

City of San Marcos/ Texas State University 2023 Work Plan

2023 City of San Marcos/Texas State University Work Plan Budget

EAHCP Section	Conservation Measure	Table 7.1	Estimated 2023 Budget
5.3.1/5.4.1	Texas wild-rice Enhancement	\$100,000	\$10,000 ^A
5.3.6/5.4.4	Sediment Management	\$25,000 ^B	\$0
5.3.8/5.4.3.1/5.4.12	Control of Non-Native Plant Species	\$50,000	\$170,000/\$40,000 Total is \$210,000 ^A
5.3.3/5.4.3	Management of Floating Vegetation Mats and Litter	\$80,000	\$40,000/ \$17,520 Total is \$57,520 ^{AD}
5.3.5/5.3.9/5.4.11/5.4.13	Non-Native Species Control	\$35,000	\$16,200 ^{AD}
5.3.7	Designation of Permanent Access Points/Bank Stabilization	\$20,000	\$0
5.7.1	Native Riparian Restoration	\$20,000	\$20,000
5.3.2/5.4.2	Management of Recreation in Key Areas	\$56,000	\$56,000
5.7.6	Impervious Cover/Water Quality Protection	\$200,000 ^B	\$1,061,705 ^{CD}
5.7.5	Management of HHW	\$30,000	\$30,000
5.3.4	Prohibition of Hazardous Material Transport	\$0	\$0
5.3.4/5.4.5,8,9/5.7.3,4	Unfunded Measures	\$0	\$0
	Total	\$616,000	\$1,461,425

A.) Difference of \$90,000 (Texas wild-rice), \$22,480 (Floating Veg Mats and Litter), and \$18,800 (Non-Native Species Control) will go towards the Control of Non-Native Plants 2023 budget.

B.) Sediment Management funding (\$25,000) has gone towards the Impervious Cover and Water Quality Protection Conservation Measure (5.7.6) per the 2017 Sediment Removal and Impervious Cover/Water Quality Protection nonroutine adaptive management. However, due to over expenditures in 2013, 2014, and 2015, there is no more funding available in the Sediment Management Conservation Measure.

C.) Funding will cover construction and construction administration services associated with Phase 1 of the Sessom Creek Stream Restoration project which began in 2022 and will be completed in 2023. Allocated funding will also cover final engineering design of Phase II of the Sessom Creek Stream Restoration project.

D.) Floating Vegetation Mats and Litter increased \$10,399 as a result of transfers from Non-Native Species Control (\$7,056) and Impervious Cover/Water Quality Protection (\$3,343).

2023 City of San Marcos/TxState Work Plan and Funding Application Amendment

Amendment #	Date EAHCP Committee Approved	Conservation Measure Amended	Y/N Funding Application Change	Funding Application Change (\$)	Date EAA Board Approved	Comments
0	5/19/2022	Original Work Plan	NA	NA	NA	Original Work Plan
1	10/13/2022	Work Plan: Control of Non-Native Plants	N	N	11/08/2022	Aquatic plant species, <i>Heteranthera dubia</i> and <i>Myriophyllum heterophyllum</i> , were added as approved species for aquatic vegetation restoration.
0	10/13/2022	Original Funding Application	NA	NA	11/8/2022	Original Funding Application
1	3/23/2023	Funding Application	Y	N*	NA	Revised the budgets for Management of Floating Veg Mats and Litter, Non-Native Species Control, and Impervious Cover and Water Quality Protection. Since the changes are within the approval authority of the EAA General Manager and there is no change to the overall funding application amount, EAA Board approval is not needed.
2	3/23/2023	Work Plan: Budgets	Y	N*	NA	Updated Table 1 with 2022 TWR coverage and revised the budgets for Management of Floating Veg Mats and Litter (increased from \$47,121 to \$57,520), Non-Native Species Control (reduced from \$23,256 to \$16,200), and Impervious Cover and Water Quality Protection (reduced from \$1,065,048 to \$1,061,705), The total 2023 budget was not reduced and will remain the same at \$1,461,425.

*There is no change to the overall funding application amount, EAA Board approval is not needed.

5.3.1/5.4.1 Texas Wild-Rice Enhancement and Restoration

Long-term Objective:

To achieve 8,000 – 15,450 m² of Texas wild-rice (TWR) and maintain existing and restored areas of TWR as required by the EAHCP.

Target for 2023:

Due to the exponential growth and expansion of TWR within the San Marcos River over the last several years, no active planting is planned for 2023. However, supplemental plantings will occur in areas denuded by flooding or low-flow. Along with the normal effort to prevent regrowth of non-natives throughout the system, extra care will go towards preventing regrowth of non-natives within current TWR stands. From Cypress Island to IH-35, TWR will be encouraged to expand naturally through the continued removal of non-native species within and around the perimeter of TWR stands. These efforts work towards attaining the 2027 biological goals as shown in **Table 1**.

Table 1. TWR areal coverage in summer 2022 relative to TWR long-term biological goals, or EAHCP Table 4-10.

River Reach	Goal Areal Coverage (m ²) *	2022 Areal Coverage (m ²)	Goal Percent of Reach**	2022 Percent of Reach
Spring Lake	1,000-1,500	99	N/A***	0.8
Spring Lake Dam to Rio Vista Dam	5,810-9,245	11,692	83-66	89.5
Rio Vista Dam to IH-35	910-1,650	860	13-12	6.5
Downstream of IH-35	280-3,055	419	4-22	3.2
TOTALS	8,000-15,450	13,070	100	100

*Represents a range of minimum long-term biological goal areal coverage over different flow conditions.

**Represents the percent of the total TWR coverage within that reach

***N/A is the goal reach percentage of total TWR coverage for Spring Lake as defined in EAHCP Table 4-10.

Methodology: The optimal conditions for TWR are 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 natural expansion. Natural expansion refers to a native species' capacity to become reestablished in denuded areas after removal efforts have taken place, which is dependent on the continued maintenance (gardening) of non-native species thereafter. Similarly, for TWR stands adjacent to non-native vegetation; the non-native plants are removed and TWR is planted as necessary.

Removal of non-natives around existing TWR stands occurs by hand, with divers allowing the non-native plants to drift into a seine, bag or catch net set up downstream, if river access is

possible, or putting them directly into a skiff. The removed vegetation is moved to the shore and plants are shaken to remove trapped fauna which are documented and returned to the river. The remaining plant matter is then disposed at the City of San Marcos (COSM) or Texas State University Spring Lake composting facilities when appropriate. Denuded areas are monitored, and any regrowth of non-native plants is removed. If TWR does not expand, other natives may be planted to secure the area (5.3.8/5.4.3/5.4.12).

