City of San Marcos/Texas State University 2019 Work Plan

2019 San Marcos/Texas State University Work Plan Budget

HCP Section	Conservation Measure	Table 7.1	Available budget for 2019 (7.1a)	Estimated 2019 Budget	Difference (from available)
5.3.1/5.4.1	Texas wild-rice Enhancement	$100,000	$100,000	84,000 TxSt 28,000 SMARC $112,000 Total	($12,000)[1]
5.3.6/5.4.4	Sediment Management	$25,000	$25,000	$0	$25,000[3]
5.3.8/5.4.3/ 5.4.12	Control of Non-Native Plant Species	$50,000	$50,000	87,360 TxSt 42,920 EBR $130,280Total	($80,280)[1]
5.3.3/5.4.3	Management of Floating Vegetation Mats and Litter	$80,000	$110,000[5]	$74,330	$35,670[1]
5.3.5/5.3.9/ 5.4.11/5.4.13	Non-Native Species Control	$35,000	$35,000	$26,750	$8,250[1]
5.3.7	Designation of Permanent Access Points/Bank Stabilization	$20,000	$20,000	$0	$20,000[1]
5.7.1	Native Riparian Restoration	$20,000	$20,000	$20,000	$0
5.3.2/5.4.2	Management of Recreation in Key Areas	$56,000	$56,000	$56,000	$0
5.7.6	Impervious Cover/Water Quality Protection	$200,000	$380,500[6]	$1,507,806	($1,127,306)[2,4]
5.7.5	Management of HHW	$30,000	$30,000	$30,000	$0
5.3.4	Prohibition of Hazardous Material Transport	$0	$0	$0	$0
5.7.3,4,5,7,8,9 & 10	Various unfunded Measures	$0	$0	$0	$0
	Total	***$616,000***	***$826,500***	***$1,957,166***	***($1,130,666)***

(1) $63,920 from Litter/Plant Mat ($35,670), Non-native animal removal ($8,250), & Access points ($20,000) of which $12,000 will be transferred to Texas wild-rice enhancement; & $51,670 will be transferred to Non-native plants (5.3.8). (2) This amount will be borrowed from 2020- 2024 of Impervious Cover funding. A better estimate of the construction costs will be determined with completion of the 60% final construction designs. (3) Sediment Management funding will be transferred to Impervious Cover and Water Quality Protection. (4) $28,360 will be transferred to Non-native Plant control. (5) The increase of $30,000 is the result of the re-allocation of unspent funds from 5.3.3/5.4.3 in 2018 ($30,000) to 2019. (6) The increase of $300,000 is the result of the re-allocation of unspent funds from 5.7.6 in 2018 ($300,000) to 2019.

5.3.1/5.4.1 Texas Wild-Rice Enhancement and Restoration

Long-term Objective:
To achieve 8,000 – 15,450 m^2 of Texas wild-rice (TWR) and maintain existing and restored areas of TWR as required in Table 4-10 & the revised **Table 4-21** discussed in measure 5.3.8/5.4.3/5.4.12 (Control of Non-Native Plant Species).

Target for 2019:
The target areas for 2019 are Spring Lake, the IH35 reach, and below IH35. The target areas were adjusted to synchronize with the removal of non-native strategy as described in Section **5.3.8/5.4.3/5.4.12** and to address the reaches that had not yet attained the long-term goal as shown in Table 1. The total restoration effort will be 205 m^2 of total TWR enhancement in 2019 (as shown by the bold numbers in Table 1).

Efforts toward the annual goals may shift, with approval from the EAHCP Science Committee, due to changes in the field, i.e. floods, natural expansion, recreational impacts, high flows effecting work in some reaches, etc. For example, if TWR expands naturally and meets the maximum annual goal, then efforts will shift toward an unmet goal or possibly into the following year's goals after conferring with the EAHCP staff and the EAHCP Science Committee.

Table 1. Texas wild-rice long-term and annual goals for all reaches.

Reaches	Species	Aquatic vegetation (m^2)	Coverage (m^2)	Restoration Goal
		Goal	Oct 2017	2019
LTBG Reaches[1]				
Spring Lake Dam	*Zizania texana*	700	1032	0*
City Park	*Zizania texana*	1750	1783	0*
IH-35	*Zizania texana*	600	83	**75**
Restoration Reaches[2]				
Spring Lake	*Zizania texana*	1000	184	**100**
Sewell Park	*Zizania texana*	1100	1811	0*
Below Sewell to City Park	*Zizania texana*	2300	2810	0*
Hopkins St to Snake Island	*Zizania texana*	950	1169	0*
Cypress Island to Rio Vista Falls	*Zizania texana*	350	247	25
IH-35 expanded	*Zizania texana*	450	381	50
Below IH-35	*Zizania texana*	280	56	**30**

*Plant coverage has exceeded the long-term biological goal and the 2019 goals are no longer applicable; however, the species will be planted if the coverage drops below the long-term biological goal
[1]*Zizania texana* 2017 LTBG reach coverage values were mapped in October 2017

[2]*Zizania texana* 2017 Restoration Reach coverage values were mapped in August 2017

Methodology:

The optimal conditions for TWR is sandy to coarse soils with water depths generally greater than 1 meter in areas of higher current velocity. In stands of TWR that have non-native plant species intermixed, the non-natives are removed and the original TWR stand is monitored for expansion. Similarly, for TWR stands adjacent to non-native vegetation; the non-native plants are removed and the area is replanted with TWR. 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. In Spring Lake, hygrophila stands will be removed in sites where TWR is to be planted. Multiple sites are being planted to determine where TWR will be successful in Spring Lake. At the request of the EAA, the site by the Meadows Center office building will not be planted.

