**Riparian assessments on the Guadalupe and Brazos Rivers**

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**TABLE OF CONTENTS**

**TABLE OF CONTENTS (continued)**

**TABLE OF CONTENTS (concluded)**

# 1. Introduction

Funding during 2009-2010 from the National Wildlife Federation supported the initial research by Texas Conservation Science (TCS), in order to quantify environmental flow requirements of riparian forests and other floodplain habitats in east Texas. The current study is part of a Texas Instream Flow Program (TIFP) project. TIFP is a cooperative effort of TPWD, TWDB, and the Texas Commission on Environmental Quality. The TCS study is now expanded to evaluate flow regimes that sustain riparian habitats in the middle and lower reaches of the Guadalupe, Brazos, and Trinity River basins. With two additional sites on the middle Trinity River being established in 2016, the TCS project currently includes 11 long-term riparian research stations mostly on private ranches and farms. With separate agency and private funding through the Caddo Lake Institute, three additional riparian research stations are operated by TCS and its partner organizations on Big Cypress Bayou. In this manner, a total of 14 stations within four Texas river basins currently utilize comparable methods for quantifying flows needed to sustain riparian habitats.

In terms of both area and population, the Texas Gulf Coastal Plain is by far the most important region of Texas (Hudson and Heitmuller 2008). Increased understanding through research is needed to assess potential impacts to water and other resources. To assist this effort, this following study includes four riparian research sites, which address riparian productivity along the lower and middle reaches of Guadalupe and Brazos Rivers (G&BR). Three of the sites are located near TPWD instream flow study (IFS) sites on the lower Guadalupe River: Victoria, Nursery, and Gonzales. The fourth site is located on the middle Brazos River near IFS site 12080 (Hearne). In addition to establishing and inventorying riparian forest transects within long-term study sites, the assessment includes inundation analyses of riparian areas along 30-mile reaches that include both an IFS site and its corresponding riparian study site.

The Guadalupe and Brazos River riparian research seeks to improve our understanding and stewardship of the spatiotemporal complexity of floodplain habitats and their connections. King et al. (2009) identified the integration of different disciplines as the critical need in the restoration and conservation of floodplain habitats. In response, the LBR project integrates different approaches, including hydrology, remote sensing, and quantitative plant ecology.

The next section presents peer-reviewed research on the ecology, flow requirements, and ecosystem processes of riparian habitats, which comprise the focus of this study. Riparian forests are emphasized, due to both their functional importance and their sensitivity to flow alterations. Subsequent sections address methods, results, discussion, and conclusions. Data are presented as figures and tables in the Appendix following Section 7 (Citations).

## 2. Background

This report includes riparian studies on both the Brazos and Guadalupe Rivers. The Brazos River is extrabasinal and, except for the Rio Grande River, the longest river in Texas. On the other hand, the Guadalupe River is a basin-fringe river originating from springs on the Edwards Plateau. Hudson and Heitmuller (2008) demonstrate how these basic geomorphic differences result in the Guadalupe River having bankfull flow, peak flood intensity (peak flow flood/bankfull flow), and valley width 0.10, 36.57, and 0.44 times, respectively, compared to those same measures for the Brazos River. In other words, the Guadalupe River is naturally a much smaller, steeper gradient, and flashier river, compared to the Brazos River.

### 2. 1 <u>Riparian Habitats</u>

Riparian areas as non-equilibrium ecosystems forming landscape-scale networks of floodplains extending into the stream channels (Nilsson and Svedmark 2002). Riparian systems are defined according to: (1) flow regime: regulates plant productivity and ecological function, (2) riparian corridor: material transport, and (3) transition zone: species-rich link between land and water processes (Nilsson and Svedmark 2002). Due to their important ecosystem functions, adverse on-site impacts to riparian habitats and connectivity are serious threats to downstream resources, including aquatic and terrestrial habitats, and the quantity and quality of stream flow (King et al. 2009).

Nearest the river are early successional species, such as black willow, boxelder, and eastern cottonwood, which first establish on recent deposits of alluvial sediments. On the floodplain away from the river channel, late successional riparian species mix with upland species. Sediment deposition during substantial floods raises the elevation of the near-channel floodplain and natural levees, so that the meander belt, which supports early successional species, lies above the more distant floodplain and backwater areas.

Morton and Donaldson (1977) characterize the Guadalupe River as a meandering channel with many point bars in an alluvial floodplain. Their subsequent paper (Morton and Donaldson 1978) describes in detail how the river becomes less active downstream, even as flows increase. Compared to Gonzales, the lower Guadalupe River near Nursery and Victoria has fewer meanders, a lower width: depth ratio, decreased channel gradient, and finer bed material.

Though floods are more intense on the Guadalupe River, as described above, the redistribution of sediments and fluvial surfaces is far more significant during floods on the extrabasinal Brazos River, due to much greater discharge and sediment load (Hudson and Heitmuller 2008). In this way, riparian forests along the Brazos River are generally more diverse in terms of species and age classes, relative to these forests on Guadalupe River that are normally more mature stands dominated by fewer species.