The contractor will grow TWR when necessary, from both tillers and seeds provided by U.S. Fish and Wildlife staff at the San Marcos Aquatic Research Center (SMARC). SMARC collects mature seeds from the panicle by gently pulling upwards until seeds are released. Mature seeds are plump, filled out, and either green or brown in color. Seeds are then placed in a plastic bag during collection and counted and potted by MCWE within 3-6 months following collection. TWR seeds are placed on top of soil in 8-inch pots and covered with pea gravel to secure the seeds from floating in the water. Seeds are spread out evenly within each pot, and gently pushed into the saturated soil and gravel mixture. Once TWR seeds have germinated they will be separated out and planted in a similar manner as TWR tillers. Tillers of TWR are collected by removing them from floating vegetation mats or from fragments attached to mature plants in the river. TWR tillers are transported to the raceways located at the Freeman Aquatic Biology (FAB) and potted in soil that consists of a bulk mixture containing topsoil and mushroom compost. TWR tillers are planted in 8-inch pots with the soil being highly saturated with water so that the tillers can be inserted without causing damage to the roots. Density of fragments per pot is generally 3-5 individuals. The pots are placed into the FAB raceways with pumps generating current velocity over the newly planted fragments. Water in the raceways is sourced from a nearby Edwards Aquifer artesian well. Plants remain in the raceways until roots are firmly established in the pots.

The process of planting begins by transporting potted TWR individuals from the 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 before returning the empty pot back to the handler for collection. The diver works downstream to upstream in a linear pattern of planting. Individuals are placed about 0.5 meters apart. This process is adjusted as needed to meet the varying conditions of each planting site.

Production of plants at the FAB 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 newly planted areas are monitored to evaluate success rate. Both planting of TWR and removal of non-natives are mapped and quantified via GIS techniques. System-wide TWR

coverage is monitored annually through the EAA Biological Monitoring program, with the data collected being used to evaluate TWR coverage and identify areas of concern.

Budget:

Table 7.1:

\$100,000

Estimated 2023 budget:

\$10,000

5.3.6/5.4.4 Sediment Management

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

Long-term Objective:

The removal of sediment in support of native aquatic planting activities has proven to be both ineffective and expensive. From 2013 to 2015, three of the six required sites have received only 158 m³ 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 aquatic plant stands down to City Park.

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

Target for 2023:

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*

Estimated budget for 2023:

\$0

***Sediment Management funding (\$25,000) has gone towards the Impervious Cover and Water Quality Protection Conservation Measure (5.7.6) per the 2017 Sediment Removal and Impervious Cover/Water Quality Protection nonroutine adaptive management. However, due to increased expenditures in 2013, 2014, and 2015, there is no more funding available in the Sediment Management Conservation Measure.**

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

Long-term Objective:

To decrease the density of non-native aquatic and littoral plants or eliminate, if possible, through monitored removal in and along the San Marcos River to enhance fountain darter habitat by increasing the distribution of native aquatic flora as assigned by the submerged aquatic vegetation (SAV) nonroutine adaptive management long-term goals.

Target for 2023:

In 2023, the removal of non-natives and planting of natives will adopt the following strategy to ensure best use of EAHCP funds and facilitate the achievement of long-term biological goals.

Aquatic non-native plant removal

Hygrophila will be removed by the contractor following the top-down protocol established with *Hydrilla* removal. This will now coincide with *Hydrilla* removal, starting below the section finished in 2022 and continuing downstream for the duration of the project.

Figure 1 (below) represents the 2023 Work Zone for removal of non-native aquatic plant species. The 2022 Work Zones will be reclassified as Recovery Zones in 2023. These Recovery Zones will be managed similarly to that described in the TWR enhancement and restoration measure (5.3.1/5.4.1) so that native species can expand either naturally or via planting while continuing to remove any regrowth of non-natives. Any Maintenance Zones will be regularly swept for remnant *Hydrilla* or *Hygrophila* regrowth and removed as necessary. The contractors will continue utilizing extended hours from May to October to take advantage of the longer periods of daylight, warmer weather, and to avoid hours of heavy river recreation.

To prevent regrowth, the top priority for 2023 will be maintaining the 2022 Work Zones due to the large dense areas of *Hydrilla* that have been removed and the overall extent of reaches that *Hygrophila* was removed. In 2022, a large area of *Hydrilla* was removed between Purgatory Creek and Cypress Island along with significant removal of *Hygrophila* in the side channel across from Purgatory Creek. This area will be regularly worked from upstream to downstream via snorkeling and SCUBA diving to prevent regrowth. Secondary priority will be making downstream progress in the new 2023 Work Zones which will follow the method of removal from upstream to downstream with the goal of thorough removal of both *Hydrilla* and *Hygrophila* from Cypress Island railroad bridge to Rio Vista Falls.

We will also perform occasional maintenance around TWR stands below I-35, if necessary, to allow for further expansion of TWR coverage in that section.

The practice of removing non-native aquatic plant stands from upstream to downstream is reducing labor hours spent on gardening unwanted regrowth that results from non-native plant

fragments drifting from upstream stands that reestablish in denuded areas and actively compete with newly planted or established native plant stands. This method also allows for increased natural expansion of native species in the absence of non-native species. Large homogenous stands of non-native aquatic vegetation will be targeted. Non-natives will be removed from mixed stands of native and non-native species and the area will be monitored for any regrowth. The plant species will be prioritized to provide the most diversity possible after removal of non-native species, if necessary, depending on available habitat and history of the plant species' success in the available habitat. If the prioritized species has not been successful in the habitat type to be planted, another species may be planted in its place. Plantings will not occur in areas impacted by intense recreation.

