APPENDIX D
U.S. FISH AND WILDLIFE SERVICE BIOLOGICAL OPINION

United States Department of the Interior

FISH AND WILDLIFE SERVICE

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OCT 18 2013

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Consultation No. 02ETAU00-2013-F-0214

Dear Colonel Klinge

This transmits the U.S. Fish and Wildlife Service's (Service) final biological opinion for the U.S. Army Corps of Engineers (USACE) proposed restoration project under section 206 of the Water Resources Development Act (WRDA) of 1996 as amended (33 U.S.C. 2201 and 2330) for the upper San Marcos River. The USACE proposes to partner with the City of San Marcos (City) and implement ecosystem restoration measures on the upper San Marcos River and its riparian corridor.

In accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.)(Act), the USACE has determined this project may affect four federally listed threatened or endangered species: Texas wild-rice (*Zizania texana*), San Marcos gambusia (*Gambusia georgei*), fountain darter (*Etheostoma fonticola*), and San Marcos salamander (*Eurycea nana*). The USACE has also determined the project may affect the critical habitat of Texas wild-rice, San Marcos gambusia, and fountain darter. Based on our review of the proposed project and restoration measures, we concur that the project may affect Texas wild-rice and its critical habitat, San Marcos gambusia critical habitat, and the fountain darter and its critical habitat (collectively, consultation species and critical habitat). This biological opinion is based on information from: (1) the BA, (2) conversations with the USACE, Texas Parks and Wildlife Department (TPWD), the City, and Gulf South Research Corporation (GSRC), (3) field investigations by the Service, TPWD, Texas State University – San Marcos, Baylor University, and BIO-WEST, Inc., and (4) other sources of information. A complete administrative record of this consultation is on file at our office.

Consultation History

September 2003	USACE prepares Preliminary Restoration Plan.
May 20, 2009	Meeting with USACE, TPWD, City, and Texas State University.
August 18, 2009	Meeting with USACE, TPWD, and City.

February 16, 2011	Meeting with USACE, TPWD, City, and GSRC.
July 26, 2012	USACE provides Draft Alternatives Formulation Briefing Report.
January 30, 2013	USACE provides updated Alternative Formulation Briefing Report.
May 21, 2013	USACE provides Draft Biological Assessment (BA).
June 3, 2013	USACE provides Integrated Detailed Project Report and Environmental Assessment (DPR/EA).
June 4, 2013	Service receives the USACE Final BA, formal consultation begins.
September 16, 2013	USACE provides clarification on sediment removal measure
October 1, 2013	Service provides draft biological opinion. Federal government offices close due to a lapse in appropriations through October 16.
October 3, 2013	USACE provides review of draft biological opinion.

This biological opinion does not rely on the regulatory definition of "destruction or adverse modification of critical habitat" at 50 CFR 402.02. Instead, we have relied on the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

BIOLOGICAL OPINION

1. Description of the Proposed Action

Action Area

By regulation, the action area is defined as all areas to be affected directly or indirectly by the federal action, and not merely the immediate area involved in the action (50 CFR 402.02). The action for the USACE proposed action includes area, which includes the San Marcos River and its riparian area from Spring Lake Dam downstream to a point just below Cummings Dam and is buffered 400 meters (m) from the centerline of the San Marcos River (Figure 1). The Service with Utah State University subdivided the upper San Marcos River into study sections, which have been used by the USACE and GSRC in their project planning and habitat evaluations (Figure 1). The action area includes all of the proposed restoration measures and nearby roads. The lowest part of the action area herein is extended from the action area presented in the BA to include the lowest reach where project activities may affect fountain darters, for example through increased temporary turbidity.

Proposed Action

The USACE proposes to partner with the City to implement measures that enhance and restore parts of the upper San Marcos River ecosystem. The proposed measures are actions that would be conducted in the river and riparian corridor to enhance: (1) native woodlands, (2) native aquatic plants and animals, and (3) natural riverine conditions. The original suite of restoration measures under consideration were:

(a) Control of exotic shrubs and trees, e.g., chinaberry trees and ligustrum (EXOT)
(b) Restoration of the riparian corridor by enhancing existing woodlands (RIP)
(c) Control of exotic emergent aquatic vegetation, including elephant ears (EXOE)
(d) Stabilization of stream bank and control of recreational access (SHORE)

(e) Control of stormwater with bioengineering improvements to improve water quality (DISC)
(f) Removal of accumulated sediment in river channel (SED)
(g) Waterfowl management (DUCK)
(h) Wetland restoration (WET)
(i) Education (EDU)

Following cost-benefit analyses and implementation considerations, only the following six restoration measures remain as part of the proposed action: EXOT, EXOE, RIP, DISC, SED, and WET. The BA and particularly the DPR/EA describe in detail each restoration measure. Some of the proposed measures are not expected to have adverse effects on listed species because: (1) they will be done above the water surface of the river, (2) riparian treatments, such as controlling exotic woody species, will affect only the immediate area treated and will have no effect on the river or its biota, and (3) the riparian treatments will use best management practices (BMPs) to minimize erosion and sedimentation. Four restoration measures, EXOT, RIP, DISC, and WET, are considered not likely to cause harm to Texas wild-rice, take of fountain darters, or have any adverse effect critical habitat of these two species.

The remaining two restoration measures, namely EXOE and SED, may affect listed species and we consider the effects of these measures on the consultation species in this biological opinion. The description of the proposed action will focus on the proposed removal of exotic vegetation and sediment removal measures, which may affect the consultation species and their critical habitats.

Elephant Ear and Other Exotic Plants Control

The BA states that elephant ear will be removed from the channel and banks of the San Marcos River downstream of Sewell Park, and that disturbed areas will be planted with native vegetation (Figure 2). About 15,141 m^2 will be disturbed (See Table 1 for area disturbed in each river section). During each year of the three establishment years proposed for this measure, elephant ears will be removed from about 33 percent, or 5,047 m^2 of the river channel and banks.

Elephant ear removal will be conducted in patches such that each patch is treated and stabilized before creating additional disturbance. Removal will occur annually between March 1 and June 30 to allow for successful establishment of native plants during the growing season. Elephant ears may be removed by hand using a shovel or spade. In some instances, plants may be removed by pulling out the whole plant along with its rhizomes. The proposed action also includes the careful use of approved herbicides by trained applicators.

The disturbed patch will be immediately replanted with locally acquired native species suited to the local conditions and could include Texas wild-rice (*Zizania texana*), creeping primrose willow (*Ludwigia repens*), delta arrowhead (*Sagittaria platyphyla*), lizard's tail (*Saururus cernuus*), Illinois pondweed (*Potamogeton illinoensis*), grassleaf mudplantain (*Heteranthera dubia*), and soft stem bulrush (*Schoenoplectus tabernaemontani*). Excess sediment and plant material will be disposed of on city property to be recycled by the city for future use as upland fill.

Sediment Removal from Upper San Marcos River

The proposed restoration project will remove sediment from the river channel at specific locations using suction dredging (Figure 3). Using a screened intake pipe, water and sediment pumped from the river and separated. While the BA indicated the mesh openings would be about 1 mm, larger mesh openings may be used to more effectively dredge. The screen mesh openings will be the minimum practicable that works for dredging starting with 0.5 inch mesh. If the 0.5 inch mesh is not practical in certain areas, mesh as large as 1.0 inch may be used.

The water-sediment mixture will flow to a portable tank. Water will be drained from the removed sediment, clarified in a stilling basin, and returned to the river. The drained sediment will be removed from the restoration area and stored for future non-aquatic fill material near the City of San Marcos Animal Shelter, where the City routinely stores and handles excess fill and compostable materials. Alternative means of dewatering the dredged sediment, such as Geotubes®, are allowable under this biological opinion provided it produces return water of equal or superior water quality than the settling tank method. The main water quality parameter of concern is turbidity.

