native riparian species most beneficial for the Comal Springs Riffle Beetle that also meet erosion control requirements. The target area for subsequent removal and establishment of native vegetation is the upstream 100 meters of Landa Lake and Spring Run 3 and proceeding north into private property lots (along the waters edge). It is assumed 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 segments during future years and incorporate revisions based on monitoring of work undertaken in previous years.

Target for 2017:

Continue to maintain previously restored areas along Spring Run 3 and the Western shoreline of Landa Lake. Continue removal of non-native vegetation and planting of native riparian vegetation. Continue to monitor recently restored areas for stability and established vegetative growth.

Methods:

Continue the removal of non-native, invasive plant species within the riparian zone. Plant deer-resistant, native plant species in Spring and Fall in areas where vegetation is sparse or not present. Plantings will be focused immediately along the waters' edge and in areas immediately up gradient of the shoreline. Utilize native plant species which have been observed in the immediate area and have proven successful in previous planting efforts. Install erosion/ sediment control devices, as needed in areas lacking sufficient vegetation and stability, to control hillside erosion and resulting sedimentation to riffle beetle habitat areas. Install fencing around young plants, as needed, to control foraging and damage by wildlife. Irrigation lines were installed in previous years and will be utilized and maintained, as necessary, to increase the survivability of plantings.

Monitoring:

Monitoring will occur on a regular basis to assess the survivability of plantings and the presence of non-native vegetation. Planting plots have been mapped and are utilized to

track the success of plantings in specific locations. Methods will be revised, as needed, based on results of monitoring. In the event of heavy rainfall, the erosion and sedimentation will be assessed in the following week. Sediment control devices will be monitored to assess effectiveness and stability. Sediment captured behind the control devices will continue to be measured and total volume quantified. The HCP Biological Monitoring program will track riffle beetle populations within Spring Run 3 and along the western shoreline of Landa Lake. Data collected as part of the biological monitoring program will be utilized to determine locations for focusing riparian zone restoration activities.

Budget:

Table 7.1:

\$25,000

Estimated 2017 budget:

\$25,000

5.2.10 Litter and Floating Vegetation Control

The City of New Braunfels will continue ongoing activities to manage floating vegetation and litter removal to enhance Covered Species and to prevent accumulations above and within aquatic vegetation restoration areas. Management activities will include dislodging of vegetation mats, to allow continued movement downstream, that form on top of the water surface and removal of litter for the littoral zone and stream bottom. The City of New Braunfels will manage aquatic vegetation in Landa Lake by dislodging floating vegetation entrained on the flow control structures, fishing piers, Landa Park Drive Bridge and other locations within Landa Lake where vegetation mats and litter accumulate.

Long-term Objective:

Minimize impacts of floating vegetation and litter on the overall aquatic community within the Comal River system.

Background:

Currently the City of New Braunfels contracts with a private contractor for the removal of litter and dislodging of floating vegetation from Landa Lake, the Comal River and the Guadalupe River. 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 HCP Section 5.2.10. It is possible that without funding from the HCP, this mitigation action would be unfunded in 2017.

All litter removal and vegetation dislodging in Landa Lake is associated with protection of Covered 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 HCP or species protection. Therefore, only costs associated with Landa Lake and underwater Comal River collections will be included in HCP activities and budgets.

Target for 2017:

Continue efforts to remove litter and dislodge floating vegetation mats from applicable portions of the Comal River system to prevent negative impacts to flow control structures, aquatic restoration areas, and Covered Species habitat. In the event of low-flow conditions or receipt of depressed dissolved oxygen levels in Landa Lake, the removal of, and/or increased efforts to dislodge, floating vegetation mats may be initiated to prevent oxygen consumption by decaying vegetative material.

Methods:

Landa Lake: (Jan 1st to December 31st). Routine vegetation maintenance and litter removal will occur from Jan 1st to December 31st. Vegetation maintenance and litter removal will occur on a scheduled basis between March and September and on an as-needed basis

during the remainder of the year. Floating vegetation mats will be dislodged from flow control structures, the Three Islands area, fishing pier and other locations where vegetation mats accumulate.

Comal River: (April 1st to October 30th). Vegetation maintenance and litter pickup from May 1st to September 30th is on a scheduled basis. Floating vegetation will be dislodged and inorganic litter will be picked up from the substrate, surface and littoral zone of the Old Channel. Underwater litter in the New Channel from the NBU Hydroelectric dam downstream to below the last tubers exit will be removed utilizing SCUBA.

Monitoring:

City of New Braunfels staff will monitor litter and floating vegetation mats in applicable areas. City staff will monitor contractor efforts and coordinate additional efforts when deemed necessary.

Budget:

Table 7.1:

\$0

Estimated 2017 budget:

\$30,000*

*\$30,000 transferred from 2017 Impervious Cover/Water Quality Protection to fund Litter and Floating Vegetation Management. The budget includes dislodging floating vegetation mats (\$20,000), underwater litter collection (\$5,000), and litter removal within the Old Channel (\$5,000).

5.2.11 Golf Course Management and Planning

The City of New Braunfels will implement their existing 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, continue to 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 continue to implement their existing IPMP and make adjustments to the plan as needed.

Target for 2017:

Continue to implement and update the existing IPMP.

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 describes 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:

The EAHCP Water Quality Monitoring Program includes base flow and storm sampling at designated locations along the Comal River both up- and downstream of the Landa Park Golf Course. Samples are analyzed for various herbicides and pesticides. Detections of pesticides and herbicides utilized for golf course maintenance operations may warrant the need for revisions to the existing IPMP.

Budget:

Table 7.1:

\$0

Estimated 2017 budget:

\$0

5.7.1 Native Riparian Habitat Restoration

Long-term Objective:

Increase the area and density of native riparian vegetation, reduce non-native riparian vegetation, and prevent streambank erosion in areas immediately adjacent to the Comal River to compliment aquatic vegetation restoration efforts and improve water quality.

Target for 2017:

Monitor and maintain previously restored riparian areas along the Old Channel of the Comal River between Landa Lake and the Golf Course Road bridge crossing (i.e. maintenance of riparian restoration that occurred as part of the Bank Stabilization and Riparian Restoration project in 2016). Remove non-native riparian vegetation along the Old Channel of the Comal River between Golf Course Road and the Old Channel Index Reach. Removal of non-native vegetation and select native vegetation will first be targeted to locations that will increase solar penetration and compliment aquatic vegetation restoration efforts. Install erosion control structures along channel utilizing removed non-native vegetation.

Methods:

Riparian restoration occurring in 2016 as part of the Bank Stabilization and Riparian Restoration project will be monitored and maintained to ensure success of native plantings and prevention of non-native vegetation re-emergence.