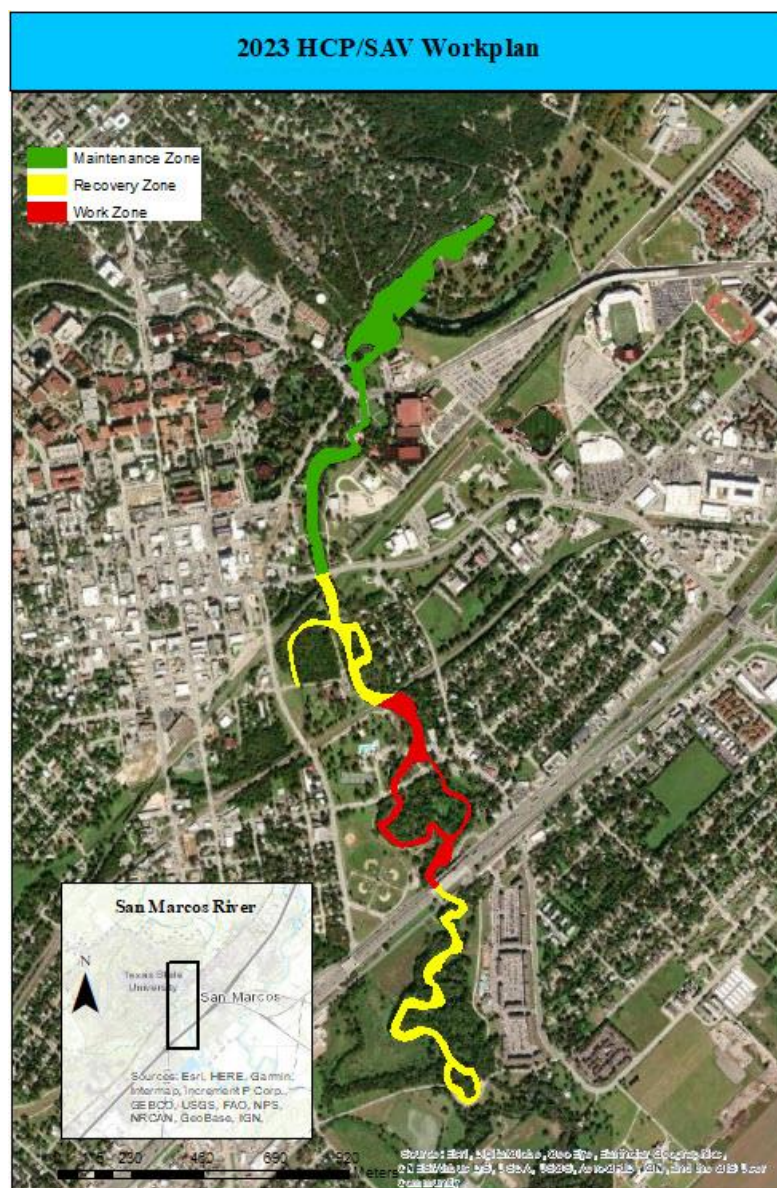


Figure 1. Proposed work zones for 2023 include the maintenance of *Hygrophila* and *Hydrilla* in Spring Lake, Spring Lake Dam, Sewell Park, Below Sewell, City Park, Lower City Park, and Hopkins/Snake Island reaches, a

Recovery Zone of the Bicentennial reach, and an active Work Zone starting at the railroad bridge just above the Cypress Island reach and continuing down to I-35.

Methodology:

Non-Native Aquatic Plant Removal

The focus will be to eliminate dense stands of non-native species that then allow for native species to maintain and/or increase their coverage through natural expansion. Any planting efforts will focus on species diversity, species habitat preferences, and available fountain darter habitat at the time of planting.

Non-native aquatic plants will be removed and replaced with native aquatic plants in association with TWR enhancement as described in Conservation Measure 5.3.1/5.4.1. Divers remove non-native aquatic plants by hand. The removed vegetation is allowed to drift down and is captured by a seine, bag, catch net, or transferred directly into a skiff where access and conditions allow. Any removed vegetation is shaken to remove trapped fauna which are returned to the river before being disposed of at the COSM or Spring Lake composting facilities. Denuded areas are then monitored for subsequent regrowth of non-native species, which are maintained as needed.

Hydrilla and *Hygrophila* are now being systematically removed from upstream to downstream. Reaches that have been thoroughly cleared of large patches of these species for two or more years are considered Maintenance Zones while reaches in which large amounts of these species are being removed are designated as Work Zones. A Work Zone in which all *Hydrilla* and *Hygrophila* have been thoroughly removed during the previous year are considered a Recovery Zone. These Recovery Zones may still require additional effort to ensure the thorough removal of these species' root systems and tubers. *Hydrilla* tubers can remain viable for multiple years despite being buried over 12 inches beneath the sediment. Downstream reaches with large areas of *Hydrilla* and *Hygrophila* are considered future Work Zones. In 2023, Spring Lake, Spring Lake Dam, Sewell Park, Below Sewell, City Park, Lower City Park, and Hopkins/Snake Island reaches will be considered in maintenance condition and Bicentennial reach, from Snake Island to the railroad tracks above Cypress Island will transition to a Recovery Zone (Figure 1). This area will require significant effort to prevent *Hydrilla* from reestablishing due to its overall abundance in that reach before removal began. The primary Work Zone for 2023 will consist of the section starting at the train tracks above Cypress Island to Rio Vista Falls, with additional removal occurring in the Upper and Lower I-35 reaches as needed. The extent of 2023 Work Zone should not exceed the maximum removal allowable for *Hydrilla* and *Hygrophila* habitat disturbance limits, disturbance estimates will still be maintained at regular intervals.

Hydrilla and *Hygrophila* are removed by hand and, when possible, are collected from the river and transported to either the COSM or MCWE composting facilities. Areas of removal are then

de-rooted, which includes meticulous removal of roots, small plants, and tubers. This process is repeated until no *Hydrilla* or *Hygrophila* are observed. After an area has been effectively de-rooted and no regrowth occurs, native plants are either planted or allowed to populate the cleared areas through natural expansion.

Planting of Native Species

The planting of native species begins once the designation of a Work Zone changes to Recovery Zone, as this maximizes reduction of invasive regrowth and subsequent outbreaks. This is expected to take 3-6 months from when the site is finished as a Work Zone, depending on the density and area of non-natives originally present in the site. Efforts primarily focus on preserving areas with existing native species to allow for the natural expansion of those populations throughout the river system. In addition to the use of natural expansion, areas that have been stripped of all vegetation will be planted with native species best suited to that habitat type while ensuring a high level of biodiversity is maintained overall. The goal provides species presence within all reaches to allow for natural expansion downstream of each population. Plantings will not occur in areas impacted by intense recreation.

Production of native SAV will continue at the FAB at Texas State University as described in the TWR Enhancement section (5.3.1/5.4.1). 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 the FAB. Funding for the production of SAV at the FAB is incorporated into this Work Plan budget.

Native vegetation species are planted as described in the TWR Enhancement section (5.3.1/5.4.1) using a team that includes one or more divers and handler depending on depth and location. A hole is made in the substrate by a diver using a trowel, the handler gives the diver a pot of native SAV. The contents are removed from the pot and inserted into the hole before returning the empty pot back to the handler for collection. The diver works downstream to upstream in a linear pattern of planting. Individuals are placed approximately 0.25 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.