However, on both the Brazos and Guadalupe Rivers, the oldest riparian forests outside the active meander belt near the river channel often do not support the largest stands along the river. Working on the Sacramento River in California, Stella et al. (2012) describe how riparian forests coevolve with the active floodplains of large meandering rivers. In their study, 50-year old riparian stands near the channel and its active meanders produced the largest trees and highest biomass, with these structural measures on the decline in more mature stands farther for the channel. By this means, Stella et al. (2012) demonstrate that uneven-aged riparian forest of intermediate age, which are adapted to surface disturbance within active near-channel floodplains, sustain highest productivity.

Floodplains with naturally variable flow regimes contain diverse habitats, including swamp and riparian forests, shrub and herbaceous wetlands, and both lentic and lotic aquatic habitats. Most important to the sustainability of essential ecosystem processes within floodplains is connectivity among these different habitat patches via water level fluctuations (Thoms et al. 2005, Junk et al. 1989). Within river-floodplain landscapes, habitats are differentiated by their dominant plant species and their range of environmental variability, which is primarily caused by spatiotemporally variable flows and geomorphic disturbance during large floods.

Floodplain habitats with different surface elevations vary in terms of dominant species due to dissimilar tolerances among species to elevation-specific regimes of inundation and soil saturation. An elevation change of only a few centimeters may cause habitat boundaries to move. When researching connections between tree growth and inundation, Smith et al. (2013) showed that river flow and related soil moisture variables impacted tree growth more than climate. How forest productivity responds to variable flows is further complicated due to competitive interactions among species. For example, a higher frequency of floods may either directly increase riparian forest growth rates or indirectly do so by impeding less flood-adapted competitors. In addition to variable flows, riparian forest composition depends upon the location within the floodplain mosaic of geomorphology, soils, and available plant species.

In this way, high species diversity results from a changeable inundation regime interacting with the geomorphologic patchwork of microtopography and soil types within floodplains (Junk et al. 1989). Unlike upland forests that are often dominated by one or two tree species, relatively undisturbed riparian forests exhibit a high diversity of tree species, primarily due to environmental variability (McKnight et al. 1981). In fact, the interplay among hydrology, geomorphology, and species causes riparian biodiversity to be usually double that of nearby upland forests (Gosselink et al. 1981).

## 2.2 Riparian Forest Hydrology

Defined for a particular site or stream reach, the “hydroperiod” is the spatiotemporal combination of frequency, timing, duration, and depth of inundation. Due to the evolutionary matching of species distributions and hydrologic cycles, the hydroperiod dictates species composition of both plants and animals in riparian forests (Bedinger 1981, King and Allen 1996). The most important influence of the hydroperiod on species composition in east Texas is flood duration (Dewey et al. 2006). Because it exerts a disproportionate influence on seedling establishment and the early stages of succession, the spring hydroperiod mostly controls the competitive sorting of species during annual tree recruitment. However, the long-term survival of riparian species and, thus, species dominance within mature riparian forests depends upon the annual hydroperiod (Townsend 2001).

### 2.2.1 Overbank Events

Annual or nearly annual flooding is a distinguishing feature of riparian forests. In the midwestern United States, most rivers and streams with relatively natural hydrology equal or exceed bank-full two out of three years (Leopold et al. 1964, Mitsch and Rust 1984). Throughout the Mississippi/Red River region, most riparian forests on relatively unregulated rivers flood about once per year for about 40 days on the average (Gosselink et al. 1981). In one of the most intensive studies of a natural flood regime in the southeastern U.S., the Ogeechee River in Georgia flooded greater than 50 percent of the natural floodplain for a minimum of least 30 days annually (Benke et al. 2000).

The existence of riparian forests depends upon flooding rivers. On the Cache River in Arkansas, intensive hydrologic studies show that more than 90 percent of the annual water budget for riparian forests consists of river inflows and outflows (Walton et al. 1996). These and other studies show that water sources other than stream flow, such as groundwater, precipitation, and evapotranspiration, are insignificant components of the riparian-forest water budget.

As floodplains become larger, floods tend to be less frequent, but increase in duration and seasonal predictability (Junk et al. 1989). Overbank flows perform many important ecosystem and societal functions, such as reducing storm damage, recharging alluvial aquifers, enhancing biological productivity, sequestering carbon, and redistributing nutrients, sediments, and organic matter (Hunter et al. 2008, Opperman et al. 2010). Annual flooding maximizes ecosystem and economic benefits, including biological production, plant and wildlife diversity, better water quality, and organic matter export (Gosselink et al. 1981, Hunter et al. 2008, Opperman et al. 2010).

2.2.2 Biological Requirements for Overbank Flows

Two major flood-related reasons for environmental and habitat complexity on both the Brazos and Guadalupe Rivers are new channel belts and new oxbow lakes, both created by bank erosion during overbank floods (Hudson and Heitmuller 2008). While researching active river meanders in south-central Texas, Tinkler (1971) ascertained that only large floods with a recurrence of ten years or more created channel meanders. This research found smaller bank-full floods (recurrence interval of one to two years) to be ineffective in generating channel meanders and thereby increasing riparian habitat diversity.