Non-native riparian vegetation (primarily *Ligustrum sp.*) will be removed utilizing herbicide applications and hand-removal methods. Removed vegetation will be utilized to form sediment capture zones in riparian areas with high erosion potential. In areas where riparian vegetation consists of only non-native species, a portion of the non-natives will be left in place until native species are planted in order to minimize the potential for erosion. Planting of native riparian vegetation is expected to occur in 2018.

Monitoring:

Monitor changes of solar exposure to the Old Channel as a result of non-native riparian plant removal. Previously restored riparian areas will be monitored for the re-emergence of non-native vegetation and success of native plantings. Sediment capture structures will be monitored for effectiveness.

Budget:

Table 7.1:

\$100,000*

*\$50,000 transferred from 2017 Native Riparian Habitat Restoration to fund Bank Stabilization and Riparian Restoration project in 2016.

Estimated 2017 budget:

\$50,000

5.7.5 Management of Household Hazardous Wastes

The City of New Braunfels will continue the hazardous household waste (HHW) program through the City of New Braunfels' Solid Waste division.

Long-term Objective:

Reduction in the improper disposal of hazardous wastes and incorporation of prescription drug and Freon drop off.

Target for 2017:

Continue hazardous household waste program which will include three HHW collection events. The City of New Braunfels will tentatively hold one additional HHW collection event in 2017 pending available budget.

Methods:

Conduct HHW collection events which incorporate an education and outreach component.

Monitoring:

The volume of hazardous waste material collected during the HHW collection events will be noted and compared to previous efforts.

Budget:

Table 7.1:

\$30,000*

*\$30,000 transferred from 2017 Management of HHW to fund Bank Stabilization and Riparian Restoration project in 2016.

Estimated 2017 budget:

\$ 30,000**

**\$30,000 transferred from 2017 Impervious Cover/Water Quality Protection task to fund HHW (5.7.5).

5.7.6 Impervious Cover/Water Quality Protection

Long-term Objective:

Reduction and control of non-point source pollutant discharges to Landa Lake and the Comal River system. To increase the implementation of Low Impact Development (LID) projects and provide incentives to reduce impervious cover.

Assumptions: It is assumed HCP funding will be available in future years to implement a LID Rebate Program and/ or other water quality protection strategies.

Target for 2017:

The City will continue to examine the LID Rebate Program, as it has been developed to date, and will consider the inclusion of specific measures, methods, and funding in the 2018 EAHCP Work Plan for implementation of a water quality protection program.

Methods:

In 2016, the City of New Braunfels adopted a LID Manual. In 2017, the City will at a minimum continue to provide information about the LID Manual to individual property owners and educate them about the incentives expected to be included in the LID Rebate Program. Other water quality protection strategies will also be evaluated in order to develop a water quality protection program that will provide maximum benefit to water quality and the covered species.

Budget:

Table 7.1:

\$100,000*

*\$15,000 transferred from 2017 Impervious Cover/Water Quality Protection to fund Bank Stabilization and Riparian Restoration project in 2016.

Estimated 2017 budget:

\$10,000

Note: From the 2017 Impervious Cover/Water Quality Protection, \$30,000 transferred to fund Litter and Floating Vegetation Management (5.2.10), \$30,000 transferred to HHW (5.7.5) and \$10,000 transferred to fund an increase in Old Channel Restoration (5.2.2.1).

**City of San Marcos/Texas State University
2017 Work Plan**

2017 San Marcos/Texas State University Work Plan Budget

| HCP Section | Conservation Measure | 7.1 | Estimated 2017 Budget | Difference |
|-------------------------------|---|------------------|------------------------------|-------------------|
| 5.3.1/5.4.1 | Texas wild-rice Enhancement | \$125,000 | \$100,000 | (\$25,000) |
| 5.3.6/5.4.4 | Sediment Removal | \$25,000 | \$0,000 ¹ | (\$25,000) |
| 5.3.8/5.4.3/ 5.4.12 | Control of Non-Native Plant Species | \$75,000 | \$150,000 | \$75,000 |
| 5.3.3/5.4.3 | Management of Floating Vegetation Mats and Litter | \$80,000 | \$51,298.10 | (\$28,701.90) |
| 5.3.5/5.3.9/ 5.4.11/5.4.13 | Non-Native Species Control | \$35,000 | \$27,959.20 | \$7,040.80 |
| 5.3.7 | Designation of Permanent Access Points/Bank Stabilization | \$20,000 | \$20,000 | \$0 |
| 5.7.1 | Native Riparian Restoration | \$20,000 | \$55,742.70 | \$35,742.70 |
| 5.3.2/5.4.2 | Management of Recreation in Key Areas | \$56,000 | \$56,000 | \$0 |
| 5.7.6 | Impervious Cover/Water Quality Protection | \$200,000 | \$150,000 | (\$50,000) |
| 5.7.5 | Management of HHW | \$30,000 | \$30,000 | \$0 |
| 5.3.4 | Prohibition of Hazardous Material Transport | \$0 | \$0 | \$0 |
| 5.7.3 | Septic System Registration and Permitting Program | \$0 | \$0 | \$0 |
| 5.7.4 | Minimizing Impacts of Contaminated Runoff | \$0 | \$0 | \$0 |
| 5.4.5 | Diversion of Surface Water | \$0 | \$0 | \$0 |
| 5.4.7 | Diving Classes in Spring Lake | \$0 | \$0 | \$0 |
| 5.4.8 | Research Programs in Spring Lake | \$0 | \$0 | \$0 |
| 5.4.10 | Boating in Spring Lake and Sewell Park | \$0 | \$0 | \$0 |
| 5.4.9 | Management of Golf Course and Grounds | \$0 | \$0 | \$0 |
| | Total | \$666,000 | \$641,000 | (\$25,000) |
| | | | | |

¹Move to 2018 Work Plan for possible Sessom Creek work

5.3.1/5.4.1 Texas Wild-Rice Enhancement and Restoration

Texas State University and the City of San Marcos are continuing to partner to enhance and restore Texas wild-rice (TWR) in Spring Lake and the San Marcos River to the San Marcos wastewater treatment plant.

Long-term Objective:

To restore 8000 m² of TWR (in addition to the 2013 baseline of 4000 m²) and protect existing and restored areas of TWR (as required in Table 4-10).

Plant Source: The production of Texas wild-rice occurs at the Freeman Aquatic Building (FAB) at Texas State University and the U.S. Fish and Wildlife Service San Marcos Aquatic Research Center (SMARC). Production of plants at the FAB and SMARC is incorporated into this work plan budget (TWR Enhancement & Removal of non-natives).