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, *Ludwigia* has been planted in a wide variety of habitat types ranging from areas with shallow depths, high velocities over coarse substrates to areas with slack-water

habitat over silt substrate to determine which habitat results in greatest rates of expansion and persistence. In 2021, *Ludwigia* planting in the Hopkins/Snake Island reach showed significant expansion in both shallow and deep areas. This species shows greater resilience in different flows and depths, if the substrate is appropriate, and is often used if other species fail to expand within the denuded area. *Hygrophila* has been observed to reduce the expansion of two native species: *Ludwigia* and *Potamogeton*. *Potamogeton* is an additional species that has struggled to become established in a few reaches, and coverage decreases past Cypress Island. Like *Ludwigia*, *Potamogeton* has been planted in numerous areas with varying substrate compositions in an attempt to determine the most suitable habitat type. It was observed to exhibit the best growth in the upper reaches with high flow and dense, coarse substrates (gravel/sand and clay).

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

On September 14, 2022, the Science Committee approved two new native aquatic plant species, *Heteranthera dubia* and *Myriophyllum heterophyllum*, as acceptable species for submerged aquatic vegetation restoration in the San Marcos River. The contractor will identify planting areas in the IH-35 long-term biological goal reach (LTBG reach) for planting of *Heteranthera* and *Myriophyllum*. The plots will be chosen to offer differing habitat types (depths, substrate, and edge/corridor).

Heteranthera and *Myriophyllum* individuals will be removed and counted from non-LTBG reaches. The removal sites will be tracked via GIS polygons. These individuals will be re-planted at the IH-35 LTBG reach. Planting sites will be tracked via GIS polygons and the number of individuals planted will be adjusted as needed.

Monitoring:

For aquatic plants, newly planted areas are monitored monthly to evaluate success rates. All planted areas are weeded (non-native species removed) and replanted as needed to stabilize the substrate. All planting and removal areas are monitored via quadcopter imagery and/or visual observation. Both planting and removal efforts are mapped and quantified via GIS techniques. Work Zones 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 to assess the expansion of native vegetation. SAV coverage is also monitored annually within LTBG reaches through the EAA Biological Monitoring program. The data collected is used to evaluate native SAV coverage and identify areas of concern.

Non-Native Littoral Plant Removal

Removal of littoral plants and other small caliper invasive plants in the riparian zone is also included in this budget. Littoral invasive removal efforts will address seed source and regrowth of invasive plants from above Spring Lake to Stokes Park (Section 5.3.8). Removal efforts will also extend to treat hot spots that contribute to regrowth.

In 2023, removal efforts for littoral invasive species will target areas outside of the USACE project areas. EAHCP contractual work area are shown in **Figures 2 - 4** below. Most work areas are now in maintenance mode (blue) which require periodic regrowth removal. Red areas indicate the need for continued invasive removal.

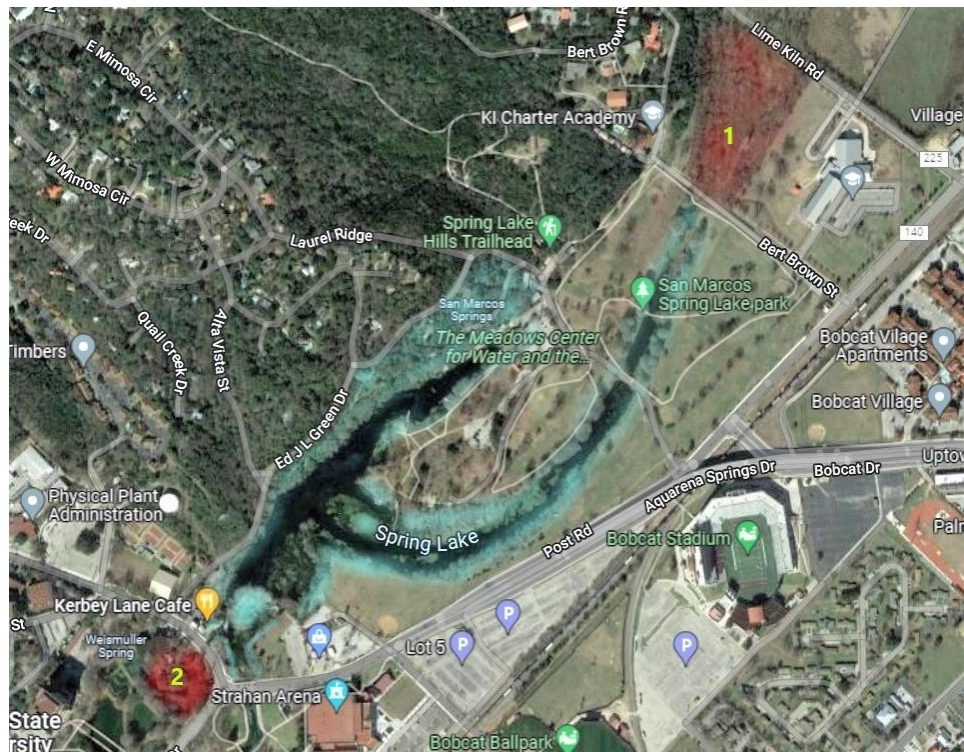


Figure 2. Spring Lake and Sink Creek Zones

Figure 2:

- The area along Sink Creek upstream of Bert Brown Road has some Chinese Tallow trees. Japanese Honeysuckle and an occasional Elephant Ear can also be found here.
- The western shoreline of Spring Lake is in a maintenance state, but the rest of the hillside has a few remaining invasives, primarily catclaw vine.

Figure 3: blue areas are in maintenance zones and will require minimal removal in 2023