Overbank flows are essential to the conservation of riparian forests. Floods distribute seeds and vegetative propagules to revitalize plant communities across the floodplain (Bendix and Hupp 2000). Seed germination and seedling establishment by many riparian plant species depend upon large floods that create new seedbeds by removing vegetation and exposing bare soil. Tree species differ in the timing of seed dispersal and germination, so that the timing and severity of floods rearrange the patchwork of different ages and species compositions that constitute riparian forests and other habitats (Hughes and Rood 2003).

Flow prescriptions to conserve riparian forest regeneration include: (1) scheduling inundation to coincide with the phenology (seed dispersal and germination) of target tree species, (2) varying the interannual timing of floods to increase plant diversity, (3) reducing the rate of flood-water recession to maintain soil moisture for seedling germination and establishment, and (4) promoting channel movement and new sedimentation sites to create regeneration sites (Hughes and Rood 2003, Rood et al. 2005). Hughes and Rood (2003) demonstrate why the stream stage elevation should not drop faster than the average rate of seedling root growth, which they found to be less than one inch or 2.5 cm per day for eastern cottonwood in western North America.

Overbank flows are not only required to perpetuate and rejuvenate riparian vegetation, but also must have sufficient frequency and duration to eliminate upland plant species. In fact, increased mortality of upland species during extended flooding is singled out by Townsend (2001) as the most effective means of sustaining riparian species composition. To achieve the same mortality of upland species, Gosselink et al. (1981) recommend the total duration of discontinuous inundation should exceed that of continuous inundation. Most efficient in terms of dispatching upland tree species and conserving bottomland hardwood species are early growing season floods lasting two to four weeks. Figure 1 presents flood duration and frequency targets to maintain each riparian habitat type in the study area.

### 2.3 Variable Flows for Sustainability

When hydrology is relatively undisturbed, riparian forests are among the most productive ecosystems, with primary production exceeding 1000 $g/m^2/y$ (Conner et al. 1990). Their high species diversity and flow subsidies maintain high primary and secondary production (Bayley 1995). Riparian forest productivity peaks with annual floods in winter and early spring (Conner et al. 1990). However, as discussed above, floods later in the growing season have the added benefit of excluding competition from invading upland species, which further boosts the productivity of riparian hardwood forests over the long term.

Though current-year flooding affects growth, stored energy resulting from flooding during the prior growing season is vital, since stem growth occurs early in the growing season. In this way, the link between annual tree productivity and flood duration is statistically significant only when examined over a combined two-year period (Anderson and Mitsch 2008).

Flow variability differs between the Brazos and Guadalupe Rivers in their middle and lower reaches. As discussed in the other TCS riparian reports for the middle and lower Brazos River (Hayes 2016a and 2016b), flow regulation decreases with distance below Waco, due to the absence of additional in-channel reservoirs. Thus, flow variability is progressively restored to a relatively natural regime on the middle and lower Brazos River.

In contrast, reservoir operation maintains reduced flow variability on the Guadalupe River from New Braunfels to below Victoria. Though there are seven in-channel reservoirs on the Guadalupe River, Canyon Lake is the only deep storage reservoir, but is responsible for a 50% reduction in small (recurrences of at least two years) and large (recurrences of at least ten years) floods, since its completion in 1964 (Perkin and Bonner 2011). After 1964, mean annual flow for the Guadalupe River increased from 1,697.9 to 2,259.2 cfs at Victoria. However, the annual frequency of small (4,236.0 cfs) and large (33,499.7 cfs) floods declined from 0.84 and 0.42 and from 0.56 to 0.42, respectively, at New Braunfels and Victoria after 1964 (Perkin and Bonner 2011).

### 2.3.1 Ecosystem Services

An important function of naturally variable flows is hydrochory, the seasonal distribution of seeds and plants by water. By distributing plant propagules more effectively according to the flow regime, hydrochory augments the range and genetic diversity of riparian forest species (Nilsson et al. 2010). The resulting increase in riparian biodiversity aids adaptation to floodplain disturbance and maintains productivity.

Variable flows also add important functionality to river systems. Local and downstream water quality in a river is affected by the condition of its connected riparian forests. When connected to naturally fluctuating river flows, riparian forests sustain enhanced capacities for the removal of nitrogen (N) and phosphorus (P) from floodwaters (Ardon et al. 2010). Due to longer residence times to absorb large nutrient pulses during storms, broad active floodplains, such as along the Brazos River, are important to reverse pollutant loading.

In addition to the rate of rise and fall, the timing of overbank flows relative to rising temperatures influences biological functions (Bayley 1995). Since most floods in Texas occur in winter or spring, the post-flood availability of carbon and nutrients often coincides with warm spring temperatures, which enhances the fertility of downstream river reaches and estuaries.

### 2.3.2 Habitat Productivity

High riparian productivity is sustained by high and overbank flows, which flush accumulated detritus and metabolic waste products, and increase annual rates of litterfall, nutrient turnover, and decomposition (Conner et al. 1990, Hunter et al. (2008). The temporal distribution of overbank flows determines not only habitat types, but also regulates biogeochemical processes in bottomland soils, such as decomposition, sedimentation, and N cycling (Hunter et al. 2008). Nutrient processing is augmented by flood pulsing that causes successive oxic and anoxic soil conditions within floodplain riparian forests.