The process of planting begins by transporting potted TWR individuals from the Texas State University Freeman Aquatic Building (FAB) to the planting site. A diver and a handler carry the plants to the designated section, and while the diver digs a hole in the substrate using a trowel, the handler gives the diver a pot of TWR. The contents are removed from the pot and inserted into the hole. The diver works downstream to upstream in a linear pattern of planting. Individuals are placed about 0.5 meters apart and gardened as needed to remove invading plants. This process is adjusted as needed to meet the varying conditions of each planting site and species.

The production of Texas wild-rice occurs at the FAB at Texas State University and the U.S. Fish and Wildlife Service San Marcos Aquatic Resources Center (SMARC) with the FAB collecting and propagating from tillers and SMARC collecting and propagating from seed.

The FAB collects tillers of TWR by removing them from floating vegetation mats or from fragments attached to mature plants in the river. Fragments are transported to the raceways located at the FAB. Potting soil consists of a bulk soil comprised of a mixture of top soil and compost. Fragments are planted in an 8-inch pot. Soil is saturated with water and the fragments inserted. Density of fragments per pot is generally 3-10 individuals, depending on the species. The pots are placed into the raceways with pumps generating current velocity over the newly planted fragments. Plants remain in the raceways until roots are firmly established in the pots (2 – 4 weeks).

SMARC collects mature seeds from the TWR panicle by gently pulling upwards until seeds are released. Seeds are placed in a plastic bag during collection and potted within 24 hours.

Potting soil consists of a bulk soil comprised of a mixture of top soil, compost, orange sand (iron source), and cedar flakes. Nitrogen (nitrate) and phosphorus contents were 46 and 115 ppm (mg/kg), respectively. No additional nutrients are added to the soil.

When germination is observed, TWR seedlings less than or equal to 15 cm in height are removed from the pots, repotted in a 255 cm^3 pot, and placed in different 0.3 x 0.6 x 2.4 m or 0.9 x 0.9 x 3.0 m tanks. Prior to all transplanting of TWR seedlings, the soil is saturated with water and the plant roots are inserted into the soil. Small amounts of pea gravel are spread on top of the soil to provide anchoring and stability for seedlings.

Production of plants at the FAB and SMARC is incorporated into this Work Plan budget (TWR Enhancement & Removal of non-natives). These methodologies may be adjusted as more is learned about collection and planting procedures.

Monitoring:

All planted areas are monitored via quadcopter and scuba divers. This data is mapped and analyzed via GIS. 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 (see conservation measure 5.3.8/5.4.3/5.4.12 Control of Non-Native Plant Species). Seeds and tillers are collected following the protocol of 50% tiller and 50% seed to help maintain genetic diversity in TWR grown at FAB and SMARC. Documented seed collection from all reaches in the upper SMR is a critical component of this effort. The seeds are stored in a moist environment for six months. Because Texas wild rice seeds are recalcitrant and short lived, after six-months seeds are removed from storage and germinated for restoration purposes. SMARC is currently the only partner propagating TWR from seed for restoration efforts. Once seedlings are vigorous enough for transport (6-10 weeks old), seedlings are picked up by the contractor, transferred to FAB raceways, then planted in the river. Using seedlings provides genetic diversity to the TWR population in the river since all other TWR used for restoration are "tillers" (i.e. genetic duplicates, clones).

Budget:

Table 7.1:
$100,000

Available budget for 2019
$100,000

Estimated 2019 budget:
$112,000*

***$84,000 TxSt & $28,000 SMARC; transfer $12,000 from measures specified in budget table**

5.3.6/5.4.4 Sediment Management

The City of San Marcos (COSM) and Texas State University (TXSTATE) 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 ineffective and expensive. From 2013 to 2015, three of the six required sites have received only 158 m^3 of sediment removal costing approximately $555,000. In 2017, an Adaptive Management Proposal to amend this conservation measure in the EAHCP was approved.

The Sediment Removal and Impervious Cover/Water Quality Protection are combined into one conservation measure that addresses sediment control within the upper San Marcos River watershed to minimize sediment and other contaminated runoff. The primary focus is the Sessom Creek watershed, which 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.

The COSM and TXSTATE will provide; (1) design of wastewater relocation and erosion/sediment control; (2) Sessom wastewater line rehab and relocation spring 2019; and (3) construction of BMPs and associated land management tasks that control erosion, minimize sedimentation, and reduce pollutants in the Sessom Creek watershed.

Additionally, TXSTATE has received 319 funds from the TCEQ. These funds will be accessed as available for design work in 2018 for the prioritized BMPs. The Meadows Center for Water and the Environment is the point of contact for the EPA 319 funds.

Target for 2019:
See discussion in Section 5.7.6 Impervious Cover/Water Quality Protection

Method:
See discussion in Section 5.7.6 Impervious Cover/Water Quality Protection

Budget:
Table 7.1:
$25,000

Available budget for 2019:
$25,000*

Estimated 2019 budget:
$0

***These funds will be transferred to the Impervious Cover and Water Quality Protection measures.**

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

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.

Target for 2019:
In 2019, the removal of non-natives and planting of natives will adopt the following strategy in an effort to ensure best use of EAHCP funds and facilitate the achievement of long-term biological goals.

Nonnative aquatic vegetation will be removed starting in the Spring Lake Dam reach and progressing downstream into the City Park Reach (Figures 1 and 2) to maximize the benefit of nonnative plant removal and native plantings. Continued removal maintenance efforts will occur downstream in previously worked areas or areas where immediate removal efforts are needed to protect existing native stands.