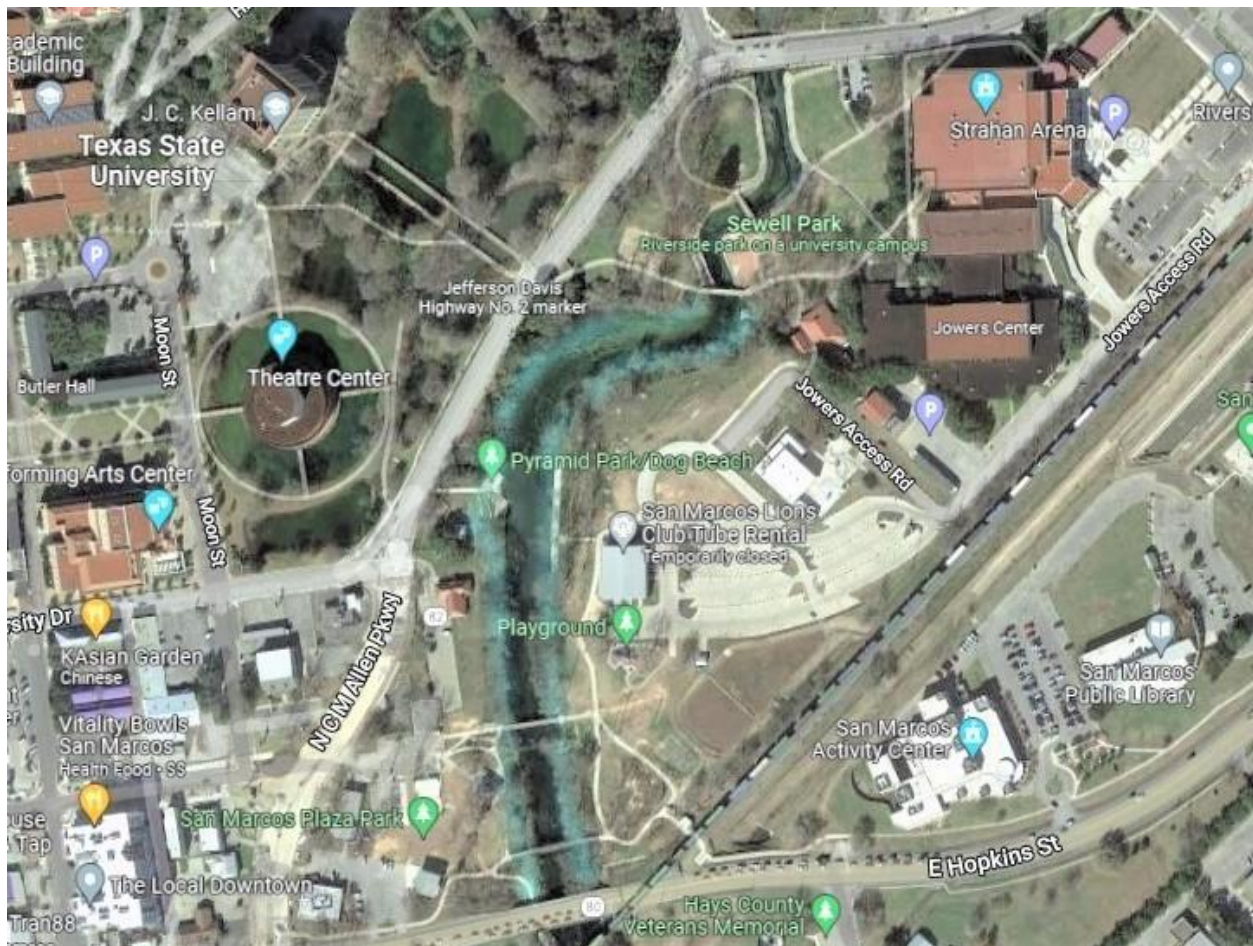


Figure 3. Sewell and City Parks

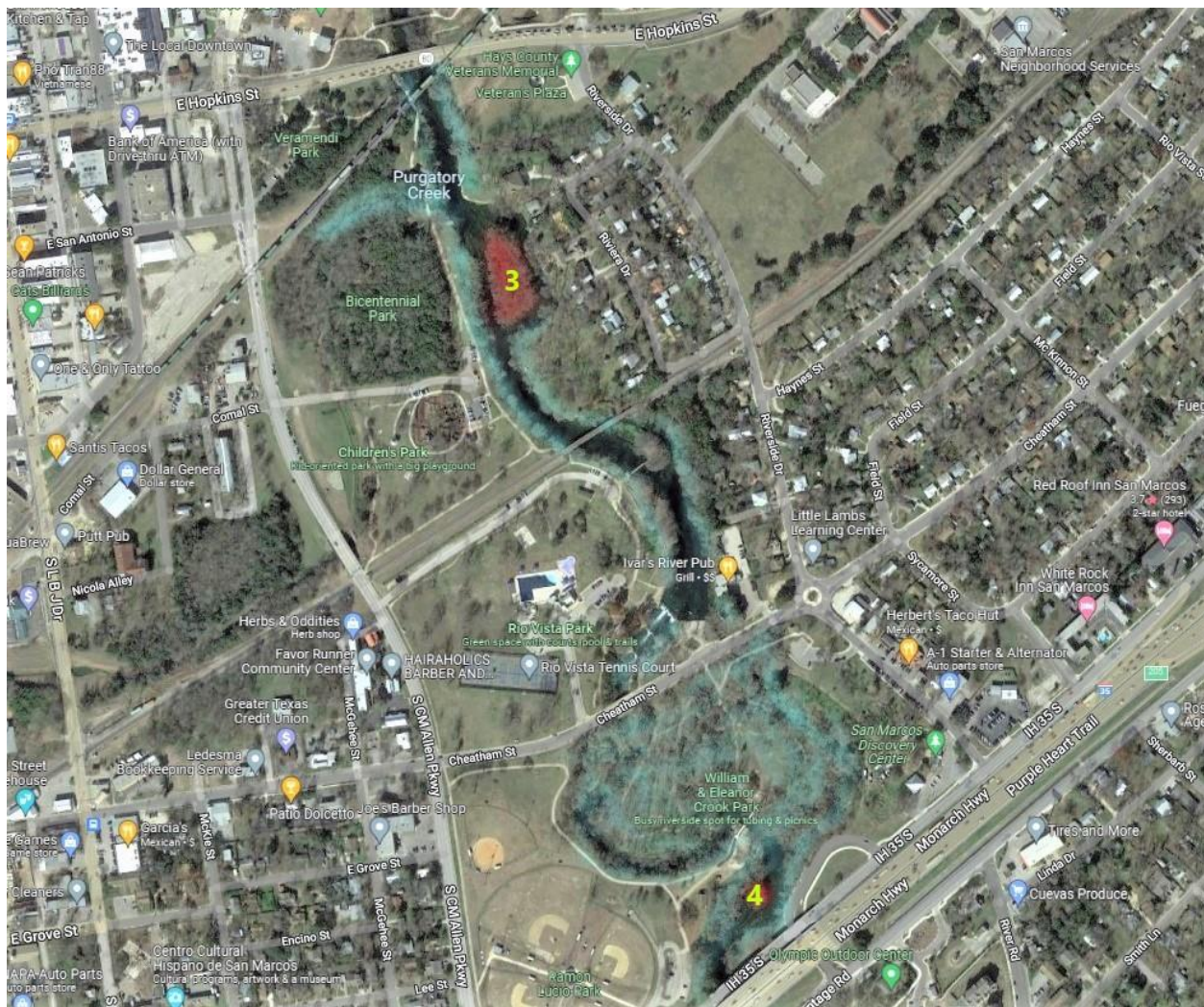


Figure 4. Veteran's Plaza, Bicentennial Park, Rio Vista Park, Ramon Lucio Park, Crook Park

Figure 4: The majority of the Crook Park site has now been completed and put into a maintenance state. The Cheatham site was completed by another contractor and Bicentennial Park and the adjacent Snake Island (shaded pink) will be collaborative areas and require multiple workdays in 2023. A small island right upstream of I-35 is full of Chinese Tallow and also needs to be worked on.