Enhancement and restoration of TWR focuses on the removal of non-native vegetation within mixed stands of TWR and removal of non-native vegetation in areas adjacent to existing TWR stands. The work plan also includes selective TWR planting areas where non-native vegetation and sediment is removed as discussed in EAHCP measures 5.3.6/5.4.4 (Sediment removal) and 5.3.8/5.4.3/5.4.12 (Control of non-native plant species). In addition, TWR areal coverage within Spring Lake is targeted for 1500 m².

Target for 2017:

TWR is now being considered as a plant that provides fountain darter habitat and will therefore be counted toward meeting EAHCP biological goals as described in the Submerged Aquatic Vegetation (SAV) Analysis and Recommendations (Section 3.1.2.2). Therefore, in accordance with Table 31 of the SAV Recommendations, 25 m² will be planted in the Spring Lake dam reach, 75m² in the City Park reach and 75m² in the IH-35 reach.

Methods:

Model results from Hardy et al. (2011a) were used to identify restoration/enhancement areas for TWR that would have sustainable depth and velocity during low flows below 90 cfs (optimal habitat). *Hydrilla* and *Hygrophila* were selected as target species for removal due to their high relative abundance in the San Marcos River. In mixed stand areas, the non-natives are removed and the original TWR stand monitored for expansion. Similarly, for TWR stands occupying optimal areas with adjacent non-native vegetation, the non-native plants are removed and the TWR monitored for expansion. Finally, in optimal areas for TWR that are unoccupied by TWR, any non-native vegetation that is present is removed and TWR planted and monitored to assess the success of transplants. Monitoring thus far has shown that invasive plants move into cleared areas more quickly than TWR, so cleared areas are now planted with either TWR or an approved native plant.

Seeds and tillers are collected following the guidance developed by the SMARC to help maintain genetic diversity in ex situ TWR (grown at FAB and SMARC). Documented seed collection from all reaches in the upper SMR is a critical component of this effort.

When removing non-native vegetation, the non-native vegetation is fanned to displace fountain darters prior to uprooting the vegetation. The non-native aquatic plants are shaken, fountain darters (and other native species) salvaged and returned to the river, and the non-native vegetation disposed at the city's or university's composting facility.

Monitoring:

All planted areas are filmed via quadcopter which is then mapped and analyzed via GIS.

Budget:

Table 7.1:

\$125,000

Estimated 2017 budget:

\$100,000*

*\$25,000 transferred to Non-native Plant Removal for 2017

5.3.6/5.4.4 Sediment Removal

The City of San Marcos and Texas State University are partnering to remove sediment from the river bottom in support of the native SAV planting program from Spring Lake to IH-35.

Long-term Objective:

The removal of sediment in support of native aquatic planting activities has proved to be both unnecessary and overly expensive. To remove 158 m³, the cost has been \$555,000 (2013 – 2015). Additionally, the crew has accomplished multiple plantings in silted areas without first removing silt, and these plantings have been successful. Therefore, the funds allocated for sediment removal will be suspended to future years in order to determine if these funds can be used to deter influx of sediment from the Sessom Creek watershed. During the 2015 October flood, Sessom Creek dumped sediment on TWR stands and other native plant stands down to City Park. Funds will be available for the TWR plantings in Spring Lake as needed.

Target for 2017:

Roll the 2017 funding to 2018 thus allowing time for the completion of adaptive management process to consider applying this funding to active sources of sediment; specifically Sessom Creek watershed. Sessom Creek is a highly urbanized steep watershed that contributes a heavy load of sediment during rain events; in the 2015 October flood, Sessom Creek dumped sediment on TWR stands and other native plant stands down to City Park.

Method:

To be determined based on the result of the AMP.

Monitoring:

N/A

Budget:

Table 7.1:

\$25,000

Estimated 2017 budget:

\$0

5.3.8/5.4.3/5.4.12 Control of Non-Native Plant Species

The City of San Marcos and Texas State University are partnering to implement an on-going non-native plant replacement program for the San Marcos River from Spring Lake to Stokes Island. Non-native species of aquatic, littoral, and riparian plants will be replaced with native species to enhance Covered Species habitat.

Long-term Objective:

To decrease the density of invasive aquatic and littoral plants or eliminate as possible through monitored removal in and along the San Marcos River. Treated areas will be replanted with native aquatic, littoral and riparian plants to enhance listed species habitat.

Assumptions: Non-native aquatic plants will be removed in association with Texas wild rice enhancement as described in conservation measure 5.3.1/5.4.1. It is also assumed that production of native submerged aquatic vegetation (SAV) will continue at the FAB and the SMARC. Funding for the production of SAV at the FAB and SMARC is incorporated into this work plan budget. Removal of littoral plants and other small caliper invasives is also included in this budget.

Target for 2017:

SAV and Texas wild rice restoration progress in the San Marcos River was recently evaluated. Based on the results, the Long Term Biological Goals (LTBG) were adjusted and restoration goals were proposed for newly defined reaches. Figures 1 and 2 describe the proposed adjustments and goals. Figure 3 sets the annual targets for SAV restoration for 2017.

Figure 1. Revised LTBG for SAV and Texas wild rice (m²)

| LTBG Reach | <i>Ludwigia repens</i> | <i>Potamogeton illinoensis</i> | <i>Hydrocotyle verticillata</i> | <i>Cabomba caroliniana</i> | <i>Sagittaria platyphylla</i> | <i>Zizania texana</i> |
|-----------------|------------------------|--------------------------------|---------------------------------|----------------------------|-------------------------------|-----------------------|
| Spring Lake Dam | 100 | 200 | 50 | 50 | 200 | 700 |
| City Park | 150 | 1450 | 10 | 90 | 300 | 1750 |
| IH-35 | 50 | 250 | 50 | 50 | 150 | 600 |

Figure 2. EAHCP SAV goals and Texas wild rice in restoration reaches (m²)

| Restoration Reach | <i>Ludwigia repens</i> | <i>Potamogeton illinoensis</i> | <i>Hydrocotyle verticillata</i> | <i>Cabomba caroliniana</i> | <i>Sagittaria platyphylla</i> | <i>Zizania texana</i> |
|-----------------------------------|------------------------|--------------------------------|---------------------------------|----------------------------|-------------------------------|-----------------------|
| Sewell Park | 25 | 150 | 10 | 25 | 25 | 1100 |
| Below Sewell to City Park | 50 | 500 | 20 | 50 | 700 | 2300 |
| Hopkins St to Snake Island | 50 | 475 | 10 | 50 | 750 | 950 |
| Cypress Island to Rio Vista Falls | 50 | 150 | 0 | 50 | 50 | 350 |
| IH-35 expanded | 50 | 250 | 50 | 100 | 450 | 450 |

| | | | | | | |
|-------|-----|------|----|-----|------|------|
| Total | 235 | 1525 | 90 | 275 | 1975 | 5150 |
|-------|-----|------|----|-----|------|------|