The potential role of riparian forest biomass in mitigating climate change is substantial. Elevated primary productivity due to overbank flows allows riparian forests and wetlands to achieve the highest biomass per area of any temperate ecosystem (Gosselink et al. 1981). Research in northeast Louisiana found the range of carbon storage in riparian forests to be 90-124 Mg C/ha (Hunter et al. 2008).

### 2.3.3 Fish and Wildlife Stewardship

For fish and other biota, the primary function of the main river channel is access to adjacent floodplain resources, not production. Access to floodplains during overbank flows is critical, since almost all animal biomass within riverine systems is produced within floodplains, not river channels (Junk et al. 1989). For instance, even for smaller streams, 67-95 percent of invertebrate production takes place in the floodplain, not the stream channel (Smock et al. 1992). Consequently, many researchers find that bird, mammal, and fish populations decline in riparian ecosystems, when flood frequency decreases (Gosselink et al. 1981).

When the area of accessible floodplain expands, fish production increases (Junk et al. 1989). For instance, fish spawning is often coordinated with rising floodwater, with spring spawners targeting the seasonal coincidence of rising floodwaters and warmer temperature. Similar to the effect on tree recruitment, good fish recruitment depends on the gradual retreat of flood waters during the warm growing season (Junk et al. 1989). A slow drop in water levels also allows invertebrate prey populations, which increase due to coincidental nutrient runoff, to reach higher densities.

## 3. Methods

Figure 2 presents the locations of the two study sites for quantitative plant inventories at Wallis and San Felipe. The associated TPWD Instream Flow Study (IFS) reaches and inundation Study Areas are also depicted for orientation. Figures 3.1-3.2 present the study site vicinities. Including transect locations and site boundaries, Figures 4.1-4.3 provide transect locations and other details within each study site.

### 3.1 Forest Ecology

Within the LBR study reaches, the floodplain is mostly 5-10 km wide (Heitmuller 2014). Largely due to agricultural land uses, remnant riparian forests along the lower Brazos River mostly occupy the active meander belt, which generally extends no more than a few hundred meters both sides of the river centerline. The forests are relatively protected from human disturbance within the meander belt, which is unsuitable for agriculture by being too wet and prone to frequent fluvial disturbance. These are the riparian forests that are quantitatively sampled as described below.

#### 3.1.1 Field Methods

The following vegetation measurements are taken along the 50-m transects. The tape measure is extended 50 m into the riparian forest from the mean high water mark (MHWM) in the direction determined to be perpendicular to the river channel. In the field, the MHWM is delineated as the lowest streamside extent of permanent woody vegetation. The tape is kept tight, straight, and level. Where the undisturbed riparian area extends further into the floodplain, transects may be stacked, so that the length of selected transects is extended in 50-m increments.

*Herb-Seedling Layer: Point-Transect Method*:

The herb-seedling layer (woody seedlings less than diameter-at-breast-height (DBH, 1.37 m) and herbs) is quantified using the point intercept method. Along the central 50-m transect in each 50 m X 10 m macroplot, canopy interception is measured at 51 points (0-50 m). All contacts between live plants (leaves, stems, etc.) and the tip of a narrow (1/8-inch diameter) vertical pin passed into vegetation are tallied. However, at each point the uppermost hit is tallied separately from further hits along the vertical projection until the ground is hit. Multiple vertical contacts with the same plant and species at a given point are recorded. The summed number of hits are used to estimate plant cover, leaf area, and relative importance for each species. The pin is kept as nearly vertical and on point as possible. A plumb bob is used to establish the vertical reference point (colored nail head, etc.) on ground for each point. The pin is kept vertical as it descends to this reference point.

In addition to canopy cover of leaves and stems, ground cover is recorded at each point according to the following categories:

| | |
|---|---|
| BM | Bare mineral soil |
| BR | Bare rock |
| FF | Forest floor (organic litter layer) |
| MB | Moss on bare mineral soil |
| MR | Moss on rocks |
| MW | Moss on dead decaying fallen wood |
| NV | Other notable non-vegetation feature (identify) |
| VW | Other vegetated wetland (sedges, etc.) |
| RT | Root tip-ups |
| S | Snag |
| SWD | Semi-wet depressions (sparsely vegetated) |
| TB | Living tree or shrub bole |
| WD | Wet depressions (non-vegetated, gray/gley litter) |
| WD-C | Woody debris, coarse (> 20 cm dia.) |
| WD-F | Woody debris, fine (0.5 < 10 cm dia.) |
| WD-M | Woody debris, medium (10 < 20 cm dia.) |

*Shrub-Sapling Layer: Line-Intercept Method*:

The shrub layer is defined as woody species 0.1-4.9 cm DBH, including tree and shrub species. For multi-stemmed woody species, the DBH of all stems must be < 5.0 cm to be included in this layer.