The USACE and City will replant the dredged area with locally acquired native species suited to the local conditions and could include Texas wild-rice (*Zizania texana*), creeping primrose willow (*Ludwigia repens*), delta arrowhead (*Sagittaria platyphyla*), lizard's tail (*Saururus cernuus*), Illinois pondweed (*Potamogeton illinoensis*), grassleaf mudplantain (*Heteranthera dubia*), and soft stem bulrush (*Schoenoplectus tabernaemontani*).

The USACE and City have developed a list of priority areas that will be targeted for sediment removal. Table 1 lists areas targeted for sediment removal by section. The total area is 19,252 m^2. 20 percent of the sediment removal will be done annually during each of the first five establishment years that funding is available.

Conservation Measures

The DPR/EA provides a detailed description of the BMPs for the restoration efforts. The BMPs include but are not limited to: (1) avoiding and minimizing erosion through use or erosion mats and properly installed silt fences, (2) selection of herbicides (for elephant ear control) that are unlikely to affect (a)Texas wild-rice, (b) other non-target aquatic vegetation, (c) fountain darters, or (d) fountain darter prey, (3) diligent and careful hand application of herbicides, (4) using elephant ear control methods that will have the least impact on the river and its biota, and (5) ongoing coordination and communication with TPWD and USFWS to help ensure minimal adverse effects from restoration measures.

In addition to the BMPs for the two restoration measures that affect the fountain darter (elephant ear and sediment removal), the project biologists (permitted by the Service and TPWD) will clear fountain darters from the work area and will carefully move fountain darters to nearby areas with plant cover.

2. Status of Species and Critical Habitat

2.a Texas Wild-Rice

Texas wild-rice was listed as endangered on April 26, 1978, and its critical habitat was designated on July 14, 1980. Critical habitat includes Spring Lake and its outflow, and the San Marcos River, downstream to the confluence with the Blanco River.

Species Description and Life History

Texas wild-rice is a typically submergent aquatic perennial grass. Its leaves are 3 to 6.5 feet long. When flowering, the inflorescence and the upper culms and leaves emerge above the water surface. In slow moving waters, Texas wild-rice functions as an annual, exhibiting less robust vegetative growth, then flowering, setting seed, and dying within a single season. Texas wild-rice forms stands in the San Marcos River at depths from 0.7 to 7.0 feet. The species requires clear, relatively cool, thermally constant (about 72°F) flowing water. Texas wild-rice prefers gravel and sand substrates overlaying Crawford black silt and clay soils (Poole and Bowles 1999, Saunders et al. 2001).

Reproduction of Texas wild-rice occurs either asexually (clonally) through stolons or sexually via seeds. Asexual reproduction occurs where shoots arise as clones at the ends of rooting stolons (Emery and Guy 1979). Clonal reproduction appears to be the primary mechanism for expansion of established stands, but does not appear to be an efficient mechanism for dispersal and colonization of new areas. Texas wild-rice tillers have, however, been observed floating downstream and some of these tillers may become established plants; but only if lodged in suitable substrate and physical habitat. Seed production is therefore believed to be essential for dispersal and establishment of new stands of Texas wild-rice (Service 1996a).

Sexual reproduction occurs when wind pollinated florets produce seed. This typically takes place in late spring through fall, though flowering and seed set may occur at other times in warm years (Service 1996a). Triggers for flowering are not well understood. Texas wild-rice seed is not long-lived, and seed viability begins to drop markedly within one year of production. No appreciable seed bank is therefore expected to exist in the substrate.

Historic and Current Distribution

Texas wild-rice was first collected in the San Marcos River in 1892 (Service 1996a). When the species was originally described in 1933, it was reported to be abundant in the San Marcos River, including Spring Lake and its irrigation waterways (Silveus 1933, Terrell et al. 1978). In 1976, Emery surveyed Texas wild-rice and estimated areal coverage at 1,131 m^2 in the San Marcos River (Emery 1977). Vaughan (1986) estimated overall Texas wild-rice coverage in 1986 at 454 m^2.

The Texas Parks and Wildlife Department has monitored Texas wild-rice coverage since June 1989, and TPWD estimates of its areal extent have ranged from 1,004 m^2 in 1989 to 4,995 m^2 in 2012. Texas wild-rice only occurs today in the upper San Marcos River from the vicinity of Spring Lake Dam downstream 5.0 river-kilometers. The most recent provisional rangewide

estimate of Texas wild-rice coverage (July 2013) is 5,529 m^2, which is an increase of about 11 percent from the previous year (pers. comm. Jeff Hutchinson, Service, San Marcos Aquatic Resource Center). Table 2 shows the two most recent available surveys for Texas wild-rice. BIO-WEST surveyed between April 10 and May 15, 2013 and Jeff Hutchinson and volunteers surveyed in latter half of July 2013.

Reasons for Decline and Threats to Survival

Reduced springflow is the greatest threat to the survival of Texas wild-rice. Other threats include water quality degradation, physical alteration of Spring Lake or the San Marcos River, and physical disturbance of the species (Service 1996a). Non-native species have also been implicated as a threat to the species.

Texas wild-rice is adapted to clear water, uniform flow rate, and constant year-round temperature (Beaty 1975). Low springflows and reduced San Marcos River flows can cause adverse effects to Texas wild-rice and designated critical habitat (Service 1996a). Drought conditions can adversely affect Texas wild-rice by reducing flows or eliminating water in portions of the river. Low flow conditions allow floating mats of vegetation (which normally move slowly downriver) to become lodged in wild-rice leaves near the surface. Vegetation mats shade plants, may mechanically damage Texas wild-rice, and may interfere with culm emergence thereby interfering with sexual reproduction (Power 1996, Power 1997). Decreased flows expose Texas wild-rice to herbivory by waterfowl, nutria, and giant rams-horn snails (Rose and Power 1992). Altered flow conditions may also result in competitive advantages for non-native plants when conditions are sub-optimal for Texas wild-rice.

An additional threat is recreational use of the river, which has been shown to have measurable adverse effects on Texas wild-rice (Breslin 1997). Breslin (1997) detailed the relative impacts of various activities (tubing, swimming, boating, and dog activities) to Texas wild-rice, and Bradsby (1994) discussed the relative quantity of use of the river during different levels of flow. These studies did not, however, quantify effects to the species at various discharge levels. As discharge decreases and the river becomes shallower, a greater percentage of Texas wild-rice plants are exposed to trampling. With decreased water depths, more Texas wild-rice leaves are on or near the river surface and therefore more exposed to physical disturbance. Recreational use of the river has also been postulated to interfere with flowering and seed set (Service 1996a). In September 2006, a significant loss of Texas wild-rice between Spring Lake Dam and University Drive bridge was reported and attributed to vandalism (BIO-WEST 2007).

Range-wide Survival and Recovery Needs

There are specific recovery actions listed in the 1996 San Marcos and Comal Springs and Associated Aquatic Ecosystems (Revised) Recovery Plan (Service 1996a). These include: (1) ensuring adequate flows and water quality in Spring Lake and the San Marcos River; (2) maintenance of genetically diverse reproductive populations in captivity; (3) creation of reintroduction techniques for use in the event of a catastrophic event; (4) removal or reduction of threats due to: (a) non-native species, (b) recreational use of the river, and (c) habitat alteration;

and (5) maintenance of healthy, self-sustaining, reproductive populations in the wild. Please refer to the Recovery Plan for additional details and priority actions prescribed for recovery.

Adequate springflows and river flows are needed throughout the year for existing Texas wild-rice to survive, grow, and recruit new individuals (stands). The San Marcos River flow regime is characterized by generally stable flows punctuated by small and large floods. However, during droughts, springflow and river flow may decrease 100 cfs in less than one year. Survival and recovery of Texas wild-rice will depend on aquifer management to avoid critically low flows.

Status of Texas wild-rice Critical Habitat

Texas wild-rice critical habitat includes Spring Lake and extends downstream to the confluence of the Blanco River. Critical habitat for Texas wild-rice (45 FR 47355) was designated July 14, 1980, prior to our October 1, 1984, regulation (49 FR 38900) directing the Service to identify primary constituent elements (PCEs) in when designating critical habitat. Nonetheless, important biological and physico-chemical factors (effectively PCEs) were described in the final rule for critical habitat of Texas wild-rice, and fountain darter.

