5.3.1/5.4.1 Texas Wild-Rice Enhancement and Restoration

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

Long-term Objective:
To restore 8000 m^2 of TWR (in addition to the 2013 baseline of 4000 m^2) and protect existing and restored areas of TWR (as required in Table 4-10).

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

Enhancement and restoration of TWR focuses on the removal of non-native vegetation within mixed stands of TWR and removal of non-native vegetation in areas adjacent to existing TWR stands. The work plan also includes selective TWR planting areas where non-native vegetation and sediment is removed as discussed in EAHCP measures 5.3.6/5.4.4 (Sediment removal) and 5.3.8/5.4.3/5.4.12 (Control of non-native plant species). In addition, TWR areal coverage within Spring Lake is targeted for 1500 m^2.

Target for 2017:
TWR is now being considered as a plant that provides fountain darter habitat and will therefore be counted toward meeting EAHCP biological goals as described in the Submerged Aquatic Vegetation (SAV) Analysis and Recommendations (Section 3.1.2.2). Therefore, in accordance with Table 31 of the SAV Recommendations, 25 m2 will be planted in the Spring Lake dam reach, 75m2 in the City Park reach, ~~and~~ 75m2 in the IH-35 reach, 100 m^2 in Spring Lake, and 20 m^2 below IH-35.~~.~~

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

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

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

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

Budget:
Table 7.1:
$125,000

Estimated 2017 budget:
$100,000*

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

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

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

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

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

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

Figure 1. Revised LTBG for SAV and Texas wild rice (m^2)

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

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

Restoration Reach	***Ludwigia repens***	***Potamogeton illinoensis***	***Hydrocotyle verticillata***	***Cabomba caroliniana***	***Sagittaria platyphylla***	***Zizania texana***
Sewell Park	25	150	10	25	25	1100
Below Sewell to City Park	50	500	20	50	700	2300

Hopkins St to Snake Island	50	475	10	50	750	950
Cypress Island to Rio Vista Falls	50	150	0	50	50	350
IH-35 expanded	50	250	50	100	450	450
Additional Texas wild rice reaches						
Spring Lake	-	-	-	-	-	1,000
Below I35	-	-	-	-	-	280
Total	235	1525	90	275	1975	6,4205~~150~~

Figure 3. Annual aquatic restoration goals (m^2) within LTBG and restoration reaches

Reaches	Species	Aquatic vegetation (m^2)		Restoration Goal
		Existing Coverage	Goal	2017
LTBG Reaches				
Spring Lake Dam	*Ludwigia repens*	0	200	10
	Cabomba caroliniana	0	25	5
	Potamogeton illinoensis	0	1000	50
	Sagittaria platyphylla	7	100	15
	Hydrocotyle verticillata	7	50	0
	Zizania texana	598	700	25
City Park	*Ludwigia repens*	1	1000	50
	Cabomba caroliniana	0	50	5
	Potamogeton illinoensis	54	2000	50

	Sagittaria platyphylla	92	300	15
	Hydrocotyle verticillata	0	10	0
	Zizania texana	1261	1750	75
IH-35	*Ludwigia repens*	0	200	10
	Cabomba caroliniana	0	300	15
	Potamogeton illinoensis	0	300	25
	Sagittaria platyphylla	0	100	10
	Hydrocotyle verticillata	0	50	0
	Zizania texana	28	600	75
Restoration Reaches				
Sewell Park	*Ludwigia repens*	0	25	0
	Cabomba caroliniana	14	25	0
	Potamogeton illinoensis	116	150	0
	Sagittaria platyphylla	2	25	0
	Hydrocotyle verticillata	0	10	0
	Zizania texana	1169	0	0
Below Sewell to City Park	*Ludwigia repens*	0	50	0
	Cabomba caroliniana	0	50	0
	Potamogeton illinoensis	172	500	0
	Sagittaria platyphylla	727	700	0

	Hydrocotyle verticillata	5	20	0
	Zizania texana	2247	2300	0
Hopkins St to Snake Island	*Ludwigia repens*	0	50	0
	Cabomba caroliniana	0	50	0
	Potamogeton illinoensis	269	475	0
	Sagittaria platyphylla	620	750	0
	Hydrocotyle verticillata	0	10	0
	Zizania texana	693	950	0
Cypress Island to Rio Vista Falls	*Ludwigia repens*	0	50	10
	Cabomba caroliniana	0	50	5
	Potamogeton illinoensis	0	150	10
	Sagittaria platyphylla	5	50	5
	Hydrocotyle verticillata	0	0	0
	Zizania texana	122	350	50
IH-35 expanded	*Ludwigia repens*	8	50	10
	Cabomba caroliniana	33	100	25
	Potamogeton illinoensis	0	250	30
	Sagittaria platyphylla	355	450	25
	Hydrocotyle verticillata	0	50	0
	Zizania texana	57	450	50

Additional Texas wild-rice Reaches				
Spring Lake	*Zizania*	31	1,000	100
Below I35	*Zizania*	0	280	20

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

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

Budget:
Table 7.1:
$75,000

Estimated 2017 budget:
$150,000 *

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