1. Except where the transect is an extension of an existing transect, a tape is used to measure 50 m into the riparian forest from the MHWM. The bearing of forest transects is perpendicular to the river channel. The tape is kept tight, straight, and level to the ground surface.

2. The total intercept length for each species is determined within each 5-m increment. Intercept length is that portion of the transect length intercepted by the plant, as measured by a vertical projection of its circumscribed canopy that overlaps the line.

3. For each species, total intercept length to the nearest cm is recorded.

*Tree Layer: Macroplot Method*:

Snags and live trees DBH: The tree layer consists of all live and dead woody species with a DBH greater or equal to (≥) 5.0 cm. Throughout each 50 m X 10 m macroplot, the following measurements are recorded for all snags (standing dead trees with an angle greater than $45^0$ to the horizontal) and live trees ≥ 5.0 cm DBH. The species name, DBH, and position of each tree is recorded along the central 50-m transect, as well as the perpendicular distance from the transect position to the tree. Also recorded is if the tree stem is left or right of the center transect, when facing the 50-m end of the transect. These data allow one to relocate each tree and if necessary construct a tree map for each macroplot. The data also allow the basal area, frequency, and density of tree species to be calculated on a per hectare basis, as described in Section 3.1.2.

In the USA, DBH is defined as the average stem diameter, outside bark, at 1.37 m (4.5') above the ground on the uphill side of the tree, disregarding any bark-litter mound at the base of tree. For consistent measurement, the steel diameter tape must be level and pulled taut, while avoiding bumps, stubs, and other outer bark and bole irregularities. For multi-stemmed woody species, trees are defined as having a least one stem ≥ 5.0 cm DBH, in order to be included in this layer. More than one DBH may be recorded for each multi-stemmed tree. Only stems ≥ 5.0 cm DBH are recorded.

The following procedure for measuring DBH of irregular trees is modified according to Avery and Burkhart (2001). When swellings, deformities, or branches occur at 1.37 m above the ground, DBH is taken above an irregularity where normal stem shape ceases to be affected. If a trunk forks immediately above DBH height, measure DBH immediately below swelling caused by fork. For forks below true DBH, each stem is normally measured at DBH above fork if DBH $\geq$ 5 cm. The exception is when normal DBH height is too close to fork so that it is influenced by swelling associated with the fork, in which case the DBH is measured immediately above such swelling. For swell-butted stems, DBH is measured above swell if swell is at normal DBH height.

<u>Forest Canopy Cover: Spherical Densimeter Method</u>: The instrument is held level, 12" – 18" in front of body and at elbow height, so that operator's head is just outside of grid area. The operator assumes four equally spaced dots in each square of the densimeter grid, and systematically measures canopy cover based on the number of dots that intercept the overhead canopy. In this manner, with the operator sequentially facing North, East, South, and West, four sets of readings of the entire densimeter grid are recorded at the 15-m and 35-m points along the transect. The average value is calculated for the four sets of canopy hits at each point, then multiplied by 1.04 to estimate percent of forest canopy cover at each point.

### 3.1.2 Data Analysis

All field data were analyzed in Microsoft Excel using standard ecological calculations. This information was then summarized to determine the most important species for each vegetation layer, transect and site. Percent cover, frequency and density were calculated where applicable, and then used to attain percent relative values for each species in comparison to the other species present within each transect and site. These percent relative values were ultimately used to find the percent relative importance of each herbaceous, shrub, and tree species within each transect and site.

*Herb Layer:*

The point-intercept method was used to collect cover data for herbs and woody seedlings, in order to calculate percent cover and percent frequency for each species. Percent cover was calculated based on the total number of hits tallied for each species, divided by the total number of intercept points per transect (51). Percent frequency for a species or ground-cover attribute is determined by dividing the number of points where it occurs by the total number of points (51).

The total cover of vegetation or ground attributes for a given transect is determined by adding the cover percentages for all plant species or ground attributes, respectively. Total cover values for a site are determined by similarly adding transect totals and dividing by the total number of transects. These transect and site totals for percent cover may exceed 100 percent if multiple hits (overlapping canopies) are recorded at each point.

Percent relative cover by species or ground-cover attribute, is calculated by dividing the percent cover for each species or ground-cover attribute by the total cover for all species or ground-cover attributes, respectively. Similarly, percent relative frequency for a species or an attribute is provided by dividing the percent frequency for a given transect by the transect total for all species or attributes. For the herb layer, percent relative importance for each species or attribute is the sum of its percent relative cover and percent relative frequency divided by two.

*Shrub Layer:*

Data were collected from the shrub layer using the line-intercept method. Within each 5-m increment, percent cover was calculated by dividing the total intercept length of each species by 500 cm. Percent frequency was calculated for each species based on how many of the 5-m segments contained that species, out of the ten total segments. Total percent cover and frequency values for each species were determined for each transect. Averages were then calculated for each species across all eight transects. Percent relative cover and percent relative frequency were then calculated for each species within each transect. These values are determined by dividing the percent cover or frequency of that species by the total percent cover/frequency of all species in that transect. Percent relative importance was then calculated by averaging percent relative cover and percent relative frequency.