The practice of removing nonnative stands from upstream to downstream is anticipated to reduce labor hours spent on gardening unwanted growth that results from nonnative plant fragments drifting from upstream stands, reduce competition for newly planted natives, and allow more time to be spent on planting. Large homogenous stands of non-native aquatic vegetation (Figure 2) will be targeted. Mixed stands of native and nonnative species will be monitored and nonnative species will be removed if expansion is observed. The plant species designated in Table 2 below will be prioritized for planting after removal of non-native species depending on available habitat and history of the plant's success in the available habitat. If the prioritized species has not been successful in the habitat type to be planted, another species will be planted in its place. Plantings will not occur in intense recreational areas, such as City Park adjacent to Lion's Club Tube Rental.

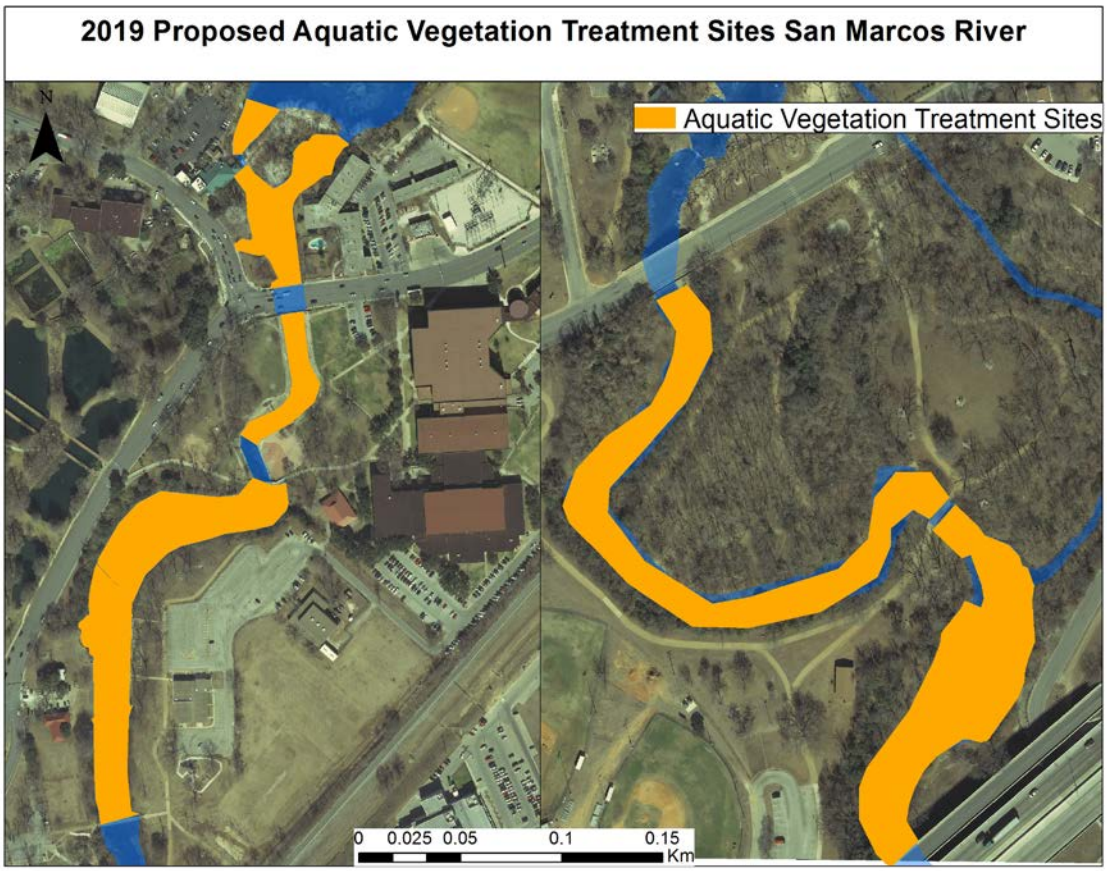

Figure 1. Areas proposed for non-native removal and native planting in 2019

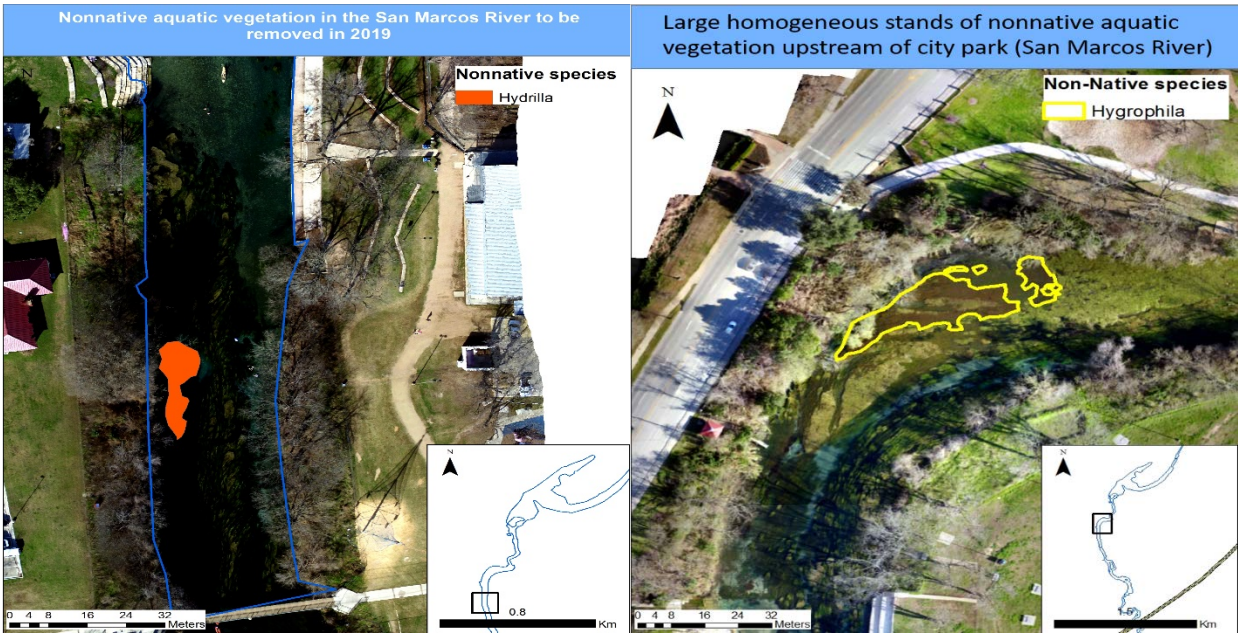

Figure 2. Dense stands of Hygrophila and Hydrilla in the City Park reach that will be targeted in 2019

In Spring Lake, volunteers will be used to remove nonnatives and plant natives because the EAHCP only allows for the planting of TWR in Spring Lake. TWR plantings have not been successful in areas of high silt. The nonnative stands in Spring Lake are located in high silt areas.

Methodology:

Non-Native Aquatic Plant Removal

Work efforts will focus on replacing the equivalent percentage of removed nonnative species within a given reach with natives, focusing on species diversity, species habitat preferences, and available habitat at the time of planting. The goal will be to reduce nonnative species percentage among reaches that then allow the native species to maintain and/or expand their distribution. The mean number of fountain darter/sq meter will be an important factor when replacing the nonnative species with native species so total fountain darter numbers are not reduced following removal and planting efforts.

Nonnative aquatic plants will be removed and replaced with native aquatic plants in association with Texas wild rice enhancement as described in conservation measure 5.3.1/5.4.1.

Divers remove nonnative aquatic plants by hand, allowing them to drift into a seine, bag, or catch net set up downstream. The removed vegetation is moved to the shore and plant debris is transferred to the work truck or trailer. There, the plants are shaken to remove trapped fauna which are returned to the river. The plants are then disposed at the COSM or Spring Lake composting facility. Denuded areas are left alone one week and any regrowth of nonnative plants is removed then the area is planted with native aquatic vegetation.

SAV Restoration