Figure 3. Annual aquatic restoration goals (m²) within LTBG and restoration reaches

| Reaches | Species | Aquatic vegetation (m ²) | | Restoration Goal |
|----------------------------|---------------------------------|--------------------------------------|------|------------------|
| | | Existing Coverage | Goal | 2017 |
| LTBG Reaches | | | | |
| Spring Lake Dam | <i>Ludwigia repens</i> | 0 | 200 | 10 |
| | <i>Cabomba caroliniana</i> | 0 | 25 | 5 |
| | <i>Potamogeton illinoensis</i> | 0 | 1000 | 50 |
| | <i>Sagittaria platyphylla</i> | 7 | 100 | 15 |
| | <i>Hydrocotyle verticillata</i> | 7 | 50 | 0 |
| | <i>Zizania texana</i> | 598 | 700 | 25 |
| City Park | <i>Ludwigia repens</i> | 1 | 1000 | 50 |
| | <i>Cabomba caroliniana</i> | 0 | 50 | 5 |
| | <i>Potamogeton illinoensis</i> | 54 | 2000 | 50 |
| | <i>Sagittaria platyphylla</i> | 92 | 300 | 15 |
| | <i>Hydrocotyle verticillata</i> | 0 | 10 | 0 |
| | <i>Zizania texana</i> | 1261 | 1750 | 75 |
| IH-35 | <i>Ludwigia repens</i> | 0 | 200 | 10 |
| | <i>Cabomba caroliniana</i> | 0 | 300 | 15 |
| | <i>Potamogeton illinoensis</i> | 0 | 300 | 25 |
| | <i>Sagittaria platyphylla</i> | 0 | 100 | 10 |
| | <i>Hydrocotyle verticillata</i> | 0 | 50 | 0 |
| | <i>Zizania texana</i> | 28 | 600 | 75 |
| Restoration Reaches | | | | |

| | | | | |
|-----------------------------------|---------------------------------|------|------|----|
| Sewell Park | <i>Ludwigia repens</i> | 0 | 25 | 0 |
| | <i>Cabomba caroliniana</i> | 14 | 25 | 0 |
| | <i>Potamogeton illinoensis</i> | 116 | 150 | 0 |
| | <i>Sagittaria platyphylla</i> | 2 | 25 | 0 |
| | <i>Hydrocotyle verticillata</i> | 0 | 10 | 0 |
| | <i>Zizania texana</i> | 1169 | 0 | 0 |
| Below Sewell to City Park | <i>Ludwigia repens</i> | 0 | 50 | 0 |
| | <i>Cabomba caroliniana</i> | 0 | 50 | 0 |
| | <i>Potamogeton illinoensis</i> | 172 | 500 | 0 |
| | <i>Sagittaria platyphylla</i> | 727 | 700 | 0 |
| | <i>Hydrocotyle verticillata</i> | 5 | 20 | 0 |
| | <i>Zizania texana</i> | 2247 | 2300 | 0 |
| Hopkins St to Snake Island | <i>Ludwigia repens</i> | 0 | 50 | 0 |
| | <i>Cabomba caroliniana</i> | 0 | 50 | 0 |
| | <i>Potamogeton illinoensis</i> | 269 | 475 | 0 |
| | <i>Sagittaria platyphylla</i> | 620 | 750 | 0 |
| | <i>Hydrocotyle verticillata</i> | 0 | 10 | 0 |
| | <i>Zizania texana</i> | 693 | 950 | 0 |
| Cypress Island to Rio Vista Falls | <i>Ludwigia repens</i> | 0 | 50 | 10 |
| | <i>Cabomba caroliniana</i> | 0 | 50 | 5 |
| | <i>Potamogeton illinoensis</i> | 0 | 150 | 10 |
| | <i>Sagittaria platyphylla</i> | 5 | 50 | 5 |
| | <i>Hydrocotyle verticillata</i> | 0 | 0 | 0 |
| | <i>Zizania texana</i> | 122 | 350 | 50 |
| IH-35 expanded | <i>Ludwigia repens</i> | 8 | 50 | 10 |
| | <i>Cabomba caroliniana</i> | 33 | 100 | 25 |
| | <i>Potamogeton illinoensis</i> | 0 | 250 | 30 |
| | <i>Sagittaria platyphylla</i> | 355 | 450 | 25 |

| | | | | |
|--|---------------------------------|----|-----|----|
| | <i>Hydrocotyle verticillata</i> | 0 | 50 | 0 |
| | <i>Zizania texana</i> | 57 | 450 | 50 |

Littoral: The area from Spring Lake to just below IH-35 has undergone initial removal of elephant ears, so in 2017 all treated areas will be monitored for regrowth and planted with natives. Most importantly, efforts will be extended to remove hot spots that contribute to regrowth.

Monitoring:

Aquatic vegetation: Newly planted areas are monitored monthly to evaluate success rate. Monitoring is accomplished using drone imagery analyzed with GIS. Planted areas are weeded (non-native species removed) and replanted as needed to deter re-invasion. An annual river inventory will be conducted to identify the presence and location of new non-native vegetation establishment. Success will be measured by the surface area cleared of non-natives and increased coverage by native SAV.

Budget:

Table 7.1:

\$75,000

Estimated 2017 budget:

\$150,000 *

*\$25,000 transferred from TWR Enhancement and \$50,000 from WQ/LID to cover the scope of this measure across three contractors' annual budget.

5.3.3/5.4.3 Management of Floating Vegetation Mats and Litter

The City of San Marcos and Texas State University are partnering to implement an ongoing program to manage floating vegetation and litter removal for the enhancement of listed species habitat. Management activities include removal of vegetation mats that form on top of Texas wild-rice plants, particularly during low flows, and removal of litter from the littoral zone, stream bottom and tributaries. Texas State University will manage aquatic vegetation in Spring Lake through use of its harvester boat and hand cutting of vegetation by divers authorized to dive in Spring Lake.

Long-term Objective:

Minimize impacts of floating vegetation and litter on TWR stands and overall aquatic community within the San Marcos River, as well as keep springs clear to enhance San Marcos salamander habitat.

Assumptions: Existing vegetation management activities in Spring Lake will continue to follow the Spring Lake Management Plan (approved by the President's Cabinet) and the EAHCP, as described under Methods. Litter and floating vegetation mat removal will follow the existing protocol and schedules currently employed by the City of San Marcos and the EAHCP, as described below under Methods.