Monitoring:

For aquatic plants, newly planted areas are monitored monthly to evaluate success rates. All planting and removal areas are monitored via quadcopter and/or visual observation by snorkelers and scuba divers. Both planting and removal efforts are mapped and quantified via GIS techniques. 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.

A composite map depicting the routine maintenance required to remove large areas of non-native aquatic vegetation will also be generated using weekly polygons.

Budget:

Table 7.1:

\$50,000

Estimated 2023 budget:

\$210,000: \$170,000 for Texas State University (aquatic) and \$40,000 for EBR (littoral)

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.

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 2023:

Management activities include removal of litter from the littoral zone, stream bottom, water column, and portions of the major tributaries, as well as vegetation mats from Spring Lake Dam reach to Stokes Park. Contractors will continue to collaborate with other groups/contractors to maximize effectiveness and public involvement. Texas State University will manage aquatic vegetation in Spring Lake through use of its harvester boat and trained divers authorized to dive in Spring Lake. Additionally, invasive aquatic floating vegetation will be managed by Texas State University with the assistance of EAHCP contractors and volunteers from various organizations.

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 machete. 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. 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 (EAHCP § 5.4.7.1) and avoid contact with them. Vegetation mats are removed from zones four and five on an as-needed basis. The total area cut equals about nine surface acres.

The Habitat Conservation Plan Manager for the COSM, in partnership with local non-profit organizations, schedule volunteers for the 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 animal species caught in the plant. The collected vegetation is transported to the COSM disposal facility.

San Marcos River: Floating vegetation in TWR and other native plant stands are pushed or lifted off the stands and removed as needed. Inorganic litter is picked up weekly from the substrate, surface and littoral zones of the San Marcos River from Upper Sewell Park 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 and type of litter removed will be tracked.

Budget:

Table 7.1:

\$80,000

Estimated 2023 budget:

\$57,520 (\$40,000 for veg mat removal & \$17,520 for litter removal)

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 2023:

Contractor will use methods that have proven to be successful in efficient removal of non-native species from Spring Lake to Stokes Park. Contractor will measure weight for removed fish species. The targeted species include suckermouth catfish, tilapia, and two snail species, *Melanoides* and *Marisa cornuarietis*. Nutria are not frequently observed, and trapping is labor intensive, therefore, nutria will not be trapped unless seen more frequently in Spring Lake and the San Marcos River.

Methodology:

Polespear and bow fishing continue to be most effective methods for fish removal. Contractor uses polespear tournaments, permitted through the municipality, to increase total removal, while saving costs and providing an educational awareness component to participants. Contractor ensures that all methods avoid impacts to resident turtles and other native species. Tournament participants are given a packet of information and are required to sign liability waivers. A free fish fry is held after the event and it should be noted that consumption of fish captured during the tournament is not condoned.

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

Polespearing tournaments were initially cleared by the COSM and for every upcoming tournament, the COSM departments are notified.

COSM has an ordinance prohibiting the dumping of aquaria into the San Marcos River (Sec. 58.037) and accepts unwanted aquatic fauna at the Discovery Center.

Monitoring:

In order to monitor the reduction of overall non-native species abundance in the San Marcos ecosystem, the contractor will compile the weights of the individual animals removed. This information may assist in determining overall effectiveness of this conservation measures impact of species population dynamics.

Budget:

Table 7.1:

\$35,000

Estimated 2023 budget

\$16,200

5.3.7 Designation of Permanent Access Points/Bank Stabilization

Long-term Objective:

Maintain integrity of structures that serve to control bank erosion, protect TWR and listed species habitat in the recreation traffic areas.

Target for 2023:

The COSM completed the construction of bank stabilization/access points at seven locations along the San Marcos River in 2014 with repairs made in 2017. City made repairs to the Dog Beach access in 2022. If additional repairs are needed, the City of San Marcos will cover construction costs.

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

Estimated 2023 budget:

\$0

5.7.1 Native Riparian Habitat Restoration

Long-term Objective:

Establish a robust native riparian and water quality buffer community that benefits the Covered Species through increasing the habitat and water quality within the San Marcos River down to city limits. The buffer will also minimize public access which causes bank erosion and impacts TWR and other stands of native vegetation. 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 2023:

Contractor (funded through the EAHCP and COSM) and volunteers will maintain all treated areas from Spring Lake to city limits to reduce non-native regrowth. Seedbanks in San Marcos River tributaries and their watersheds will be addressed as appropriate. Areas that will be focused on in 2023 include Snake Island, tributary hot spots and City property in the right bank riparian zone as defined in Figures 5-6. The USACE project will be addressing all other riparian buffers from City Park to the City's wastewater treatment plant.

Methodology:

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

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.



Figure 5. Riparian Restoration near Snake Island located across Bicentennial Park

Snake island is dominated by non-native species. The two main species covering the Island, are Chinese Tallow and Ligustrum. This section needs to be worked slowly over time during this year. If we remove all the non-natives at once, the island will be in a critical condition. This section is only accessible by boat, crossing through the river on either side.