*Tree Layer:*

Tree field data were summarized in Microsoft Excel for each 50-m transect. DBH measurements, taken in the field for each individual tree located in the 50 m X 10 m transect, were used in calculating basal area in square meters per hectare ($m^2$/ha). These calculations were performed separately for snags and live trees. Frequency of distribution was also determined for individual species present on each transect. This was done by evaluating distance from the 0-m pin and plotting presence or absence in each 5-m segment of the 50-m transect, resulting in possible frequencies of 0-100% with 10% intervals. Frequency was also calculated in the same manner for all snags. Next, density was calculated for each transect. This was done by dividing the total number trees for a given species, by the area (500 $m^2$) of the plot, then converting the density to the number of trees per species per hectare. This was done for both snags and live trees.

Percent relative values for basal area, frequency, and density were then calculated for each species within each transect, in the same manner as described above for the shrub layer. Percent relative importance was then calculated for each species by averaging its three percent relative values.

*Forest Canopy Cover:*

Field calculations for the spherical densimeter method are described above. Average percent canopy cover values for each transect and site are subsequently tabulated.

3.2 Inundation Analysis

The methodology is empirical, in order to directly measure habitat inundation. Transitions among riparian habitats and from wetland to non-wetland floodplain communities can occur with a change in elevation of only a few centimeters (Alldredge and Moore 2012). Therefore, the following empirical approach may more accurately delineate wetted surfaces within the geomorphic complexity of riparian areas. In this way, the wetted surface created by a given river stage provides a direct estimate of the affected elevations and habitat areas within riparian areas.

### 3.2.1 Flow Event Selection

Historical USGS daily stream flow records (1982-present) were analyzed to select flow-event dates for wetted-surface classification of Landsat data. Table 2 lists the USGS stream gages and respective periods of record, which are applicable for each of the riparian study sites. As necessary, event travel times were calculated based on stream miles between gage and study site, and comparison of stream flows recorded for successive USGS gages, in order to determine the actual event date at a given study site.

To avoid imagery obscured by canopy cover, only flow events during the leaf-off period between mid-December and mid-March were considered for wetted-surface analysis. To avoid error due to previous inundation lingering on the floodplain, none of the selected event days had higher flows in the preceding three days. In this manner, the selected days were limited to rising or stable flows. No dates were selected during a period of declining flows. Primarily due to issues with gaps within Landsat scenes and cloud cover, less than 0.5 percent of examined dates had usable Landsat data.

### 3.2.2 Wetted-Surface Classification

ENVI (Harris Geospatial Solutions software) and Environmental Systems Research Institute (ESRI) ArcGIS software are used to map wetted-surface based on each suitable Landsat thematic-mapper (TM) scene. TM is a sensor on Landsat satellite. Density slice (also called “level slice”), one type of single band image classification method, is used to conduct the wetted-surface classification. This method is especially helpful, since the wetted-surface has a unique digital number (DN) value. The unique DN value is assigned to some gray level (density) and all other DNs are assigned another level. The above procedure develops a simple map of the distribution of wetted-surface and all the other surface features. ENVI and ESRI ArcGIS software packages are used to yield wetted-surface maps based on each suitable Landsat TM scene. Wetted-surface classification follows the same step-wise methodology, as described below.

*Wetted-Surface Mapping:*

1. Download the acquired Landsat TM scenes for specified dates. Load the band 5 image in TIFF format.
2. Mask the study reaches. The mask is created from a 51X5-mile buffer of the study reaches and saved as a shapefile via ESRI ArcGIS.
3. The Landsat TM images covering the study reaches are classified into two thematic classes using the ENVI color slicing process. The minimum threshold is two. The original maximum threshold is 27. The maximum threshold varies from 27 to 67. Increase the maximum threshold until the wetted-surface class is clearly separated from non-wetted-surface class. Convert the two-class thematic image into shapefile format via ESRI ArcGIS.
4. Two thematic classes are then assigned to either wetted-surface class or non-wetted-surface class by visual interpretation using the raw image in bands 4, 3, and 2.
5. The resulting two-class image is re-coded using ESRI ArcGIS Raster Editor tool. The ESRI ArcGIS Eliminate tool is then run on the two-class image. The ESRI ArcGIS Eliminate tool is used to remove all groups of pixels less than one hectare in area, those areas smaller than one hectare are assigned the value of nearby larger class.

*Quality Control:*

1. Create a set of random points within the thematic classified area and assign the two-class code to each individual point via visual interpretation for referencing.
2. ESRI ArcGIS Spatial Selection is run on the random points using the wetted-surface and non-wetted-surface polygons separately. Assign the class information to the set of random points above.

The accuracy estimate is the ratio between the number of error wetted-surface (non-wetted-surface) points and the actual wetted-surface (non-wetted-surface) points.

3.3 Geographical Information System

ArcGIS ArcMap 10 was used to calculate inundation acreages for each TPWD Texas Ecological System (TES) type (Elliott, L.F., et al. 2014, Elliot, L.F. 2009) within the specified study reaches by overlaying final wetted-surface shape files maps based on suitable Landsat TM scenes. TES types are also called habitat types in this study. In order to accurately gage inundation acreages across several decades, channel meander was addressed in selected study areas.