In 2016 the SAV and TWR restoration progress in the San Marcos River was evaluated. Based on the results, the Long Term Biological Goals (LTBG) were adjusted and restoration goals were proposed for newly defined reaches. The official annual goals are shown in **Table 2**. Double asterisks indicate the reaches that will be targeted in 2019 for the reasons previously described.

Table 2: Annual aquatic vegetation restoration goals, in meters squared (m^2) within San Marcos LTBG reaches and newly defined restoration reaches.

Reaches	Species	Aquatic vegetation (m^2)	Coverage[#] (m^2)	Restoration Goal
		Goal	Oct 2017	2019
LTBG Reaches[3]				
Spring Lake Dam	*Ludwigia*	100	5.8	10
	Cabomba	50	0.92	5
	Potamogeton	200	208	0*
	Sagittaria	200	11.3	20

	Hydrocotyle	50	53.4	0*
City Park	*Ludwigia*	150	28.6	20
	Cabomba	90	2.9	10
	Potamogeton	1450	255.6	100
	Sagittaria	300	115.5	15
	Hydrocotyle	10	0	0
IH-35	*Ludwigia*	50	1.7	5
	Cabomba	50	72.1	0*
	Potamogeton	250	4.6	25
	Sagittaria	150	3.3	10
	Hydrocotyle	50	0	5
Restoration Reaches[4]				
Sewell Park	*Ludwigia*	25	NA[#]	0
	Cabomba	25	NA[#]	0
	Potamogeton	150	NA[#]	0
	Sagittaria	25	NA[#]	0
	Hydrocotyle	10	NA[#]	0
Below Sewell to City Park	*Ludwigia*	50	NA[#]	0
	Cabomba	50	NA[#]	0
	Potamogeton	500	NA[#]	0
	Sagittaria	700	NA[#]	0
	Hydrocotyle	20	NA[#]	0
Hopkins St to Snake Island	*Ludwigia*	50	NA[#]	0
	Cabomba	50	NA[#]	0
	Potamogeton	475	NA[#]	0
	Sagittaria	750	NA[#]	0
	Hydrocotyle	10	NA[#]	0
Cypress Island to Rio Vista Falls[4]	*Ludwigia*	50	14.89	10
	Cabomba	50	4.78	5
	Potamogeton	150	1.56	25
	Sagittaria	50	3.81	5
	Hydrocotyle	0	0	0
IH-35 expanded[4]	*Ludwigia*	50	256	10
	Cabomba	100	28.65	10
	Potamogeton	250	0	25
	Sagittaria	450	411	10
	Hydrocotyle	50	2.6	0

[3]2017 LTBG coverage values were mapped in October 2017

[4]2017 Restoration Reach coverage values were mapped by MCWE in Fall 2017

[#]Species coverage values will be updated in Summer 2018 with values from the Spring 2018 full system survey

*Plant coverage has reached the long-term biological goal and the 2019 goal values are no longer applicable; however, the species will be planted if the coverage drops below the long-term biological goal

Production of native SAV will continue at the Freeman Aquatic Building (FAB) at Texas State University. Fragments and tillers of native aquatic plants removed from floating vegetation mats or from fragments attached to mature plants in the river are used for propagation at FAB. Fragments are potted in an 8-inch pot using a bulk soil comprised of a mixture of top soil and compost. Soil is saturated with water and the fragments inserted into the soil. Small amounts of pea gravel are spread on top of the soil to provide anchoring and stability for the plant fragments. Density of fragments per pot ranges with species but is generally 3-10 individuals. The pots are placed into the raceways with pumps generating current velocity over the newly planted fragments. Plants remain in the raceways until roots are firmly established in the pots (generally 2 – 4 weeks). Funding for the production of SAV at the FAB is incorporated into this Work Plan budget.