Target for 2017:

Continued implementation of the established protocols.

Methods:

Spring Lake: Each week about five springs are cut, with divers returning to cut the same springs every two to three weeks. During summer algal blooms, the springs will be managed more frequently (up to four springs per day), but mostly to remove algae. Texas State employees and supervised volunteers will fin the area around the springs to remove accumulated sediment, and then clear a 1.5 meter radius around each spring opening in Spring Lake with a scythe. Over the next 1.5 meter radius around the spring opening, they will shear vegetation to a height of 30 cm, and then to one meter over the following three meter radius. Plant material will not be collected, but carried away by the current. Cumulatively, about six meters of vegetation around each spring opening will be modified. Mosses will not be cut. The volume of plant material to be removed will vary by the amount of time between cuttings, and season. The harvester boat will remove a range of 15 to 20 boatloads of plant material a month from Spring Lake. The harvester will clear the top meter of the water column, cutting vegetation from sections one, two, and three once a week (See HCP Figure 5.2). The harvested vegetation will be visually checked by driver for fauna caught in the vegetation. If the driver observes fauna, he/she will stop work and put the animal(s) back into Spring Lake if appropriate. Texas State employees and supervised volunteers are trained to recognize the Covered Species through the Diving for Science program (Section 5.4.7.1), and avoid contact with them. Vegetation mats will be removed from zones four and five on an as-needed basis (See HCP Figure 5-2). The total area cut will equal about nine surface acres. The Spring Lake Area Supervisor also schedules cleanup of nuisance floating species such as water hyacinth and water lettuce from Spring Lake. The floating plants will be collected by hand and shaken prior to removal from the river to dislodge any aquatic species caught in the

plant. The plants will be deposited into dump trucks and taken to the Meadows Center compost area. The activities described in this section are not funded by the EAHCP. They are fully supported by Texas State University.

San Marcos River: Floating vegetation in Texas wild-rice stands will be pushed and/or lifted off the stands and removed. Inorganic litter will be picked up weekly from the substrate, surface and littoral zones of the San Marcos River from upper Sewell Park to City Park and from IH-35 to Stokes Island during the recreational season (May 1st to September 30th) and monthly during offseason. Litter will also be picked up from public lands within the four tributaries. Monitoring of downstream Texas wild-rice stands to keep the stands clear of drifting vegetation will also be undertaken.

Monitoring:

Floating vegetation and litter are targeted weekly during the recreation season and then monthly during the remainder of the year. In the event of low flows, this activity will be monitored for potential impacts on listed species and will be suspended if impacts are observed. Volume of litter will be tracked.

Budget:

Table 7.1:
\$80,000

Estimated 2017 budget:
\$51,298.10

*Total includes contract amount (\$48,798.10) and public outreach funds (\$2,500). \$28,701.90 will be transferred to Native Riparian Habitat Restoration

5.3.5/5.3.9/5.4.11/5.4.13 Non-Native Species Control

The City of San Marcos, in partnership with Texas State University, will implement a program of invasive faunal control in the San Marcos River on a periodic basis with expanded efforts of control, if needed, at low flows. The species include suckermouth catfish, tilapia, nutria and *Melanoides* and *Marisa cornuarietis*. Educational materials will be provided to local pet shops, commercial outlets who sell aquarium species, University buildings and dorms and various public facilities. Alternatives, such as a local pet shop and discovery center release pond, will be offered to fish and snail owners.

Long-term Objective:

Reduction of non-native, invasive species in the San Marcos River to levels that minimize their possible impacts on Covered Species and the aquatic ecosystem.

Target for 2017:

Contractor will use methods that have proven to be successful in efficient capture of invasive species from Spring Lake to IH-35. Contractor will count and trend captured individuals for all targeted species.

Methods:

Methods will be undertaken in a manner that avoids impacts to resident turtles and other native species. Fyke nets, live trap cages, spear and bow fishing continue to be effective methods. Contractor uses and will continue to use volunteer spearfishing tournaments to increase total removal, while saving costs and providing an educational awareness component to the community.

Effective removal of *Melanoides* and *Marisa cornuarietis* will continue to be accomplished by determining the locations of highest snail density and using dip nets to remove the snails weekly. The species will be controlled by diving several hours after sunset to hand-pick the snails from the submergent vegetation.

Monitoring:

It is assumed that the integrated biological monitoring program will assess the status of non-native animal species to accompany trend data collected by contractor.

Budget:

Table 7.1:

\$35,000

Estimated 2017 budget:

\$27,959.20

*Total includes contract amount (\$25,459.20) and public outreach funds (\$2,500). \$7,040.80 will be transferred to Native Riparian Habitat Restoration.

5.3.7 Designation of Permanent Access Points/Bank Stabilization

The City of San Marcos has completed the construction of bank stabilization/access points at seven locations along the San Marcos River. In 2015/16, concrete bags were used to stabilize the undermined rocks until a permanent repair can be accomplished.

Long-term Objective:

Maintain integrity of structures and control erosion in the recreation traffic areas at each structure.

Target for 2017:

Permanent repair of all access points. Quarterly monitoring to ensure ongoing structural stability.

Budget:

Table 7.1:

\$20,000

Estimated 2017 budget:

\$20,000

5.7.1 Native Riparian Habitat Restoration

The City of San Marcos and Texas State University have undertaken a program to increase the area and density of the riparian and water quality buffer zone on public and private lands from the Spring Lake Dam to Stokes Park using native vegetation. Upon completion of the riparian and water quality buffer zone on public land, private landowners will be asked to voluntarily participate in the plan.

Long-term Objective:

Establish a robust native riparian and water quality buffer community that benefits Covered Species and the habitat quality adjacent to and within the San Marcos River down to IH-35 as well as prevent public access in undesirable locations which will decrease bank erosion. A zone of prohibitive vegetation along the uppermost edge of the riparian and water quality buffer community will be established to encourage river users to access the river via hardened access points. Encourage private riverside landowner participation in this program and provide the labor and plants as practical. Contractor(s) will perform invasive removal and maintenance. Native plantings and maintenance will be done by volunteers during regular planting events.

Target for 2017:

Use contractor to remove invasives from the last portion of Ramon Lucio Park (Wildlife Annex). Volunteers will replant with natives, and contractor/volunteers will maintain all treated areas from Spring Lake to IH35. *Arundo donax* removal will be researched for possible extraction. Once sediment has been removed from the channel behind Snake Island, the private landowners will be contacted to participate in this program.

Monitoring:

Monitoring will occur monthly to check for re-growth and treat as needed. HTC provided a cost proposal for water quality buffer maintenance from headwaters to IH-35 @ \$30,000 per year. So maintenance will continue to be a mix of contract work and volunteerism.