The first step was to acquire suitable TPWD TES shapefiles for each study site (https://tpwd.texas.gov/gis/data/downloads), prepare study-reach shapefiles, and acquire previously prepared wetted-surface shapefiles for specified dates.

To compensate for channel meander, study-reach area shapefiles were created for each site with gaps for meanders moving more than 50 m laterally over the approximately three-decade long study period (Figure 2). To ensure channel position accuracy throughout the project, TWDB river channel (http://www.twdb.texas.gov/mapping/gisdata.asp) position is updated and adhered to the position indicated by TES “open water” data. Next, for meander channel position comparison, first and last Landsat TM shapefiles showing inundation were overlaid. Next, meanders were located where both a clear channel is outlined and there is a recognizable shift in location of banks between the two dates. Meanders were numbered for identification and future comparison to evaluate importance. Additionally, 1982 National High-Altitude Program (NAHP), 1988 USGS National Aerial Photography Program (NAPP), 1996 Texas Orthoimagery Program (TOP), and 2014 USDA National Agriculture Imagery Program (NAIP) color infrared imagery was referenced to compare meanders throughout study period and further verify movement.

Using the ArcGIS Measure tool, first and last Landsat TM inundation shapefiles were overlaid and distances between well-defined banks of each meander were measured. For each meander that moved 50 m or more, the following steps were used: Using the Split tool in ArcMap in conjunction with the TWDB river shapefile, the length attribute (set to miles) was measured for identified meanders, and then the buffer tool was used to create polygon shapefiles which identify channel positions for future reference. Using a study reach shapefile of 30x4 miles as a template, the line construction tool was used to create parallel lines to exclude meanders from study area. Constrain perpendicular to the channel was used when possible, as well as constrain parallel to the first line placed. Due to channel meander, the increased study reach length was tabulated and added to any channel segment in the exclusion area but not part of the meander (collateral). Meander length and collateral stream length were added to original 30-mile study reach to determine the amount of increase for total stream mile study length. For adjacent sites Navasota and Bryan, the overall increase was allotted 20% in the interfering direction and 80% in the opposite direction to avoid study reach overlap.

IFS center points were utilized as study reach centers, first by splitting TWDB river channel line at center point location as basis for splitting a certain length. A modified study reach was then created based on the new increased length to compensate for meander and collateral, using the split tool on each half upstream (US) and downstream (DS) of the center point. Split tool was set to 15 miles plus new increased length. US and DS lines were then combined after which the buffer tool was used with distance set to 2 miles and “dissolve all” option selected to create new study reach polygon. Next, additional buffers were also created with distances set to 0.5 and 1 mile to measure inundation distance incrementally from channel. Cut polygons tool was used on new study reach polygons with lines from previous meander-based line construction step as templates. Resulting gaps were deleted from the study reach polygon and merged. Any rounded ends were removed from study reach polygons by using similar method as in previous steps while constraining parallel.

In order to measure area of inundation, first TES data was clipped into the study-reach area polygon created in the previous step. If both Blackland Prairie and Central Texas Plains TES data sets are required for the study area, merge tool was used to combine into one after clipping. To tabulate acreages, an attribute field (double) in the TES attribute table named “area” was created and set to calculate area in hectares.

Using shapefiles created from incremental buffers (0-0.5 mile, 0.5-1 mile and 1-2 mile) extending from the river centerline located within the study reach, the Clip tool was used to apply TES data to each incremental sub-reach.

The Intersect tool was used to choose a Landsat wetted-surface shapefile and the incremental TES shapefiles as inputs, in order to determine which habitat types were located in the same position as the wetted-surface data for that increment.

For each incremental intersect, ArcMap's Summary Statistics tool was used to quickly summarize area data. Using Summary Statistics, the newly formed intersects' Statistics field was set to the previously created area attribute and the Case field to Common Name. Summary results were opened and acreages transferred from ArcMap into an Excel spreadsheet. Summary Statistics was also utilized when tabulating total habitat areas for study sites by using the previously clipped TES data as input with no wetted-surface intersect.

## 4. Results

### 4.1 Riparian Forest

Table 1 provides an annotated list of 115 representative plant species collected at the four G&BR study sites. The list includes scientific and common names, wetland indicator status, family, environmental information, growth form, and relative abundance for each of the study sites.

#### 4.1.1 Tree Layer

*Habitat Overview*

The G&BR riparian study provides a quantitative inventory of tree species occupying major forest types. Riparian forests include forested wetlands (lower and upper swamps) at lower elevations and riparian forests (seasonally and temporarily flooded forests) at higher elevations (Figures 1.1 & 1.2). Lower swamps are often dominated by black willow (*Salix nigra*) and box elder, with bald cypress locally important on the Guadalupe River. At low surface elevations primarily near the edge of the river and sometimes either side of the first naturally deposited levee, these forests flood for large portions of the growing season essentially every year.