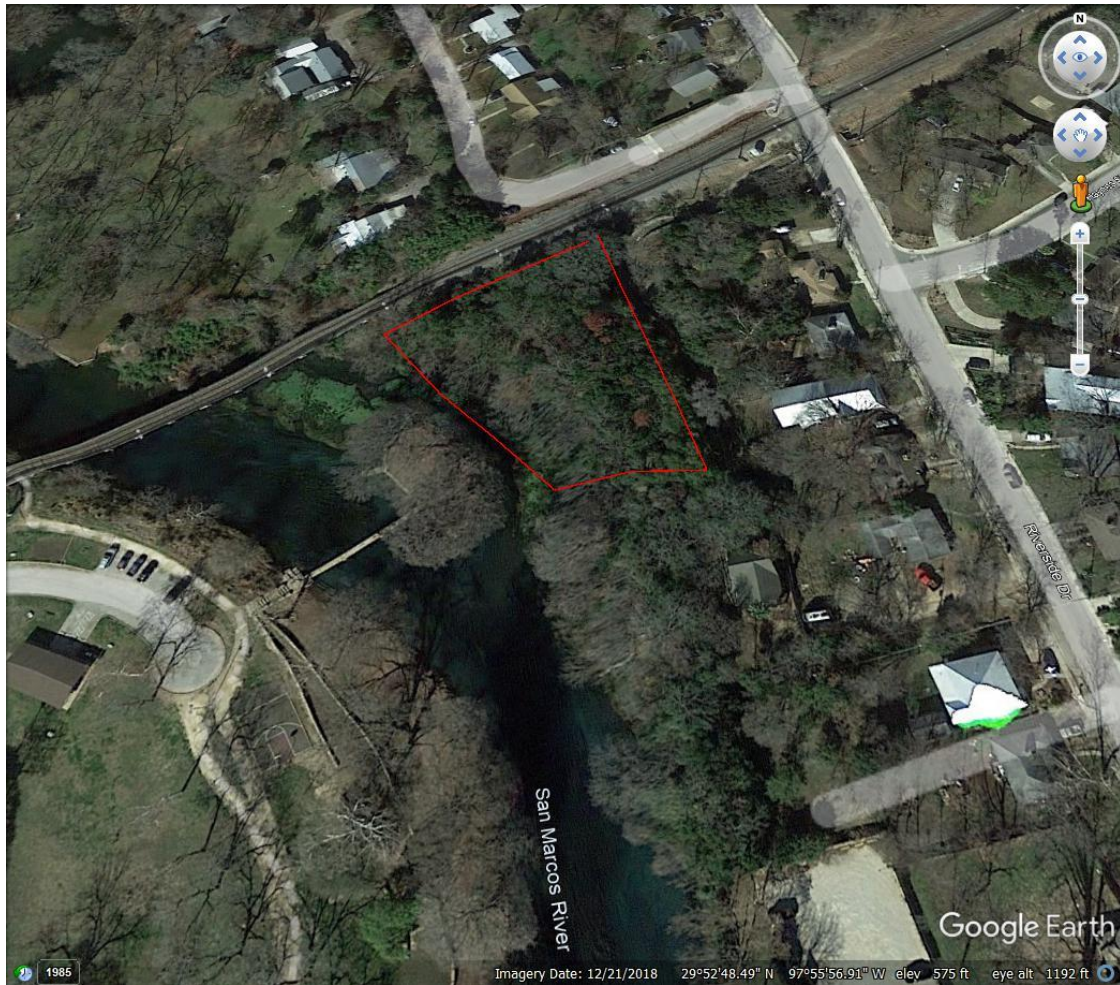


Figure 6. Riparian Restoration across from Rio Vista Park, near the railroad

Red areas outline work will be completed in 2023. This section is dominated by Ligustrum. All areas cleared will be planted with natives.

Budget:

Table 7.1:

\$20,000

Estimated 2023 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, paddle boarding, scuba diving, snorkeling and fishing.

Target for 2023:

1. Hire Conservation Crew members that work approximately 15 hours/week (Wed to Sun) from mid-May to September with members working prior to summer season and after to continue public outreach, recreation impact minimization efforts, and assists the MCWE SAV team in their efforts to remove floating vegetation mats and non-native vegetation.
2. Continue the implementation of the following recreational management goals at a minimum:
 - a. Signage. Signs have been posted in kiosks at most of the river access points. Signs cover the rules of the river and educate the public on the importance of the resource. Exclusion barriers are also established when flows are below 120 cfs and TWR stands are vulnerable (primarily during the recreation season).
 - b. Video loop at City Park 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, and other amenities. River maps are located at the Discovery Center which serves as the trailhead to the San Marcos River and help inform visitors and recreationists about the San Marcos River/Blanco River confluence.
 - d. EAHCP brochures have been placed at the Tourist Information Bureau for visitors.
 - e. Park Rangers. Training materials covering the river flora and fauna are available for the park ranger training so they can help disseminate listed species 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. A local nonprofit is accomplishing this goal.
 - g. Coordinate with the Texas State University Outdoor Recreation center to help educate river users about endangered species and EAHCP restoration on the San Marcos River.
 - h. Continue to provide outreach at booths including Concert Series (Earth & Water), Passport SMTX, Business Expo, Mermaid Society events, San Marcos Sustainability Fair, and Don't Mess with Texas Litter Cleanup.

- i. Continue to educate the public during volunteer planting days and public events.
- j. 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.
- k. Introduce the Certificate of Inclusion (COI) program to qualified third parties conducting recreational activities in and along the San Marcos River.
- l. Monitor watercraft and educate recreationists about the invasive zebra mussels.

Monitoring:

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

Budget:

Table 7.1:

\$56,000

Estimated 2023 budget:

\$56,000

5.7.6 Impervious Cover/Water Quality Protection

Long-term Objective:

Establish a program to protect water quality and reduce the impacts from contaminated runoff based on recommendations listed in the *San Marcos Watershed Protection Plan*.

Target for 2023

The EAHCP commitment for a combined effort (Sediment Management and Impervious Cover and Water Quality Protection) for 2023 includes completing the construction of Sessom Creek Restoration Phase 1.

The most cost-effective strategy identified through the adaptive management process (AMP) in 2017 was implementation of stream restoration projects in the middle reach of Sessom Creek. Restoration will also address a tributary flowing into the middle reach, the Windmill Tributary, that is experiencing accelerated stream erosion and also contributing high sediment loads. 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 Phase 1, approximately 1400 linear feet of Sessom Creek, from above North LBJ Drive upstream to the Windmill Tributary confluence and Phase 2, approximately 565 linear feet from the confluence to the Loquat/Canyon intersection, plus 550 linear feet of Windmill Tributary. Stream and watershed restoration practices identified for each project reach include grade control, bank stabilization, gully control, stormwater management ponds, natural channel design, and riparian restoration.

In addition, the COSM 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. These improvements will be funded by COSM and will work in collaboration with the stream restoration and stormwater management practices to the maximum extent practical. The wastewater improvement project is separate but is planned to start prior to the Sessom Creek channel stabilization phase 1 and 2.

Monitoring:

The EAA Sessom Creek Real-Time monitoring station will measure turbidity, dissolved oxygen, and temperature. Any changes in water quality due to Sessom Creek restoration will be monitored by this monitoring station, the construction site will be monitored by the construction inspector.