Native vegetation species are planted using a team that, at times, includes a diver(s). A hole is made in the substrate using a hand shovel and the native plants are hand planted until the denuded area is approximately 20-70% coverage, depending on species and area planted. The pots are removed before planting and handed back to the assistant for reuse. Planting native plants soon after removal of nonnatives is needed to stabilize the substrate.

Environmental conditions at the time of planting determine which native species are planted. *Cabomba* and *Sagittaria* have exhibited greater success in finer substrates (silt) with areas of slower moving water. Both can be planted in a range of water depths. However, some reaches are challenging, such as Cypress Island, where only TWR and *Heteranthera* have shown success in outcompeting *Hydrilla*.

In the San Marcos River, *L. repens* has been planted in a wide variety of habitat types ranging from areas with shallow depths, high velocities over coarse substrates to areas with slackwater habitat over silt substrate to determine which habitat results in greatest rates of expansion and persistence. In 2017, *L repens* was planted in areas of the City Park LTBG and annual mapping suggested establishment of ~30 m^2. *Ludwigia repens* coverage also expanded greatly in the lower IH35 reach in 2017. Planting of *L. repens* will continue in parts of City Park to assess if continual expansion occurs.

In 2016, *Hydrocotyle verticillata* was accepted as an approved native species to plant in the San Marcos River. *Hydrocotyle verticillata* can become a littoral species, persisting in areas of shallow water. Therefore, this species is utilized to replant river margins or areas of very shallow water depths.

Non-Native Littoral and Riparian Plant Removal

Removal of littoral plants and other small caliper invasive plants in the riparian zone is also included in this budget. In 2019, removal efforts for littoral invasives will target areas shown in **Figure 3** below. Riparian invasive removal will address seed source and regrowth of invasive plants from above Spring Lake to IH-35 with continuing effort on removal in the remaining area to Stokes Park (Section 5.3.8). City contractor, staff and volunteers will assist with the effort

from Clear Springs to Stokes Park. Removal of elephant ears may be greater in fall and winter before spring growth. Removal efforts will also extend to treat hot spots that contribute to regrowth**.** The littoral zone will be replanted as needed to stabilize the bank. The riparian zone will be re-planted to cover a minimum of 15 meters in width where possible. The COSM will install fencing to protect the new plantings while they mature.

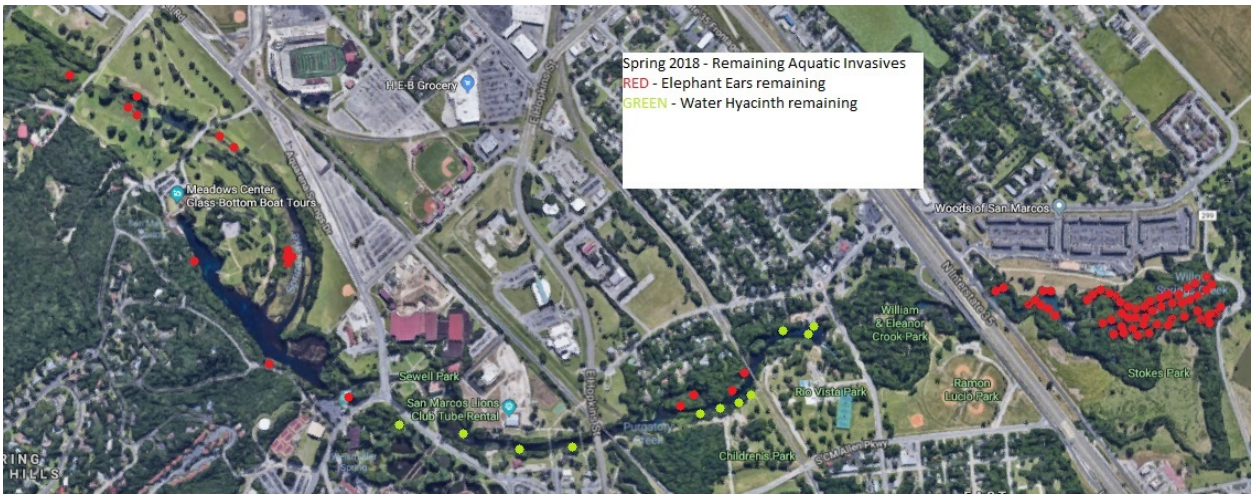

Figure 3. Locations of remaining littoral invasive plant stands.

For littoral and riparian zones, re-growth of invasive species will continue to be removed to maintain the desired state. Seed sources will also be targeted.

The herbicide mix used for littoral removal is Aquaneat (glyphosate-based herbicide) for elephant ears and other non-native plants encountered in the littoral zone. This herbicide will be mixed with Aqua King Plus Surfactant and Turf Mark Blue, a blue dye. On the upland tree, shrub stumps and root buttresses, Relegate **(**Triclopyr-based herbicide) is used. The Relegate is mixed with glyphosate, Drexel Surf Ac 820 Surfactant and Turf Mark Blue, a blue dye. Chemicals are applied with a one-gallon pump-up sprayer set on a steady stream for a more precise target hit to minimize leaching and non-target plant damage. Roots of woody plants are scarred to expose the cambium layer before treated.