Texas wild-rice critical habitat's primary constituent elements could generally be defined as: (1) clear high quality water, (2) unaltered San Marcos River flow, (3) constant year-round temperature, and (4) maintenance of the natural substrate. Texas wild-rice critical habitat encompasses about 253,000 m^2 (62 acres) of the upper San Marcos River.

2.b San Marcos Gambusia

The entire range of the San Marcos gambusia (*Gambusia georgei)* falls within the action area and this species description therefore constitutes the environmental baseline for this species.

Species Description and Life History

The San Marcos gambusia (SMG) was described from the upper San Marcos River system in 1969, and was subsequently listed as endangered on July 14, 1980 (45 FR 47355). Of the three species of *Gambusia* native to the San Marcos River, SMG has apparently always been much less abundant than either the largespring gambusia (*G. geiseri*) or the western mosquitofish (*G. affinis*) (Hubbs and Peden 1969).

The SMG is a member of the family Poeciliidae and belongs to a genus of Central American origin having more than 30 species of livebearing freshwater fishes. The genus *Gambusia* is well defined and mature males may be distinguished from related genera by their thickened upper pectoral fin rays (Rosen and Bailey 1963). Only a limited number of species of *Gambusia* are native to the United States, and of these the SMG has one of the most restricted ranges.

The food habits of SMG are unknown. Presumably, as in other poeciliids, insect larvae and other invertebrates account for most of the diet of this species.

There is little information on the reproductive capabilities of SMG. Two individuals kept in laboratory aquaria produced 12, 30, and 60 young, although the largest clutch appeared to have been aborted and did not survive (Edwards et al. 1980).

Hybridization between SMG and *G. affinis* was first noted by Hubbs and Peden (1969) and the production of hybrid individuals between them has continued for many years without obvious introgression of genetic material into either of the parental species. Given the history of hybridization between these two species, this factor was not thought to be of primary importance in considerations of the status of SMG. It was thought that so long as the proportion of hybrids remained relatively low compared to the abundance of pure SMG, few problems associated with genetic swamping or introgression would occur (Hubbs and Peden 1969, Edwards et al. 1980). However, the series of collections (R.J. Edwards, pers. comm.) taken during 1981 - 1983 indicate that hybrid individuals may have become many times more abundant than the pure SMG. It may have been possible that hybrid individuals at that time were competing with SMG, placing an additional stress on the small native population of SMG.

The SMG apparently prefers quiet waters adjacent to moving water, but seemingly of greatest importance, thermally constant waters. SMG is found mostly over muddy substrates but generally not silted habitats, and shade from over-hanging vegetation or bridge structures is a factor common to all sites along the upper San Marcos River where apparently suitable habitats for this species occur (Hubbs and Peden 1969, Edwards et al. 1980).

Historic and Current Distribution

The SMG is represented in collections taken in 1884 by Jordan and Gilbert during their surveys of Texas stream fishes and in later collections (as a hybrid) taken in 1925 (Hubbs and Peden 1969). Unfortunately, records of exact sampling localities are not available for these earliest collections, as localities were merely listed as “San Marcos Springs.” These collections likely were taken at or near the headsprings area. If true, then SMG appears to have significantly altered its distribution over time. For the area of the San Marcos River downstream of the headwaters area, there are few records of sampling efforts prior to 1950. However, even in the samples that were taken there are few collections of SMG.

A single individual was taken in 1953 below the low dam at Rio Vista Park. Almost every specimen of SMG collected since that time, however, has been taken in the vicinity of the Interstate Highway 35 Bridge crossing or shortly downstream. The single exception was a male captured accidentally with an Ekman dredge (sediment sampler) about 0.62 miles below the outfall of the San Marcos wastewater treatment plant in 1974 (Longley 1975).

Historically, SMG populations have been extremely sparse. Intensive collections during 1978 and 1979 yielded only 18 SMG from 20,199 *Gambusia* total (0.09 percent) (Edwards et al. 1980). Collections made in 1981 and 1982 within the range of SMG indicated a slight decrease in relative abundance of this species (0.06 percent of all *Gambusia*) and none have been collected in subsequent sampling from 1982 to the present. Intensive searches for SMG were conducted in May, July, and September of 1990 but were unsuccessful in locating any pure SMG. The searches consisted of a total of 18 hours of effort (more than 180 people-hours) over

three separate days and covered the area from the headwaters at Spring Lake to the San Marcos wastewater treatment plant outfall. Over 15,450 *Gambusia* were identified during the searches. One individual collected during the search was visually identified as a possible backcross of *G. affinis* and SMG (Service 1990 permit report). This individual was an immature fish with plain coloration. Additional sampling near the Interstate Highway 35 type locality has occurred at approximately yearly intervals since 1990 and no SMG have been found.

The Service and cooperators conducted five fish collections in the upper San Marcos River during the period 1994 and 1996. Edwards (1999) identified 32,811 *Gambusia* in collection jars from that effort. No SMG were found and Edwards concluded this species appears to be extinct.

The pattern of SMG abundance strongly suggests a decrease beginning prior to the mid-1970s. The increase in hybrid abundance between SMG and *G. affinis* and the decrease in the proportion of genetically pure SMG is considered evidence of its rarity. As fewer pure individuals encountered each other, the chances of hybridization with the much more common *G. affinis* substantially increased. The subsequent decrease in SMG abundance along with their hybrids suggests the extinction of this species.

The SMG has not been collected since 1982 despite annual survey efforts, and may no longer exist in the wild. The species has not, however, been declared extinct or removed from the list of endangered species and must therefore be addressed in this biological opinion.

Reasons for Decline and Threats to Survival

At the time the species was listed, small and declining populations, lowered water tables, pollution, bottom plowing, and cutting of vegetation were cited as threats to the species (Service 1980).

Groundwater depletion, reduced springflows, contamination, habitat impacts resulting from severe drought conditions, and cumulative effects of human activities are all identified as threats to the species throughout all or a significant portion of its range (Service 1980).

Water quality is believed to be important to the SMG. Groundwater contamination or pollution resulting from a catastrophic event such as a hazardous material spill into the San Marcos River constitutes another threat to the species. The upper San Marcos River and its immediate tributaries are crossed by a total of 30 bridges including four railroad bridges and six associated with Interstate Highway 35. Any of these river crossings could be the source of a spill or release that could affect the species or its designated critical habitat in the San Marcos River. Stormwater inflows and other non-point sources of contamination may also pose a threat to the species.

Recreational use of the San Marcos River can also result in adverse impacts to the SMG or its habitat. Recreational uses that physically alter habitats may affect the species ability to feed and shelter.

Non-native species may threaten the SMG though habitat disturbance, or alteration. The SMG inhabits open areas with little vegetation. Suckermouth catfishes (Loricaridae) introduced into the San Marcos River disrupt substrates and may burrow into and destabilize riverbanks, thereby introducing additional sediment loads and turbidity into the river systems. Some researchers have hypothesized that the non-native plant elephant ears (*Colocasia esculenta*) may have adversely affected SMG habitat suitability (Service 1996*a*).

Sediment and sand bar accumulations that modify the river channel and associated habitats may also impact the species or its designated critical habitat. These sediment loads may be associated with the increasing urbanization of the lands surrounding the upper San Marcos River.

The apparent demise of the SMG may be attributed in part to the Allee effect, which becomes important in small populations. The few SMG present in the early 1980s were unlikely to find mates and reproduction rates likely went from rare to zero.

Survival Needs and Recovery Criteria

The SMG apparently requires thermally constant water; quiet, shallow, open water adjacent to moving water; muddy substrates without appreciable quantities of silt; partial shading; clean and clear water; and a food supply of living organisms.