The City has provided and will continue to provide all fences to protect the sites as well as game cameras and other security measures as needed to prevent theft, vandalism and unauthorized access

Budget:

Table 7.1:

\$20,000

Estimated 2017 budget:

\$55,742.70

*\$35,742.70 will be transferred from Litter Removal and Non-native Species Control to fund this measure. Budget plan includes funding the project over four years (2015 -2018) to cover expenses through the transfer of funds from other measures and the yearly allocation. This budget plan was approved during the 2015 Work Plan session.

5.3.2/5.4.2 Management of Recreation in Key Areas

Public recreational use of the San Marcos Springs and 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 San Marcos will implement the Recreation Mitigation Measures adopted by the San Marcos City Council on February 1, 2011 (Resolution 2011-21). The City of San Marcos and Texas State University will enforce these measures (as covered in HCP Section 5.3.2.1) to ensure their success. Section 5.3.2.1 includes multiple educational and public outreach suggestions for implementation:

- a. Signage. Post signage at the City Park tube rental facility, Rio Vista Falls and at proposed hard access points along the river. Signs will have the same template and coloration so they are recognized up and down the river. Signs will cover the rules of the river and educate the public on the importance of the resource. All signs will be bilingual. Kiosk signs have been produced, but kiosks need to be built for posting at each access point. Awaiting final construction of the access points in 2016. Interpretive map has been designed and will be produced and posted in 2017.
- b. Video Loop at City Park and Rio Vista Falls offering information about the river and safety rules while people are waiting for shuttle or tubes. Video will be finished in 2016 for Lion's Club and will be updated and distributed electronically for increased exposure.
- c. Posted maps showing trail, access points, fishing access and other amenities. Include a map at Stokes Park to help inform about the San Marcos River/Blanco confluence. This map is under design by interns.
- d. Work with the Tourist Information Bureau to include information on the endangered species and ongoing HCP projects at hotels/restaurants, bed and breakfast facilities, Chamber of Commerce, Visitor's Center, City of San Marcos internet site, etc. along with the recreational information.
- e. Park Rangers. Include a section on river biology in the training of the park rangers so they can help disseminate the information.
- f. School Outreach. Implement an outreach program for San Marcos Consolidated Independent School District (SMCISD) so this information can be relayed to youth in San Marcos and indirectly to the parents. This is underway through the embedding of our interactive river habitat card game into curriculum for SMCISD elementary schools.
- g. Overall Interpretation Plan. This would pull all the informational ideas together for conformity, continuity, and implementation. This is also under development.
- h. *Additional outreach:* The San Marcos Discovery Center provides a facility dedicated to inclusion of HCP education and public outreach for the aquifer region.

- i. Provide HCP presentations to TxState Outdoor Recreation class and Wildlife Society club and partner with TxState Geography Intern Program to increase volunteer participation.
- j. Provide outreach at booths including 72 degree festival, Concert Series (Earth & Water), Passport SMTX, Business Expo, Don't Mess with Texas Litter Cleanup.
- k. Present Water Quality and Riparian Restoration outreach during volunteer planting days; most recently to the entire Texas State football team.

Long-term Objective:

To establish and maintain a trained seasonal conservation resource that will monitor recreational activities and monitor/maintain ongoing HCP measures in and along the San Marcos River while educating the public about the Covered Species and importance of their protection as part of our enforcement obligations under the SSA and HCP measures and establish an ongoing stream of information to increase public awareness and support. Also, to establish a program that provides incidental take coverage to third parties through the acquisition of a Certificate of Inclusion (COI).

Target for 2017:

Continue the implementation of recreational management goals as outlined above. Educate the public engaged in water-based recreation on sustainable river use that protects listed species and their habitats. The seasonal workers will also conduct miscellaneous cleanup and HCP project maintenance while walking/kayaking. Introduce the COI program to qualified third parties conducting recreational activities in and along the San Marcos River.

Methods:

The contracted conservation resource will monitor river user activities from Memorial Day weekend to Labor Day weekend on a Wednesday through Sunday schedule. They will also actively engage in public education and outreach about target species and their habitats. Finally, they will aid in the implementation of recreational management goals.

Monitoring:

Every few years, the public will be surveyed during the recreation season to assess the level of understanding of Covered Species, ongoing HCP Measures, effectiveness of the public outreach and education program, and the impacts of recreational activities on species and habitat. Last survey occurred in 2015.

Budget:

Table 7.1:

\$ 56,000

Estimated 2017 budget:

\$56,000

5.7.6 Impervious Cover/Water Quality Protection

The City of San Marcos and Texas State University will implement a program to protect water quality and reduce the impacts of urbanization based upon the LID/BMP practices. Urban land development tends to increase the intensity of storm water flows and the amount of nonpoint source (NPS) pollution reaching local water resources. Buildings, roads, and other impervious surfaces shed rain more rapidly than areas covered by vegetation, and most typical urban land uses require rapid drainage of storm water. The very rapid, direct connection of developed land across paved surfaces and through drainage conveyances to waterways tends to carry more pollutants more quickly from the land surface to water resources. A number of water quality problems and impairments in Texas are attributed in full or in part to such urban storm water runoff carried through storm sewers and channelized streams. The science committee stated this measure was one of great importance to the success of the EAHCP for listed species protection (May 9, 2013). Addressing water quality is critical to protection of the listed species in a rapidly developing environment.

Long-term Objective:

Implement a program that minimizes the impacts associated with urbanization and changes in land use/cover in the Upper San Marcos watershed, manages stormwater as close to its source as possible, treats stormwater as a resource rather than a waste product, emphasizes conservation and the use of on-site features to protect water quality, and increases infiltration to groundwater and aquifer recharge for the protection of riverine integrity.

Target for 2017:

Implement the Water Quality Protection Plan (WQPP) for Texas State University and City of San Marcos incorporating all jurisdictional watershed areas that directly or indirectly impact Covered Species' critical habitat for the purpose of meeting the goals stated in the long-term objective. Includes public education, staff integration, potential changes to the City's Land Development Code and Stormwater Technical Criteria Manual, potential changes to the University's Master Plan and Construction Standards, designs for retrofit water quality projects, grant proposals, land conservation program and coordination with ongoing stormwater management plans for city and university.

Methods:

City of San Marcos and Texas State University have a contract for the implementation of the developed plan.

Budget:

Table 7.1:
\$200,000

Estimated 2017 budget:
\$150,000

*\$50,000 will be transferred to Non-native Plant Removal

5.7.5 Management of Household Hazardous Waste

The City of San Marcos will maintain a Household Hazardous Waste (HHW) program that involves the periodic collection of Household Hazardous Waste Collection (HHWC) and its disposal.