Monitoring:

For aquatic plants, newly planted areas are monitored monthly to evaluate success rate. All planted areas are weeded (non-native species removed) and replanted as needed to stabilize the substrate. Aquatic vegetation in work sites is mapped using geo-referenced imagery collected using a quadcopter in conjunction with Trimble GPS units prior to and post non-native vegetation removal and native planting to assess changes in the vegetation community through time. Work sites are separated into reaches to assess changes among and within reaches of the San Marcos River and to identify presence of non-native vegetation and also to assess the expansion of native vegetation.

Progress for non-native vegetation removal will be tracked with polygons containing the species removed, estimated area (m^2) and percent removed. A composite map depicting the routine maintenance required to remove large areas of non-native aquatic vegetation will also be generated using weekly polygons. The maps illustrating the degree of effort will be created by overlaying all the weekly polygons.

Budget:

Table 7.1:
$50,000

Available budget for 2019:
$50,000

Estimated 2019 budget:
$130,280*

***$87,360 TxSt & $42,920 EBR; transfer $80,280 from measures specified in budget table.**

5.3.3/5.4.3 Management of Floating Vegetation Mats and Litter

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. Litter is also removed from portions of Sink, Sessom, Purgatory and Willow Creeks.

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 Methodology.

Target for 2019:
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 portions of the tributaries. Texas State University will manage aquatic vegetation in Spring Lake through use of its harvester boat and hand cutting of SAV by divers authorized to dive in Spring Lake.

Methodology:
Spring Lake: Each week about five springs are gardened, with divers returning to garden the same springs every two to three weeks. During summer algal blooms, the springs are managed more frequently (up to four springs per day), primarily to remove algae. Texas State employees and supervised volunteers 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 shear vegetation to a height of 30 cm, and then to one meter over the following three meter radius. Plant materials are not collected, but rather carried away by the current. Cumulatively, about six meters of vegetation around each spring opening is modified. Mosses are not 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 clears 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 is visually checked by the driver for fauna caught in the vegetation. If the driver observes fauna, he/she will stop work and return 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 are removed from zones four and five on an as-needed basis (See HCP Figure 5-2). The total area cut equals 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 are collected by hand and shaken prior to removal from the river to dislodge any aquatic species caught in the plant. The plants are deposited into dump trucks and taken to the MCWE 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 is lifted off the stands and removed. Inorganic litter is picked up weekly from the substrate, surface and littoral zones of the San Marcos River from Clear Springs Natural Area to City Park and from IH-35 to Stokes Island during the recreational season (May 1st to September 30th) and monthly during offseason. Litter is also removed from public lands within the four tributaries.

Monitoring:
In the event of low flows, this activity will be monitored by the EAA contractor for potential impacts on listed species and will be suspended if impacts are observed. Volume of litter removed will be tracked.

Budget:
Table 7.1:
$80,000

Available budget for 2019:
$110,000*[#]

Estimated 2019 budget:
$74,330*

***$35,670 to be transferred to insufficiently funded measures.**
[#] Rollover $30,000 of unspent funds from 2018 to cover 2019 activities.

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

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 2019:
Contractor will use methods that have proven to be successful in efficient removal of invasive species from Spring Lake to IH-35. Contractor will measure length, weight and determine gender (as practicable) for fish species. The targeted species include suckermouth catfish, tilapia, nutria and two snail species, *Melanoides* and *Marisa cornuarietis.*

Methodology:
Fyke nets, live trap cages, spear and bow fishing continue to be effective methods for fish removal. Contractor uses spearfishing tournaments, permitted through the municipality, to increase total removal, while saving costs and providing an educational awareness component to participants. Contractor ensures that there is no human consumption of fish captured and that all methods avoid impacts to resident turtles and other native species.

Effective removal of *Melanoides* and *Marisa cornuarietus* is accomplished by determining the locations of highest snail density and using dip nets to remove the snails weekly. These species are best controlled by diving several hours after sunset to hand-pick the snails from the substrate and SAV.

City of San Marcos has an ordinance prohibiting the dumping of aquaria into the San Marcos River (Sec. 58.037).

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. Additionally, in order to monitor the reduction of overall non-native species abundance in the San Marcos ecosystem, the COSM and TXSTATE will compile information regarding the size (weight and total length) of the individual animals removed as well as a sex ratio (male:female) (as practicable). This information may assist in determining overall effectiveness of this conservation measures impact of species population dynamics.

A true quantitative measurement of population size would be difficult and require increased resources. By providing detailed information regarding these characteristics of removed animals the EAHCP staff and committees could determine a reduction in overall size and/or provide habitat destruction avoidance based on breeding habits by female fish species (i.e. tilapia nests in fountain darter habitat).

Budget:
Table 7.1:
$35,000

Available budget for 2019:
$35,000

Estimated 2019 budget
$26,750*

***$8,250 to be transferred to insufficiently funded measures**

5.3.7 Designation of Permanent Access Points/Bank Stabilization

Long-term Objective:
Maintain integrity of structures that serve to control bank erosion, protect Texas wild-rice and listed species habitat in the recreation traffic areas.

Target for 2019:
The City of San Marcos completed the construction of bank stabilization/access points at seven locations along the San Marcos River in 2017. Quarterly monitoring will occur to ensure ongoing structural stability.

Monitoring:
A diver will measure possible undermining at each site twice yearly. The surface of each site will also be inspected for damage.

Budget:
Table 7.1:
$20,000

Available budget for 2019:
$20,000

Estimated 2019 budget:
$0*

***$20,000 will be transferred to insufficiently funded measures**

5.7.1 Native Riparian Habitat Restoration

Long-term Objective:
Establish a robust native riparian and water quality buffer community that benefits Covered Species through increasing the habitat and water quality within the San Marcos River down to city limits. The buffer will also prevent public access which causes bank erosion and impacts TWR stands. 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. Private riverside landowner participation in this program will be encouraged and the EAHCP will provide the labor and plants as practical. EAHCP-funded contractor(s) will perform invasive removal and maintenance. Native plantings and maintenance will be done by volunteers during regular planting events.