Elephant ears (*Colocasia esculenta*) are a non-native emergent macrophyte believed to have been introduced into the San Marcos area in the early 1900s (Akridge and Fonteyn 1981). This species has displaced native vegetation and now form extensive stands at the water's edge in the San Marcos system. Although the exact nature of the relationship between the occurrence and abundance of elephant ears and the disappearance of SMG is unknown, some investigators believe these nonnative plants may have decreased habitat suitability and contributed to its decline (Service 1996*a*).

The San Marcos gambusia has been presumed extinct for over ten years. The uppermost reach of the action area (Rio Vista Park downstream to Thompson Island) has less suitable San Marcos gambusia habitat compared to 50 years ago due to spread of elephant ears on the San Marcos River banks. There are small areas of suitable habitat for the San Marcos gambusia present in the reach between Hopkins Road and Capes Dam. All of the action area is San Marcos gambusia critical habitat.

Status of San Marcos Gambusia Critical Habitat

Critical habitat of the San Marcos gambusia includes the San Marcos River from Hopkins Street Bridge downstream to approximately 0.5 miles below IH-35 Bridge (45 FR 47355). Important elements of San Marcos gambusia habitat are: (1) open areas with minimal aquatic vegetation, (2) mud substrate, (3) reduced water velocities, and (4) stenothermal (fairly constant) water temperature regime of the spring-fed San Marcos River. The San Marcos River currently provides these elements.

2.c Fountain Darter

The fountain darter was listed as endangered on October 13, 1970, and critical habitat was designated on July 14, 1980. The designated critical habitat is described as "Texas, Hays County; Spring Lake and its outflow, the San Marcos River, downstream approximately 0.5 miles below Interstate Highway 35 Bridge." Fountain darter critical habitat encompasses about 199,772 m^2 (49 acres) of the upper San Marcos River.

Species Description and Life History

The fountain darter is a small benthic, reddish-brown fish. Adult fountain darters range in length from 0.75 to 1.5 inches. Fountain darter habitat requirements as described in the Recovery Plan (Service 1996a) include: undisturbed stream floor habitats; a mix of submergent plants (algae, mosses, and vascular plants), in part for cover; clear and clean water; invertebrate food supply of living organisms; constant water temperatures within the natural and normal river gradients; and adequate springflows. Fountain darters have reduced densities, or are absent, in areas lacking submergent vegetation (Service 1996b, BIO-WEST 2011).

Historic and Current Distribution

The historic range of the fountain darter includes the San Marcos and Comal rivers in central Texas (Service 1996a). In 1884, Jordan and Gilbert (1886) collected the type specimens of *E. fonticola* in the San Marcos River from immediately below the confluence of the Blanco River.

In the San Marcos River system, the fountain darter is found in Spring Lake and the San Marcos River downstream to an area just below the emergency spillway to the Smith Ranch impoundment. The fountain darter population in the San Marcos River downstream of Spring Lake Dam was estimated annually over a 9 year period from 2002 to 2010, and ranged from a minimum of 58,562 to a maximum of 471,315 (EARIP 2012). Fountain darter densities appear to be highest in the upper segments of the San Marcos River and decrease markedly below Cape's Dam (Linam 1993).

In the Comal River system, the fountain darter is found in Landa Lake and throughout the Comal River system downstream to the confluence with the Guadalupe River (Service, unpublished data, 1996b). The fountain darter population in the Comal River system, including Landa Lake, was estimated annually over the same 9 year period as in the San Marcos River, and ranged from a minimum of 172,783 to a maximum of 775,567 (EARIP 2012). Similar to the San Marcos River, Comal River fountain darter densities are lowest in the downstream reaches, due in part to a limited coverage of rooted aquatic plants.

Reasons for Decline and Threats to Survival

The Recovery Plan (Service 1996a) identifies several threats to the fountain darter. The primary threats are related to the quality and quantity of aquifer and spring water. Drought conditions or increased groundwater utilization resulting in reductions to or loss of springflows threaten the species recovery. Activities that may pollute the Edwards aquifer and its springs and

streamflows may also threaten or harm the species (Service 1996a). Additional threats include effects from increased urbanization near the rivers, recreational activities, alteration of the rivers, habitat modification (e.g., dams, bank stabilization, and flood control measures), predation, competition, habitat alteration by non-native species, and introduced parasites (Service 1996a).

Fountain darters are being affected by an introduced parasitic trematode that attaches the gills. Multiple researchers have documented the presence of a trematode parasite that threatens fountain darters (Mitchell et al. 2000 and McDonald et al. 2006). This trematode is more widespread in the Comal than the San Marcos system. The effect of these parasites on darters is likely to increase during stressful periods of low spring discharge (Cantu 2003), and the parasite's adverse effects may be greater to younger fountain darter life-stages (McDonald et al. 2006). Currently, the trematode in the San Marcos system is found in the river near IH-35. The trematode may spread in the San Marcos system through movement of host species such as other fish species, snails, and black-crowned night-herons, and adversely impact the health of the San Marcos fountain darter population.

Range-wide Survival and Recovery Needs

There are numerous actions listed in the Recovery Plan regarding specific recovery efforts. The Recovery Plan recommends recovery efforts aimed at maintaining adequate springflows, protecting water quality, and reducing local threats to fountain darter habitat.

The Recovery Plan specifies the need to develop and implement management plans for both the San Marcos and Comal systems. One recovery need is to protect species and their habitats by management of river recreation entry and exit points to help avoid aquatic plant losses (Service 1996a, EARIP 2012). Recreational use of the river adversely impacts aquatic vegetation. Rooted submergent plants are an important component of fountain darter habitat. Aquatic plants provide: (1) surface area for egg attachment (breeding); (2) nursery habitats; (3) habitat for prey species such as amphipods; and (4) cover from predators. The recovery plan calls for enhancement of fountain darter habitat by protecting and restoring rooted aquatic plants, including Texas wild-rice.

Status of Fountain Darter Critical Habitat

The rulemaking for the fountain darter predates the October 1, 1984, regulation (49 CFR 38900) stipulating that primary constituent elements essential for the conservation of the species be identified at the time critical habitat is designated. However, the rule designating fountain darter critical habitat (45 CFR 47362) does describe actions that would adversely modify designated critical habitat, including any actions that would significantly reduce aquatic vegetation in the San Marcos River, impound water, excessively withdraw water, reduce flow, and pollute the water.

Fountain darter critical habitat includes the San Marcos River, including Spring Lake downstream to approximately 0.5 miles below the Interstate Highway 35 Bridge.

The important elements of fountain darter critical habitat are generally be defined as:
(1) undisturbed stream floor habitats (including runs, riffles, and pools), (2) a mix of submergent vegetation (algae, mosses, and vascular plants), (3) clear and clean water, (4) a food supply of small, living invertebrates, (5) constant water temperatures within the natural and normal river gradients, and (6) adequate spring flows to maintain the conditions above.

The springflow element of fountain darter critical habitat is dependent on the Edwards aquifer water level which can be reduced by drought and by groundwater pumping from the Edwards aquifer.

The water quality in the upper San Marcos River is generally recognized as good. However, a gradient of increasing turbidity from upstream to downstream is notable, particularly during daylight hours in the months of May through September.

Aquatic plants have been mapped and highest densities are found in the uppermost reaches. Below IH-35 and particularly below Capes Dam, aquatic plants in the San Marcos River become less dense. Thus, overall, as one moves downstream from Spring Lake to the Cape Dam and continuing to the downstream end of the critical habitat, the water quality and the density of aquatic vegetation decreases.

3. Environmental Baseline

The environmental baseline section focuses on factors affecting the species and critical habitat in the action area and the status of the species in the action area. As described in the BA, there are ongoing efforts that will benefit the listed species, namely, the conservation and restoration measures resulting from implementation of the EARIP HCP, and the establishment of the San Marcos River State Scientific Area. Also, the City is making improvements to its sewer and stormwater systems to reduce river pollution. The City is also working on reducing the impacts of river recreation on Texas wild-rice in concert with the EARIP HCP.