Long-term Objective:

Continue to provide a place for citizens of San Marcos and Hays County to safely dispose of HHW.

Assumptions: City of San Marcos will continue its existing program.

Target 2017:

Continue outreach and target 2750 participants for public outreach events. Staff will conduct these events and convert or dispose of the HHW between events. Fund outreach to surrounding communities within the San Marcos River watershed that cannot afford to partner in a HHWC program.

Methods:

Open drop-off opportunities two days a week (Tuesday and Friday) from 12:00 noon to 3:30 p.m. to the public. Conduct HHWC events 1 to 2 times per year on a Saturday in north central Hays County. Cover disposal costs for these events.

Monitoring:

Track the amount of HHW received and number of participants from San Marcos, Hays County, and surrounding communities. All necessary documentation will be turned in to TCEQ. Identify the HHW that comes from communities with the San Marcos River watershed and the cost of collecting, processing and disposing of HHW from these communities.

Budget:

Table 7.1:

\$30,000

Estimated 2017 budget:

\$30,000

5.3.4 Prohibition of Hazardous Materials Transport Across the San Marcos River and Its Tributaries

The City of San Marcos will coordinate with the Texas Department of Transportation to designate hazardous materials routes which minimize the potential for spills into the San Marcos River. This effort will include legislation, if necessary, and additional signage.

Long-term Objective:

Reduce the potential of spill of hazardous materials in the San Marcos River and its tributaries.

Assumptions: The primary effort will involve stakeholder engagement, public meetings, and coordination with TXDOT.

Target for 2017:

Coordination with TxDOT for the implementation of hazardous materials restrictions and establishment of signage. Contact New Braunfels office for more rapid implementation.

Methods:

Complete checklist provided by TxDOT to establish a hazmat route that all transport routes that cross the San Marcos River and its primary tributaries.

Monitoring:

Bi-annual monitoring of hazmat traps on designated roadways to determine functionality and annual monitoring of all installed signage will be accomplished. Substandard conditions will be repaired or replaced as necessary.

Budget:

Table 7.1:

\$0

Estimated 2017 budget:

\$0

5.7.3 Septic System Registration and Permitting Program

The City of San Marcos will undertake an aerobic and anaerobic septic system registration, evaluation, and permitting program to prevent subsurface pollutant loadings from potentially being introduced to the San Marcos Springs ecosystem within city limits.

Long Term Objective:

To continue the registration, permitting and inspection of all new or existing septic systems installed or modified in the City of San Marcos jurisdiction. This has and will continue to be done to ensure compliance of all Texas Commission on Environmental Quality (TCEQ) regulations governing septic systems.

Assumptions: The existing program is adequate to meet the intent of this Measure.

Target for 2017:

To have an accurate record of new and existing septic systems installed and modified in city jurisdiction. Also, by ordinance, to have all owners of septic systems connect to municipal sewer lines as they become available.

Methods:

It is required by law that all septic systems are permitted by the local Designated Representative (DR), which is the City of San Marcos Environmental Health Department. Plans are submitted with the application and reviewed by the DR for TCEQ compliance. Once these are met, the permit to construct is issued. The design, site evaluation, installation and inspections can only be performed by individual that are licensed by TCEQ. Before the installation or modification is approved, inspections are made by the DR to ensure that the system installed corresponds with the design. Once completed, a license to operate is issued to the property owner by the DR. All DRs are subject to TCEQ Compliance Reviews.

Monitoring:

The City of San Marcos Environmental Health Department reviews all applications and inspects the installations of all new and modified septic systems within the City's jurisdiction. The Department also monitors maintenance and responds to all complaints reported or observed.

Budget:

Table 7.1:

\$0

Estimated Budget:

\$0

5.7.4 Minimizing Impacts of Contaminated Runoff

The City of San Marcos will construct two sedimentation ponds along the river to help reduce the amount of contaminated material that enters the river as a result of rain events. The first pond will be located in Veramendi Park beside Hopkins Street Bridge. The second pond will be created by widening the drainage ditches that run alongside Hopkins Street and cut directly to the San Marcos River.

Long-term Objective:

Reduce the input of sediment and roadway pollutants into the San Marcos River.

Assumptions: Construction of the proposed sediment retention ponds are funded under Measure 5.7.6.

Target for 2017:

Continue to research funding sources for the design and construction of the Best Management Practices (BMPs) to be constructed at Veramendi Park and along Hopkins Street that will reduce total suspended solids (TSS) by 85%. Baseline water quality measurements should be taken prior to BMP installation. Storm water discharge should be re-sampled after BMP installation to measure success.

Methods:

A contractor will research applicable BMP designs and recommend the most economic and efficient methods to control contaminants.

Budget:

Table 7.1:

\$0

Estimated 2017 budget:

*See Measure 5.7.6

5.4.5 Diversion of Surface Water

Texas State University will curtail its permitted surface water diversions as a function of total San Marcos spring flow to protect the aquatic resources as specified under the HCP flow management strategy. Under TCEQ Certificates 18-3865 and 18-3866, Texas State University's total diversion rate from the headwaters of the San Marcos River for consumptive use is limited to 8.1 cfs (See HCP Section 2.5.5). The total diversion rate from Spring Lake is limited to 4.88 cfs; the total diversion rate from the San Marcos River at Sewell Park is limited to 3.22 cfs (See HCP Section 2.5.5.1 and 2.5.5.2 respectively).

Long-term Objective:

Meet diversion restrictions specified under the HCP.

Target for 2017:

Restriction of surface pumping as specified under the HCP.

Methods:

To minimize the impacts of these diversions, when flow at the USGS gauge at the University Bridge reaches 80 cfs, Texas State University will reduce the total rate of surface water diversion by 2 cfs, *i.e.*, to a total of approximately 6.1 cfs. This reduction in pumping will occur at the pump just below Spring Lake Dam in order to maximize the benefits to salamanders, Texas wild-rice, and other aquatic resources in the San Marcos River below Spring Lake Dam. The University will reduce the total rate of surface water diversion by an additional 2 cfs when the USGS gauge reaches 60 cfs. The additional 2 cfs reduction will be made from the pumps located in the slough arm of Spring Lake, and, therefore, maximize the benefits to the aquatic resources within the main stem San Marcos River below Spring Lake Dam. When the USGS gauge reaches 49 cfs, Texas State University will reduce the total diversion rate to 1 cfs. This further reduction will be made by restricting the pumps located in the Sewell Park reach. The diversion of water will be suspended when the springflow reaches 45 cfs.