Target for 2019:
Contractor (funded through the EAHCP and COSM)/volunteers will maintain all treated areas from Spring Lake to Stokes Park, and any new adjacent areas to address invasive regrowth and/or seedbank source as appropriate. Volunteers will plant natives in previously worked areas during regular planting days as needed. Additional volunteer plantings will occur along the channel behind Snake Island contingent upon private landowners' participation response. Private landowners along the river above Cheatham Street have been contacted to determine interest in the development of a native vegetative buffer on their property. As budget allows, contractor will continue invasive removal downstream in Capes Park, Thompsons Island and Stokes Park (Section 5.3.8).

Methodology:
Contractor removes and treats invasive regrowth using a glyphosate/trichlopyr herbicide mix to treat the stumps and/or roots. Volunteers complete all other native riparian habitat restoration as described above. Native plants used for restoration are propagated at the COSM Discovery Center. Treated and adjacent areas will be monitored for re-growth and seed sources. Roots will be scraped and treated with herbicide mix then monitored.

Monitoring:
Monitoring will occur monthly to check for re-growth and treat as needed. Maintenance will continue to be a mix of contract work funded by EAHCP and COSM, as well as volunteerism. The City 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

Available budget for 2019:
$20,000

Estimated 2019 budget:
$20,000

5.3.2/5.4.2 Management of Recreation in Key Areas

Long-term Objective:
To minimize the impacts of incidental take resulting from recreation which includes, but is not limited to swimming, wading, tubing, boating, canoeing, kayaking, golfing, scuba diving, snorkeling and fishing.

Target for 2019:

1. Hire 10 Conservation Crew members that work 16 hours/week (Wed to Sun) from May to September with 2 – 3 members working prior to summer season and after to continue public outreach and recreation impact minimization efforts. Conservation Crew will also assist the MCWE HCP team to remove floating plant mats.

2. Continue the implementation of the following recreational management goals at a minimum:

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. Kiosk signs have been built and will be placed at each access point in 2018 and 2019.

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 was finished and installed in 2016/2017 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. River maps are located at the Discovery Center which serves as the trailhead to the San Marcos River and help inform about the San Marcos River/Blanco confluence.

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**.** EAHCP brochures have been placed at the TIB for visitors and associated facilities.

e. Park Rangers. Training materials covering the river flora and fauna have been developed and provided for 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. The San Marcos Discovery Center is a facility dedicated to public education and outreach regarding the San Marcos River. Outreach

efforts include the production of an interactive river habitat card game that was introduced into the curriculum for SMCISD elementary schools.

g. Continue to provide EAHCP presentations to TxState Outdoor Recreation class and Wildlife Society club and partner with TxState Geography Intern Program to increase volunteer participation.

h. Continue to provide outreach at booths including 72 degree festival, Concert Series (Earth & Water), Passport SMTX, Business Expo, Don't Mess with Texas Litter Cleanup.

j. Continue to educate the public during volunteer planting days.

k. Continue to educate the public engaged in water-based recreation on sustainable river behaviors that protect listed species and their habitats through interns and Conservation Crew program.

l. Introduce the COI program to qualified third parties conducting recreational activities in and along the San Marcos River. 2019 target to be determined by the EAA/HCP Division.

Monitoring:
Litter removed from the river during the recreation season is tracked Also, the Conservation Crew will monitor for the presence of zebra mussels from IH-35 to Spring Lake Dam.

Budget:
Table 7.1:
$56,000

Available budget for 2019:
$56,000

Estimated 2019 budget:
$56,000

5.7.6 Impervious Cover/Water Quality Protection

Long-term Objective:

The EAHCP commitment for the combined effort (Sediment Management and Impervious Cover/Water Quality Protection) includes (1) completion of the Downtown Pond, (2) design of Sessom BMPs; (3) construction of Sessom BMPs starting fall of 2019; and (4) potential development of Phase 2 of Sessom Creek restoration and/or conservation of a headwater parcel through acquisition or conservation easement.

The EAHCP Conservation Measure 5.3.6/5.4.4, Sediment Management, requires the completion of two water quality ponds. The Science Committee recommended, and the Implementing Committee approved the construction of the Downtown Pond and the City Park Pond to fulfill this requirement. City Park Pond construction was 100% funded by the City of San Marcos and is now undergoing the Final Construction Checklist. The Downtown Pond will begin construction in Summer 2019. The construction of the Downtown Pond will be funded with City of San Marcos ($15,000), TCEQ grant ($35,000), and EAHCP providing ($50,000). It was anticipated that the TCWQ grant would provide $85,000, but the full amount was not funded, leaving a $50,000 shortfall. In that Sediment Management funds have been redirected into the Impervious Cover Conservation Measure, the Impervious Cover Conservation Measure will fund the $50,000 shortfall.

The most cost-effective strategy identified under the AMP was implementation of stream restoration projects in the middle reach of Sessom Creek, using a Natural Channel Design (NCD) approach. A tributary entering within the reach, the Windmill Tributary, is also experiencing accelerated stream erosion and is contributing high sediment loads. The AMP-recommended strategy for the tributary is implementation of a stormwater management pond to trap sediment and provide hydrologic control of erosive flows, in conjunction with limited stream restoration. Primary objectives of the AMP strategies are (1) reduce existing stream erosion, and (2) accelerate the natural re-stabilization process for Sessom Creek, i.e., to return it to a state of geomorphic equilibrium.