Texas wild-rice

The factors affecting Texas wild-rice in the action area are similar to those outside the action area. The action area is occupied by about 3,837 m^2 of Texas wild-rice, which is 69 percent of the July 2013 estimate of 5,530 m^2 (pers. comm. Jeff Hutchinson, SMARC). All of the current stands of Texas wild-rice occur within the critical habitat. The action area includes about 15.858 ha (63 percent) of all Texas wild-rice critical habitat. The most recent survey results (July 2013) indicate that the total coverage increased about 11 percent from July 2012. For comparison, the average annual increase since 1990 has been about 8 percent. Texas wild-rice's status is currently stable but a prolonged drought and lack of Edwards Aquifer recharge, may result in instream flows that expose Texas wild-rice to damage.

The Service has issued 10 biological opinions on Federal actions that affected Texas wild-rice in the action area. The 10 formal consultations including a sewage pipeline crossing, a wastewater discharge permit, stormwater outfalls, a railroad bridge replacement, two road bridge repairs, National Fish Hatchery use of Edwards Aquifer water, Joint Base San Antonio use of Edwards

Aquifer water, and the EARIP HCP. All biological opinions were non-jeopardy and non-adverse modification or destruction of critical habitat.

San Marcos Gambusia

The San Marcos gambusia is likely extinct and has not been found in the wild since 1982. All historical collections and all San Marcos gambusia critical habitat are within the action area. Thus the status provided above in Section 2 addresses the environmental baseline.

Fountain Darter

The factors affecting the fountain darter in the action area are similar to those affecting the species rangewide. The highest densities of fountain darters in San Marcos are found in the heavily vegetated headwaters in Spring Lake and in nearby sections of the San Marcos River. The density of native submergent aquatic vegetation (NSAV) decreases downstream of the headwaters. Similarly, fountain darters abundance decreases going downstream. The upper part of the action area has a relatively large fountain darter population and the downstream reaches of the action area have few aquatic plants and low densities of fountain darters (see Table 1). BIO-WEST (2011) estimated 480,000 individual fountain darters within the San Marcos River downstream of Spring Lake and we infer that the action area supports more than half of that population.

Rangewide, the fountain darter has been the subject of 18 formal consultations. The Service has issued 10 biological opinions on actions affecting fountain darters in the action area, including a sewage pipeline crossing, a wastewater discharge permit, two stormwater outfalls, a railroad bridge replacement, two road bridge repairs, San Marcos Aquatic Resources Center and National Fish Hatchery use of Edwards Aquifer groundwater, Joint Base San Antonio use of Edwards Aquifer groundwater, and the EARIP HCP. All biological opinions were non-jeopardy and non-adverse modification and destruction of critical habitat.

4. Effects of the Action

Analysis for Effects

This BO analyzes the effects of the two restoration measures contained in the San Marcos Section 206 Aquatic Ecosystem Restoration Project, and the BMPs and conservation measures associated with those two restoration measures that may affect listed species. There have been prior efforts to control elephant ears above the river level and available information indicates that work has not affected biota in the river. However, the non-native plant removal taking place along the edge of the river or sediment removal in the river may affect listed species in several ways: (1) temporarily increasing turbidity, (2) unavoidably impacting submergent native aquatic vegetation, and (3) causing lethal or sub-lethal effects to fountain darters from hydraulic dredging. The specific measures that are considered to have an effect on Texas wild-rice, fountain darters, and San Marcos gambusia are: (1) the removal of elephant ears, and (2) sediment removal. Table 3 summarizes the areas involved for elephant ear removal and

sediment removal. Table 4 shows the area of current stands of Texas wild-rice in proposed sediment removal target areas.

Texas wild-rice

The restoration measures in the river are planned in such a manner as to avoid and minimize impacts to Texas wild-rice. However, the distribution of Texas wild-rice plants is dynamic and new plants can show up in previously unoccupied areas wherever habitat is suitable. The proposed action will either avoid Texas wild-rice or translocate a limited number of plants to nearby suitable habitat. Some loss of plants is expected even if carefully transplanted. The number of Texas wild-rice plants to be moved is unknown at this time but conservation measures will direct efforts to limit translocations to a small fraction (e.g., less than 5 percent of a TPWD Texas wild-rice segment total coverage).

The effects of the USACE's proposed San Marcos Section 206 Aquatic Ecosystem Restoration Project would be similar to some ongoing restoration efforts conducted under the EARIP HCP. The proposed elephant ear removal is not expected to impact any current stand of Texas wild-rice. However, sediment removal target areas include a small number of Texas wild-rice plants and the breakdown by TPWD segment is shown in Table 4. While efforts to avoid Texas wild-rice whenever possible will be made, some small stands that cannot be avoided will be transplanted to suitable habitat in the same general area, based on the expertise of botanists working to recover Texas wild-rice.

Critical habitat of Texas wild-rice

Texas wild-rice critical habitat's primary constituent elements could generally be defined as:

i. Clear high quality water,
ii. Unaltered San Marcos River flow,
iii. Constant year-round temperature, and
iv. Maintenance of natural substrate

The restoration project is not expected that permanently alter or affect any of these PCEs. There will be some temporary turbidity for the measures in the river. However, best management practices are planned to minimize the turbidity in work areas from affecting the river at large (e.g., through use of silt curtains or similar means).

San Marcos Gambusia

No effects to San Marcos gambusia are expected since this species is likely extinct.

Critical Habitat of San Marcos Gambusia

San Marcos gambusia critical habitat's primary constituent elements could generally be defined as:

i. Open areas with little current or vegetation away from stream banks;

ii. Maintenance of natural substrates;
iii. A natural temperature regime in occupied areas of the San Marcos River, and
iv. Reduced water velocities.

The restoration project is not expected to alter any of these PCEs. Sediment removal (primarily silt) will be removed during the project and the disturbance created by dredging and plant removal will be temporary. The restoration activities will reduce elephant ear coverage, which will improve habitat for the San Marcos gambusia.

Fountain Darter

The restoration project is expected to affect the fountain darter wherever the river substrate and vegetation are affected. The removal of elephant ears and sediment removal are the measures that are expected to result in fountain darter take. Fountain darter density varies by section and generally decreases in the downstream direction. The work area for elephant ear removal is estimated at 15,141 m^2 and the area for sediment removal is estimated at 19,252 m^2. Table 3 shows the estimated number of darters affected by elephant ear removal per river section by multiplying the expected density by the area affected.

About 22,651 fountain darters would be harassed or killed in the areas affected by elephant ear removal throughout the life of project. Elephant ear removal is slated to work on 33 percent each year for three years. The number of fountain darters affected annually by elephant ear removal is expected to be less than 7,550 (33 percent of 22,651) because fountain darter density in elephant ears is lower than the average for other aquatic plants.

To estimate the effects of sediment removal on the fountain darter, we divided the work area into the Service's study sections (4 through 13). In the 1990s, the Service estimated that fountain darter densities in sections 4 through 8 averaged 2.24 darters per m^2. The density for sections 9 through 11 averaged lower at 0.22 darters per m^2. Section specific fountain darter densities were used to estimate the number of fountain darters occupying the areas affected by elephant ear and sediment removal. The specific areas to be treated for sediment removal may change over time due to flooding and other geomorphic processes. The restoration project proposes to limit sediment removal to 20 percent of the total area for a given year. If sediment removal is done as proposed, the number of fountain darters affected on an annual basis is 6,634 individuals. The actual number of darters affected will be strongly dependent on the coverage of submergent plants in sediment removal work area. Plants like hydrilla and hygrophila are adapted to colonize disturbed areas and it is likely both native and non-native submergent plants will occur in areas targeted for sediment removal. If not captured during efforts to clear the area of fauna, a few fountain darters may be killed if they take cover in a work area and are then entrained or impinged during suction dredging.