Monitoring:

Pumping rates will be reported on a daily basis when any of the pumping restrictions are in force.

Budget:

Table 7.1:

\$0

Estimated 2017 budget:

\$0

5.4.7 Diving Classes in Spring Lake

Access to Spring Lake is strictly controlled and regulated in accordance to federal, state and local laws. City ordinance and state law designate the public waters of Spring Lake as restricted to activities authorized by the University. All diving activities in Spring Lake are governed by the Spring Lake Management Plan.

Long-term Objective:

Maintain the integrity of the ecology and cultural resources within Spring Lake.

Assumptions: All diving activities in Spring Lake are governed by the Spring Lake Management Plan.

Target for 2017:

Implement the diving protocols as outlined in the Spring Lake Management Plan and the Edwards Aquifer HCP Incidental Take Plan.

Methods:

The Diving Safety Officer will monitor all diving activities in Spring Lake, assuring all guidelines contained in the Diving Safety Manual for Spring Lake and the EAHCP ITP are observed.

Monitoring:

The Lake Manager, with assistance from the Diving Safety Officer, will compile an annual summary of diving activities conducted in Spring Lake and provide to the Diving Control Board for its review.

Budget:

Table 7.1:

\$0

Estimated 2017 budget:

\$0

5.4.8 Research Programs in Spring Lake

Access to Spring Lake is strictly controlled and regulated in accordance to federal, state and local laws. City ordinance and state law designate the public waters of Spring Lake as restricted to activities authorized by the University. Proposals for research projects in Spring Lake must be submitted to the Environmental Review Committee, through the Lake Manager, for review and approval.

Long-term Objective:

Maintain the integrity of the ecology and cultural resources within Spring Lake. All research activities in Spring Lake are governed by the Spring Lake Management Plan.

Target for 2017:

Implement the protocols for research as specified in the Spring Lake Management Plan and the EAHCP ITP.

Methods:

Proposals for research projects in Spring Lake must be submitted to the Environmental Review Committee, through the Lake Manager, for review and approval.

Proposals for research projects must be submitted in writing and include:

1. Name and contact information of the responsible party conducting the research,
2. Purpose and expected outcomes of the activities, including a description of how the project contributes to science,
3. Description of activities, including, if appropriate, measures to be taken to minimize any impact on endangered species or their habitat, or any cultural resources found in the lake,
4. Methodology, including literature review,
5. Type of equipment used, how much; where it will be placed, and for how long it will remain in lake (see Equipment in Lake Section E of the Spring Lake Management Plan)
6. Expected impact, and
7. Timeline of Project

Monitoring:

The Lake Manager will compile an annual summary of the research conducted in the lake, including statements on the impact of these activities on the health of the lake.

Budget:

Table 7.1

\$0

Estimated 2017 budget:

\$0

5.4.10 Boating in Spring Lake and Sewell Park

Access to Spring Lake is strictly controlled and regulated in accordance to federal, state and local laws. City ordinance and state law designate the public waters of Spring Lake as restricted to activities authorized by the University. All activities involving access to the lake, including glass bottom boat operations, will abide by the rules and intentions of the Edwards Aquifer Recovery Implementation Program Habitat Conservation Plan.

Long-term Objective:

Maintain the integrity of the ecology and cultural resources within Spring Lake and San Marcos River. All boating activities in Spring Lake are governed by the Spring Lake Management Plan and the EAHCP ITP.

Target for 2017:

Implement the protocols for boating as specified in the Spring Lake Management Plan in support of the EAHCP ITP.

Methods:

Boats (canoe, kayak) used for educational activities, excluding glass bottom boats:

1. All boats must be properly washed/disinfected before being placed in lake and once they are removed (see Equipment in Lake in the Spring Lake Management Plan).
2. Participants must receive an orientation prior to boating including: instruction on safety, basic boat handling, and on-site rules and regulations. The orientation will cover information specific to Spring Lake's sensitivity and endangered species.
3. All boating events must be designed to keep participants away from glass bottom boat operations.

To minimize the impacts of boating on the Covered Species' habitat in Sewell Park, canoeing/kayaking classes in Sewell Park will be confined to the region between Sewell Park and Rio Vista dam. Students will enter/exit canoes/kayaks at specified access points to avoid impacting the flora and fauna along the bank. Classes will be no longer than two hours and up to three classes will be held per day. Classes will have a maximum of 20 students in 10 canoes. All classes will be supervised.

Monitoring:

The Lake Manager will compile an annual summary of boating activities conducted on the lake, including statements on the impact of these activities on the health of the lake.

Budget:

Table 7.1:

\$0

Estimated 2017 budget:

\$0

5.4.9 Management of Athletic Fields and Grounds

Texas State University will complete a golf course management plan that will document current practices and include an Integrated Pest Management Plan (IPMP). The golf course management plan and 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. The golf course is transforming to athletic fields. The IPMP will be used for these fields.

Long-term Objective:

Management of the grounds to minimize and reduce negative effects to aquatic ecosystem in Spring Lake and the San Marcos River.

Target for 2017:

Continued implementation of the Golf Course Management Plan and Integrated Pest Management Plan, but modify to fit the new field functions.

Methods:

The grounds will be maintained in an aesthetically pleasing, yet environmentally sensitive manner. It is the responsibility of the Manager to maintain the course and grounds in accordance with the Integrative Pest Management Plan (IPM). This plan 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. The IPM will be developed and updated by the Manager, in consultation with the Lake Manager and the Environmental Review Committee. The Manager will consult with the Lake Manager on any unique situation that may arise outside of routine maintenance that could impact Spring Lake.

Monitoring:

Each year the Manager will report to the Lake Manager detailed information on maintenance activities and materials used during the year. The water quality monitoring program performed by the Edwards Aquifer Authority will sample for runoff from the fields.

Budget:

Table 7.1:

\$0

Estimated 2017 budget:

\$0

Protocol for Implementation of HCP Measures Requiring Diving and/or Boating

All activities in Spring Lake must be submitted to the Spring Lake Environmental Review Committee and/or the Spring Lake Diving Control Board for approval as outlined in the Spring Lake Management Plan. This includes required training and orientation for any diving based activities in Spring Lake by the RSI Diving Safety Officer, using guidelines set out in the RSI Diving Safety Manual for Spring Lake and the San Marcos River. This includes an orientation that covers: instruction on safety, basic boat handling, and on-site rules and regulations. The orientation will cover information specific to Spring Lake's sensitivity, endangered species as well as cultural resources.

All personnel implementing any portion of the HCP for the City of San Marcos and Texas State University will undergo an orientation at the SMARC to ensure awareness of the listed species and safe procedures while working in and along the San Marcos River.