The preliminary recommendations address an initial phase of approximately 1955 linear feet of Sessom Creek, from above North LBJ Drive upstream to a short distance above the Loquat-Canyon road intersection, plus the lower 320 linear feet of the Windmill Tributary. A future phase 3 may address Sessom Creek above the road intersection (an additional 840 linear feet), plus “Upper” Windmill Tributary (an additional 220 linear feet). Four project reaches have been proposed for the initial phase, based on factors that include stream geomorphic characteristics, as shown in the **Figure 4**. Stream and watershed restoration practices identified for each project reach include grade control, bank stabilization, gully control, stormwater management ponds, and riparian restoration.

In addition, the City of San Marcos has identified several other projects and concerns within the same geographic area. These include wastewater improvements, road repair and improvements, site-specific erosion repairs, and a water main project. Preliminary recommendations will be provided for these, consistent with the sediment source control strategy, i.e., the improvements

will work in concert with the stream restoration and stormwater management practices to the maximum extent practical. The wastewater improvement project is separate but is planned to occur concurrently with the other projects.

Figure 4. Sessom Creek Proposed Project Reaches

Target for 2019:
Complete design of all Sessom Creek restoration Projects 1, 2, 3 and 4 and begin construction in the Project 1 section which extends from Sessom Creek from above North LBJ Drive upstream to the confluence of Windmill Tributary. Measures have been taken to reduce costs through natural channel design in some project reaches, allowing for more work to be done in the overall watershed.

Monitoring:
Water quality monitoring program managed by the EAA will set the pre-construction parameters. A sampling program to determine long-term results will be designed.

Budget:
Table 7.1
$200,000

Available budget for 2019:
$380,500

Estimated 2019 budget:
$1,507,806

5.7.5 Management of Household Hazardous Waste

Long-term Objective:
Strengthen the COSM existing program that provides a place for citizens of San Marcos and Hays County to safely dispose of HHW. This prevents loss of HHW into the river or recharge zone and thus impacting listed species.

Target 2019:
Target 3000 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.

Methodology - open drop-off opportunities two days a week (Tuesday and Friday) from 12:00 noon to 3:30 p.m. to the public.

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

Available budget for 2019:
$30,000

Estimated 2019 budget:
$30,000

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

Long-term Objective:
Reduce the potential of spill of hazardous materials in the San Marcos River and its tributaries through the designation of a hazardous materials route in COSM.

Target for 2019:
Work with MS4 and the EOC to prepare a hazmat route meeting TxDOT specifications.

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

Available budget for 2019:
$0

Estimated 2019 budget:
$0

5.7.3 Septic System Registration and Permitting Program

Long Term Objective:
To ensure 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

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

Target for 2019:
To have an accurate record of new and existing septic systems installed and modified in city jurisdiction. In addition, city ordinance requires all owners of septic systems connect to municipal sewer lines as they become available.

Methodology - 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 requirements 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

Available budget for 2019:
$0

Estimated Budget:
$0

5.7.4 Minimizing Impacts of Contaminated Runoff

Long-term Objective:
The goal of this measure is to reduce the input of sediment and roadway contaminates into the San Marcos River. In order to leverage existing investment from the COSM, the EAHCP will assist in completing two ponds currently under construction. Both ponds are designed for high pollutant load reduction and have been identified as a priority management strategy.

Target for 2019:
All activities and funds associated with this measure have been completed. Both the Hutchison and City Park ponds were designed and constructed in 2018 as required by the EAHCP.

Budget:
Table 7.1:
$0

Available budget for 2019:
$0

Estimated 2019 budget:
$0

5.4.5 Diversion of Surface Water

Long-term Objective:
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. Meet diversion restrictions specified under the HCP.

Target for 2019:
Restriction of surface pumping as specified under the HCP. 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).

Methodology - 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 52 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

Available budget for 2019:
$0

Estimated 2019 budget:
$0

5.4.7 Diving Classes in Spring Lake

Long-term Objective:
Maintain the integrity of the ecology within Spring Lake through controlling access to Spring Lake in accordance to federal, state and local laws.

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

Target for 2019:
Implement the diving protocols as outlined in the Spring Lake Management Plan and the Edwards Aquifer HCP Incidental Take Plan.

Methodology - 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

Available budget for 2019:
$0

Estimated budget:
$0

5.4.8 Research Programs in Spring Lake

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 within Spring Lake through controlling access to Spring Lake in accordance to federal, state and local laws. All research activities in Spring Lake are governed by the Spring Lake Management Plan.

Target for 2019:
Implement the protocols for research as specified in the Spring Lake Management Plan and the EAHCP ITP.

Methodology - 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

Available budget for 2019:
$0

Estimated budget:
$0

5.4.10 Boating in Spring Lake and Sewell Park

Long-term Objective:
Maintain the integrity of the ecology within Spring Lake and San Marcos River through controlling access to Spring Lake in accordance to federal, state and local laws. All boating activities in Spring Lake are governed by the Spring Lake Management Plan and the EAHCP ITP.

Target for 2019:
Implement the protocols for boating as specified in the Spring Lake Management Plan in support of the EAHCP ITP.

Methodology – Follow the below protocol for all 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

Available budget for 2019:
$0

Estimated budget:
$0

5.4.9 Management of Golf Course and Grounds

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 2019:
Continued implementation of the Grounds Management Plan and Integrated Pest Management Plan.

Methodology - the grounds will be maintained to meet the recreational function, yet in an environmentally sensitive manner. It is the responsibility of the Manager to maintain the 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) in a way that minimally impacts the environment. The IPM updated as needed by the Grounds Manager, in consultation with the Lake Manager and the Environmental Review Committee. The Grounds 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 Grounds 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

Available budget for 2019:
$0

Estimated budget:
$0