Critical Habitat of Fountain Darter

The important elements of fountain darter critical habitat are generally be defined as:

i. Undisturbed stream floor habitats (including runs, riffles, and pools),

ii. A mix of submergent vegetation (algae, mosses, and vascular plants),
iii. Clear and clean water,
iv. A food supply of small, living invertebrates,
v. Constant water temperatures within the natural and normal river gradients, and
vi. Adequate spring flows to maintain the conditions above.

The restoration project is expected to affect two of these habitat elements. First, suction dredging will disturb the streambed. Second, the activity will increase turbidity during dredging. Some slight disturbance of the stream floor will result from elephant ear removal when areas are treated. The careful use of herbicides is one means of killing and controlling elephant ears. Physical removal by restoration may also be used although the removal of the elephant ear corm would result in sediment suspension and turbidity.

5. Cumulative Effects

Cumulative effects include the effects of future State, local or private (i.e., non-Federal) actions that are reasonably certain to occur in the action area. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. The USACE, Department of Defense (U.S. Air Force and U.S. Army), Federal Highway Administration, FEMA, U.S. Department of Agriculture – Rural Development, USEPA, and Service are the most likely Federal agencies to authorize or fund projects warranting section 7 review in the vicinity of San Marcos, Texas.

Ongoing impacts from water recreationists remain a serious local threat to Texas wild-rice and fountain darter habitat. The most intense use of the river by recreationists is from late spring to late summer. An invasive non-native species, Beckett's water trumpet (*Cryptocoryne beckettii*), has almost been eliminated in the action area. However, future unintentional introductions (and establishment) of other non-native plants seem likely to occur. These introduced plants may out compete with Texas wild-rice for habitat. Mild to severe flooding is expected in the action area during the life of the project. Flood control projects in the San Marcos area have reduced the severity of flooding in the action area. However, as the immediate watershed becomes more developed, the stormwater hydrograph and water quality are expected to be altered. One effect of greater impervious cover in the watershed will be flashier runoff events. Another effect of increased urbanization on Texas wild-rice, fountain darters, and other biota of the upper San Marcos River is the potential increase risk of contaminants draining into the upper San Marcos River.

6. Biological Opinion Conclusion

After reviewing the current status, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, it is the Service's biological opinion that the proposed USACE's Section 206 San Marcos Aquatic Ecosystem Restoration Project will not jeopardize the continued existence of Texas wild-rice, fountain darter, or the San Marcos gambusia. This conclusion is based on: (1) the limited areal extent of the project effects relative to the areas currently occupied by these species; (2) the limits of work done in the San Marcos River during any given year of the project; (3) the likely continued occupation of the San Marcos

River by Texas wild-rice and fountain darters above, in, and below the work area; and (4) the likelihood of that fountain darters will recolonize available aquatic habitats after elephant ears and sediment have been removed and turbidity has subsided. The recolonization of disturbed areas by fountain darters will depend in part on the availability of plant cover. The proposed action includes the timely restoration of submergent plants including Texas wild-rice. The proposed restoration project will not destroy or adversely modify designated critical habitat of Texas wild-rice, fountain darter, or San Marcos gambusia. This conclusion is based on the limited amount of critical habitat affected by the proposed action and the temporary nature of project-related effects.

7. Incidental Take Statement

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this incidental take statement.

Sections 7(b)(4) and 7(o)(2) of the Act do not generally apply to listed plant species. However, limited protection of listed plants from damage is provided to the extent that the Act prohibits the removal and reduction to possession of federally listed endangered plants from areas under Federal jurisdiction, or for any act that would remove, cut, dig up, or damage or destroy any such species on any other area in know violation of any regulation of any State or in the course of any violation of a State criminal trespass law.

The measures described below are non-discretionary, and must be undertaken by the USACE so that they become binding conditions of any authorization issued to the City or its contractors, as appropriate, for the exemption in section 7(o)(2) to apply. The USACE has a continuing duty to regulate the activity covered by this incidental take statement. If the USACE: (1) fails to assume and implement the terms and conditions or (2) fails to require the local sponsor to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. To monitor the effect of incidental take, the USACE must report the progress of the action and its effect on the species to the Service as specified in the incidental take statement [50 CFR §402.14(i)(3)].

Amount or Extent of Take Anticipated

Fountain Darter Incidental Take

We estimate the incidental take associated with the early phases of the restoration project where the aquatic habitat is temporarily disturbed by treatments.

The incidental take for the project is considered to be all fountain darters within the riverine habitat areas disturbed by the specific measures – treatments discussed above. The total number of fountain darters taken for is estimated at: (1) 22,651 fountain darters resulting from elephant ear removal and (2) 33,169 fountain darters resulting from sediment removal. The areas to be treated for sediment removal were identified as complimentary and do not overlap with the sediment removal efforts of the EARIP HCP. Capturing and moving fountain darters also constitutes take and we anticipate the temporary silt curtains and general presence of people standing and working in the river will harm some darters. The total number of fountain darters taken is 55,820 from all restoration measures for the life of the project.

The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize the effects of incidental take that might otherwise result from the proposed action. If, during the course of the action, this level of incidental take is exceeded, such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. The USACE must directly provide an explanation of the causes of the taking and review with the Service the need for possible modification of the reasonable and prudent measures.

Effect of the take

In the accompanying biological opinion, we have determined that this level of anticipated take is not likely to jeopardize the continued existence of the fountain darter and San Marcos gambusia for the reasons stated in Section VI above.

REASONABLE AND PRUDENT MEASURES

Pursuant to section 7(b)(4) of the Act, we believe the following reasonable and prudent measures (RPM) are necessary and appropriate to minimize effects of incidental take on fountain darters:

RPM 1 Restoration activities affecting (a) substrate, (b) water quality, (c) aquatic plants, and (d) listed animals of the San Marcos River will avoid disturbances of Texas wild-rice and fountain darters to the maximum extent practicable. Where avoidance is not practical, USACE will minimize the disturbance in space and time. Best management practices to improve the water quality of stormwater shall be employed.

RPM 2 The USACE shall monitor the project and ensure appropriate and relevant information on the project is provided in a timely manner to the Service.

RPM 3 The USACE shall ensure that the coverage of submergent aquatic plants is not permanently reduced by the restoration activities particularly sediment removal. The USACE shall plant a commensurate coverage of native submergent plants within one year of removing or destroying any rooted macrophytes.

Terms and conditions

To be exempt from the prohibitions of section 9 of the Act, the USACE must ensure compliance with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. The applicant shall be responsible for complying with these terms and conditions, which are non-discretionary. Terms and conditions that implement RPM 1:

1. The USACE and City will ensure: (a) equipment will be readied and mobilized in a manner to minimize the duration for disturbance, and (b) equipment will be demobilized if a precipitation event and runoff is likely to flood the area.

2. Work by the USACE, City, and/or contractors shall be done with careful staging of heavy equipment by the river and inspections for leakage of fuels, hydraulic fluids, coolants, and any other fluids are required. If fluid leakage is detected, equipment must be repaired and cleaned prior to working in or along the river. Care must be taken to prevent material falling into the river.

3. The biologists working to clear fountain darters species from the area will carefully move any algal or moss mats, to nearby areas with macrophytes.

4. Captured fountain darters will be removed and released in a manner that avoids predation by larger fishes, by releasing individuals with aquarium nets near plant cover on the river bed. Persons involved in these efforts should have proper equipment and authorizations/permits from the Service (section 10(a)(1)(A)) and Texas Parks and Wildlife Department (Scientific Permits pursuant to Texas Parks and Wildlife Code Chapter 43, subchapter C). Habitat will be swept with small (D-frame type or similar) dipnets or small seine to salvage fountain darters immediately prior to sediment removal. The amount of time that netted fountain darters are out of water must be kept to a minimum.

5. Turbidity will be visually monitored daily during elephant ear and sediment removal. If project-related turbidity in the San Marcos River averages more than 20 ntu (nephelometric turbidity units) in a 24-hour period, the applicant will contact the Service to discuss the source of turbidity. If indicated, additional measures to reduce turbidity may be recommended.