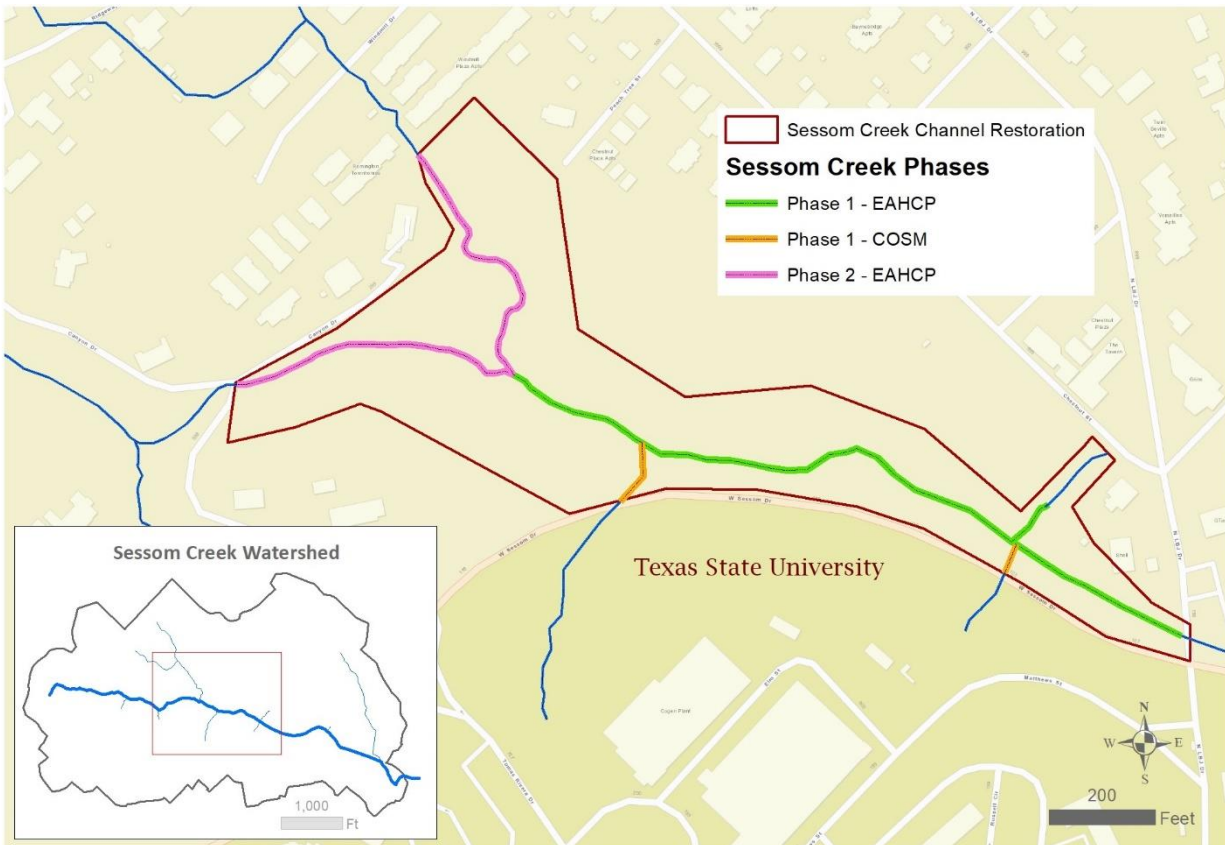


Figure 7. Sessom Creek Proposed Project Reaches - Phase 1 (green line) and Phase 2 (pink lines)

Budget:

Table 7.1

\$200,000

Estimated 2023 budget:

\$1,061,705

****\$1,528,200.00** was approved for this conservation measure in 2019, \$1,037,862.00 remained in December 2020, an additional \$62,138 was approved for this conservation measure in 2021, which increased the total budget to \$1,100,000. \$1,065,048.25 remained as of the December 2021 invoice, \$204,988.09 was spent in 2022 and \$895,011.91 remains as of the December 2022 invoice. However, the 2023 budget will not be reduced to this amount. Instead, only \$3,343 will be transferred to Floating Vegetation and Litter Control. Construction of Phase 1 of the Sessom Creek Stream Restoration project began in 2022 and will continue into 2023. Funding will cover construction and construction administration services associated with Phase I of the Sessom Creek Stream Restoration project and final design of Phase II. Construction of Phase 2 of the Sessom Creek Stream Restoration project is expected to begin in 2024 pending project and funding approval by the IC and EAA Board.

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 Household Hazardous Waste (HHW). This prevents the dumping of HHW into the river or recharge zone and thus impacting the Covered Species.

Target 2023:

Target 3,000 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 HHW collection program. Mailing quick fact flyers out with HHW information.

Methodology: Open drop-off opportunities two days a week (Tuesday and Friday) from 12:00 p.m. 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

Estimated 2023 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 2023:

Route map is completed, next steps include coordination between surrounding political subdivisions, Texas Department of Transportation, and the COSM.

Monitoring:

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

Budget:

Table 7.1:

\$0

Available budget for 2023:

\$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.

Target for 2023:

To maintain 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 individuals 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 2023:

\$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 contaminants into the San Marcos River. In order to leverage existing investment from the COSM, the EAHCP will assist in constructing two ponds. Both ponds are designed for high pollutant load reduction and have been identified as a priority management strategy.

Target for 2023:

The ponds were completed in 2020, all activities and funds associated with this measure have been completed.

Budget:

Table 7.1:

\$0

Available budget for 2023:

\$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 springflow to protect the aquatic resources as specified under the EAHCP flow management strategy.

Target for 2023:

Restriction of surface pumping as specified under the EAHCP. 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 EAHCP Section 2.5.5). The total diversion rate from Spring Lake is limited to 4.78 cfs; the total diversion rate from the San Marcos River at Sewell Park is limited to 2.22- cfs (See EAHCP Section 2.5.5.1 and 2.5.5.2 respectively).

Methodology - When flow at the USGS gauge (08170500) San Marcos River in Sewell Park 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, TWR, 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 2023:

\$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 with federal, state and local laws.

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

Target for 2023:

Implement the diving protocols as outlined in the Spring Lake Management Plan, EAHCP, and the ITP with the following modifications: no more than 16 volunteer divers will be allowed in the lake per day, with no more than eight at one time.

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, Spring Lake Management Plan, EAHCP, and 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 2023:

\$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 with federal, state and local laws. All research activities in Spring Lake are governed by the Spring Lake Management Plan, EAHCP, and ITP.

Target for 2023:

Implement the protocols for research as specified in the Spring Lake Management Plan, EAHCP, and 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 2023:

\$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, EAHCP, and ITP.

Target for 2023:

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

Follow the below protocol for all boats (canoe, kayak, and paddleboards) 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 per the protocol defined 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 non-glass bottom boat activity must not interfere with routine 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. 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 2023:

\$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 2023:

Continued implementation of the Grounds Management Plan and Integrated Pest Management Plan. Texas State University completed conversion of the Golf Course to Intramural Recreation Fields. COSM will work with the Texas State Facilities to better understand how the change will affect the Grounds Management Plan and the Integrated Pesticide Management Plan.

Methodology - The grounds will be maintained to meet the recreational function in an environmentally sensitive manner. It is the responsibility of the Grounds Manager to maintain the grounds in accordance with the Integrative Pest Management Plan (IPM). This plan describes 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 is 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 situations 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. Documentation of herbicide application is monitored by the Texas Department of Agriculture through unannounced spot checks.

Budget:

Table 7.1:

\$0

Available budget for 2023:

\$0