6. If Texas wild-rice plants or stands occur in an area to be disturbed, the trans-location of Texas wild-rice may be done after written coordination and approval by the Service and TPWD's lead for Texas wild-rice.

Terms and Conditions that implement RPM 2

7. USACE will ensure project-related work will be actively monitored by the City, who will help ensure that actions taken on-site are consistent with approved plans and this biological opinion.

Terms and Conditions that implement RPM 3

8. USACE will monitor the areal coverage of submergent macrophytes removed or destroyed by restoration activities and USACE and the City will restore native submergent plants in dredged areas within two years. Native macrophytes will be planted and maintained such that the coverage at year five equals or exceeds the coverage at the beginning of the project. USACE and the City will, in coordination with the Service and TPWD, plan for plantings of native submergent aquatic plants in areas not expected to be affected by future restoration activities or other factors. The species composition and planting strategies will be discussed during further coordination on the restoration project.

8. Conservation Recommendations

1. Increase the coverage of native submergent aquatic vegetation (NSAV) throughout the upper San Marcos River. The most effective enhancement will be in areas currently lacking or deficient in NSAV, such as below Capes Dam. It is not clear that the measures in the Nationally Recommend Plan or the Locally Preferred Plan specifically address or support this need explicitly. If sediment removal occurs, the area treated will generally lack rooted macrophytes. We recommend that the project limit the reduction in fountain darter habitat by establishing a commensurate extent of NSAV in appropriate areas prior to sediment removal. Desirable native rooted macrophytes include Texas wild-rice and creeping primrose-willow (*Ludwigia repens*). Texas State University is investigating factors that may affect NSAV including incidence of sunlight and diurnal turbidity. Prof. Thomas Hardy (pers. comm, 2013) indicated Texas wild-rice and other macrophytes are more successful establishing stands and growing in areas where sunlight is not obstructed by tree canopy.

2. Assist with restoration and protection of native macrophytes in the upper San Marcos River, including Texas wild-rice.

3 Assist with efforts to improve the water quality of runoff from San Marcos to the San Marcos River including but not limited to stormwater associated with neighborhoods, railroads, and roads.

4 Assist with additional efforts to avoid and minimize disturbance of the San Marcos River by people.

5 Assist with the implementation of recovery tasks for the fountain darter and Texas wild-rice in the revised Recovery Plan.

We request notification of the implementation of any conservation recommendations so we may be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats.

9. Reinitiation Notice

This concludes formal consultation on the actions outlined in the request. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. If the final action to be carried out differs from the proposed action that our opinion is based on, USACE needs to communicate with the Service to make sure the effects to species and the amount of take are not changed. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation. Reinitiation would be indicated if final plans differ from the proposed action in a manner that additional aquatic habitats or species numbers are affected.

Thank you for your efforts to protect the ecologically unique fish and wildlife resources of the upper San Marcos River. If you have any questions about our letter, please contact Tanya Sommer at (512) 490-0057 extension 222.

Sincerely,

Adam Zerrenner
Field Supervisor

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Tables and Figures

Table 1. Work areas proposed for elephant ear and sediment removal by section

Table 2. Texas wild-rice surveys from 2013.

Table 3. Estimated effects to fountain darters from section 206 activities in the San Marcos River (elephant ear removal and sediment removal)

Table 4. Estimated areal extent of Texas wild-rice in areas targeted for sediment removal

Figure 1. Action area with sections.

Figure 2. Areas proposed for elephant ear removal under the section 206 project

Figure 3. Areas proposed for sediment removal under the section 206 project

FIGURE 1.
ACTION AREA FOR
SAN MARCOS RIVER
SECTION 206
WITH STUDY SECTIONS
PROJECT

ACTION AREA SEC. 206 PROJECT

SMR_by_Sections

SECTION

- 1
- 2
- 3
- 4 ABOVE WORK AREA
- 4 IN WORK AREA
- 5
- 6
- 7
- 8
- 9
- 10
- 11
- 12
- 13
- 14

UPSTREAM LIMIT OF RESTORATION MEASURES

INTERSTATE HWY 35

Spring Lake Dam

San Marcos Springs

1

2

3

4

5

6

7

8

9

10

11

12

13

14

San Marcos River

Blanco River

Cummings Dam

0 200 400 800 Meters

N

W

E

S

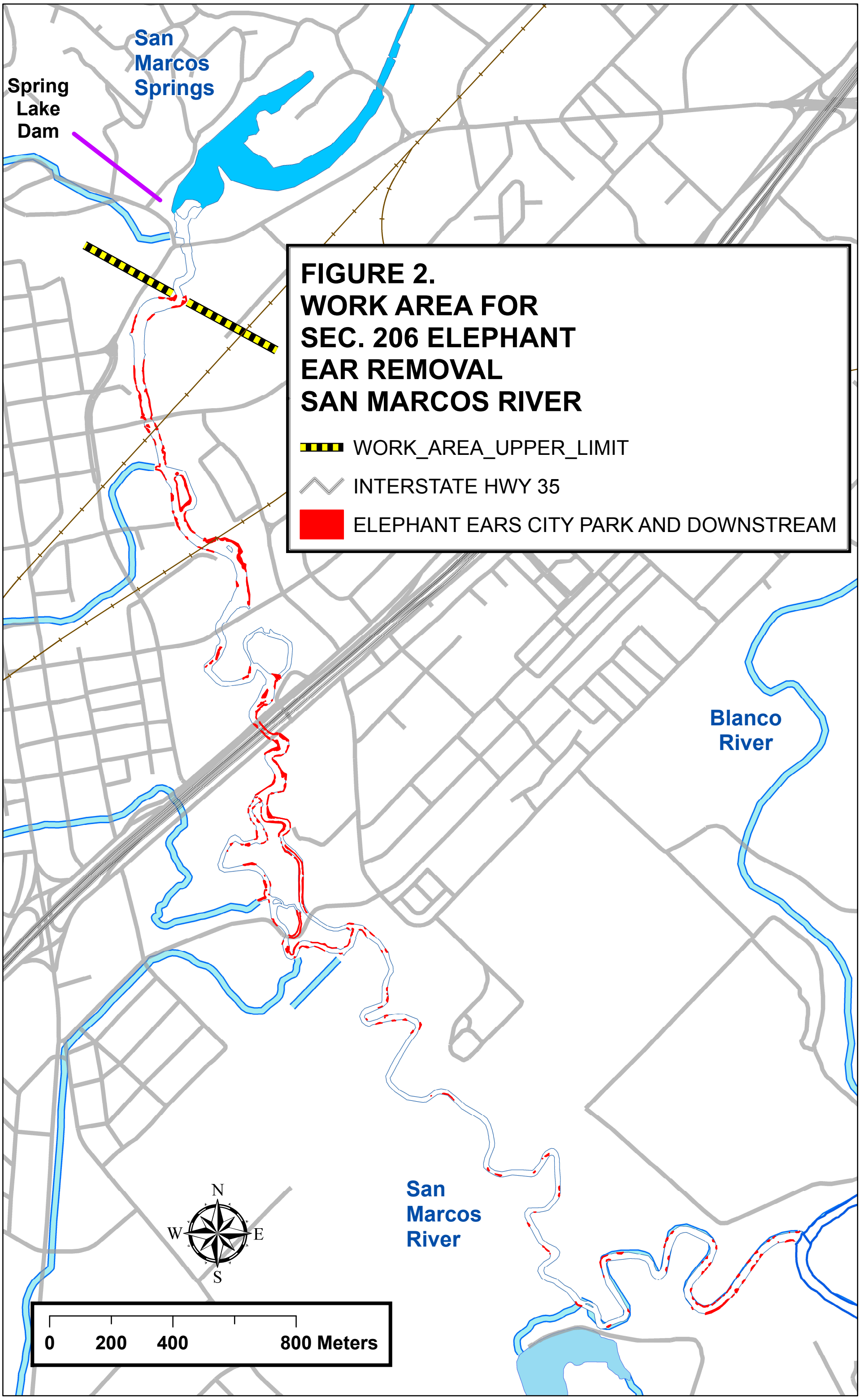
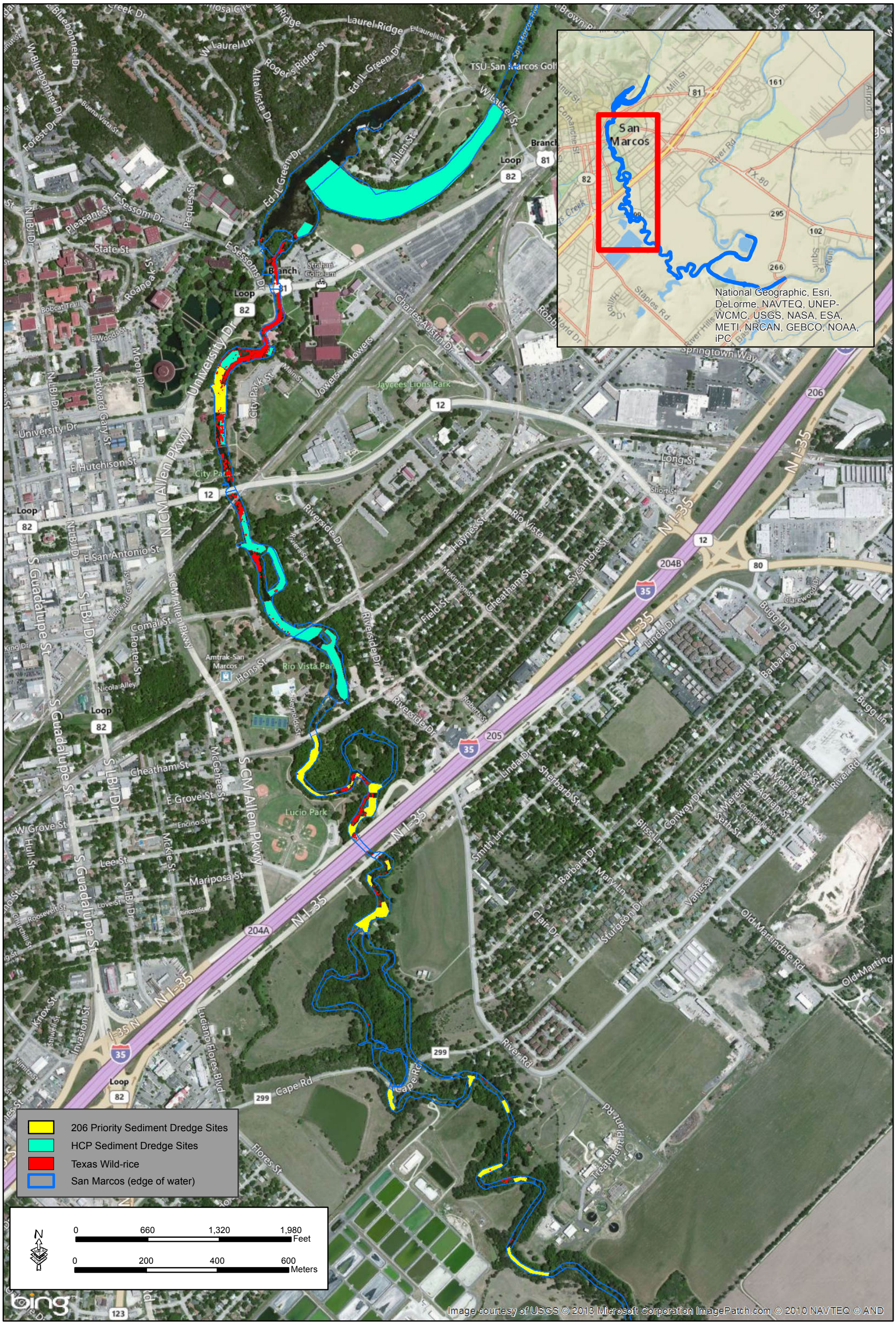

San
Marcos
Springs
Spring
Lake
Dam
FIGURE 2.
WORK AREA FOR
SEC. 206 ELEPHANT
EAR REMOVAL
SAN MARCOS RIVER
WORK_AREA_UPPER_LIMIT
INTERSTATE HWY 35
ELEPHANT EARS CITY PARK AND DOWNSTREAM
Blanco
River
San
Marcos
River
N
W
E
S
0
200
400
800 Meters

FIGURE 3. SEDIMENT REMOVAL TARGET AREAS



Priority Areas for Sediment Removal
TY1 to TY5

GSRC

September 2013

TABLE 1. WORK AREAS SAN MARCOS RIVER BY SECTION	Area of Section in M SQ *	SUM OF ELEPHANT EARS AREA M SQ	SUM OF SEDIMENT REMOVAL TARGET AREA M SQ
4 City Park Only	15,789	1,606	3,877.1
5	14,860	2,526	
6	9,697	1,585	
7	19,193	1,548	6,808.6
8	10,817	2,502	3,472.4
9	4,520	913	
10	17,377	1,863	1,324.3
11	13,091	413	3,769.1
12	19,538	419	
13	29,733	1,766	
Total	154,616	15,141	19,252
* PARTIAL FOR SECTION 4			

FIGURE 2. TEXAS WILD-RICE (ZIZANIA TEXANA) SURVEYS

ZIZANIA TPWD SEGMENT	10 APR - 15 MAY 2013 AREA BIO-WEST	JULY 2013 AREA SMARC PROVISIONAL
Spring Lake	34.22	t.b.d.
A	645.74	535.35
B	3,373.92	3,503.39
C	782.78	813.16
D		
E	2.49	0.24
F	493.69	503.22
G	57.65	56.45
H	20.36	19.59
I		
X		
J	1.79	0.87
K	56.66	55.59
L	10.77	8.76
M	0.67	0.52
UNASSIGNED		31.59
Grand Total	5,480.74	5,528.73

t.b.d. = to be determined

TABLE 3. ESTIMATED EFFECTS SAN MARCOS RIVER SECTION	Area of Section in M SQ	FOUNTAIN DARTER DENSITY INDIVIDUALS PER M SQ	ESTIMATED FOUNTAIN DARTER POPULATION IN SECTION *	SUM OF ELEPHANT EARS AREA M SQ	ESTIMATED NUMBER OF INDIVIDUALS IN ELEPHANT EARS REMOVAL TARGET AREA	SUM OF SEDIMENT REMOVAL TARGET AREA M SQ	ESTIMATED NUMBER OF INDIVIDUALS IN SEDIMENT REMOVAL TARGET AREA	TOTAL NUMBER OF FOUNTAIN DARTERS IN BOTH WORK AREAS (ELEPHANT EAR AND SEDIMENT REMOVAL)
4 City Park Only	15,789	3.20	50,524	1,606	5,139	3,877.1	12,407	17,545
5	14,860	2.20	32,692	2,526	5,556			5,556
6	9,697	2.00	19,395	1,585	3,171			3,171
7	19,193	1.89	36,275	1,548	2,925	6,808.6	12,868	15,793
8	10,817	1.92	20,768	2,502	4,803	3,472.4	6,667	11,470
9	4,520	0.30	1,356	913	274			274
10	17,377	0.30	5,213	1,863	559	1,324.3	397	956
11	13,091	0.22	2,880	413	91	3,769.1	829	920
12	19,538	0.15	2,931	419	63			63
13	29,733	0.04	1,189	1,766	71			71
Total	154,616		173,224	15,141	22,651	19,252	33,169	55,820

* PARTIAL FOR SECTION 4

TABLE 4. TEXAS WILD-RICE TO BE POTENTIALLY TRANSPLANTED

BASED ON BIO-WEST SPRING 2013 SURVEY

TEXAS WILD-RICE CURRENTLY IN SEDIMENT REMOVAL TARGET AREAS

TPWD SEGMENT	AREA IN M SQ
B	25.3
E	2.0
F	7.6
G	3.1
J	1.8
K	10.1
Grand Total	49.9