Slightly higher elevations within the G&BR riparian corridors support upper swamps, which are sustained by intermittent flooding or soil saturation (typically over two months during the growing season). In the study areas, these swamps usually occupy the frequently wetted area between the first and second levees. Less commonly, upper swamps are found in low-elevation swales and backwater areas often at some distance from the river channel. In fact, backwater swamps within the active floodplain, which may be farther from the river and adjacent to transitional upland slopes, may be inundated longer than all but the streamside lower swamps following overbank flow events. Upper swamps are typically inundated every year for two or more months during the growing season. In addition to black willow and box elder, these upper G&BR swamps may include slippery elm, green ash, eastern cottonwood, and roughleaf dogwood as locally common species.

At still higher elevations, riparian forests include seasonally flooded and temporarily flooded forests (Figure 1). The probability of seasonally flooded riparian forests being flooded in a given year is 51-100 percent or at least once every 1-2 years (Huffman and Forsythe 1981). When the natural hydrologic regime is relatively intact, these forests flood a total of 1-2 months (12.5-25 percent) during the growing season. Species composition of seasonally flooded forest is highly variable within the G&BR study sites, with common species including slippery elm, eastern cottonwood, pecan, cedar elm, roughleaf dogwood, and hackberry.

With an annual flood probability of 11-50 percent, temporarily flooded forests experience a total growing-season flood duration of 5-30 days or 2-12.5 percent (Figure 1; Huffman and Forsythe 1981). Tree species diversity in temporarily flooded forests is high, and, in the G&BR reaches, includes hackberry, eastern cottonwood, roughleaf dogwood, chinaberry, both cedar (Guadalupe River) and slippery (Brazos River) elms, and other species.

*Data Summaries*

Data for the tree layer at the four G&BR sites are summarized in Tables 3.1-3.4, while more detailed transect data for the tree layer are presented in the Tables 4.1-4.4. For each live and dead tree measured in the 50 m X 10 m macroplots, these tables list data for basal area ($m^2$/ha), frequency per 5-m increments, density (trees/ha), along with percent relative values and percent importance. For the three Guadalupe River sites, sandpaper tree is overall the most important species, and appears to be increasing due to relatively low mortality as evidenced in the snag tallies. At the Hearne site on the Brazos River, slippery elm is the most dominant tree species. The top three most important tree species in order of importance at each site are:
Victoria: sandpaper tree, cedar elm, Chinese tallow (invasive exotic species)
Nursery: box elder, sandpaper tree, hackberry
Gonzales: sandpaper tree, cedar elm, hackberry
Hearne: slippery elm, box elder, roughleaf dogwood

Table 5 presents the percentage of identifiable snags versus live trees for each tree species. Based on both their relatively high mortality and low importance among live trees, more mesic riparian species, such as slippery elm, green ash, and eastern cottonwood, are declining at the four G&BR sites.

Forest canopy cover values are presented in Table 6 as both transect and site averages. Of the three sites on the Guadalupe River, the upstream site at Gonzales has the lowest canopy coverage with a site average of 77.52%, compared to site averages of 90.91% and 91.45%, respectively, at Victoria and Nursery, which are much farther downstream. At the Hearne, which is one of the upstream sites on the Brazos River, the average canopy cover for the site is a low 46.48%.

### 4.1.2 Shrub-Sapling Layer

For the riparian forest shrub-sapling layer, canopy cover and frequency data for species are presented in Tables 7.1-7.4 and 8.1-8.4, respectively, as site and transect summaries by species. In addition to canopy cover and frequency, species data include overall importance values. At the three Guadalupe River sites, most important species in the shrub-sapling layer are box elder, hardy orange, cedar elm, and hackberry. Except for hardy orange, all of the dominant shrub-layer species at the four sites are tree saplings, as are essentially all species in this layer. Dominant shrub-layer species at Hearne include roughleaf dogwood (43.16%), box elder (17.48%), and slippery elm (11.24%). Of interest, though box elder is consistently one of three dominant saplings at all four sites, this species is not as dominant in the tree layer.

4.1.3 Herb-Seedling Layer and Ground Cover

Across all four study sites, the forest herb-seedling layer has a higher species diversity than the tree and shrub-sapling forest layers. Quantitative herb-seedling data is summarized in Tables 9.1-9.4 and 10.1-10.4, by sites and transects, respectively. Frostweed, basketgrass, inland sea oats, and horseherb dominate this layer at the three Guadalupe River sites (Victoria, Nursery, and Gonzales), while Virginia wild rye and inland sea oats are the dominant herbs at the Hearne site Gonzales.

Tree seedlings are notably sparse and unimportant in the herb-seedling layer at all four G&BR sites. The primary tree species in the herb-seedling layer is sandpaper tree at each of the three Guadalupe River sites, though its highest importance value among these sites is only 2.76%. (Gonzales). At Hearne, box elder is the most important tree species (2.95%) in the herb-seedling layer.

Table 11 summarizes the ground-cover transect data. In G&BR riparian forests, the dominant ground cover is forest floor (67.9-86.8%) consisting of organic leaf and twig litter. When all three size classes are combined, woody debris is the second-most important ground cover at the four G&BR sites, with relative importance values of 15.44% (Victoria) to 8.33% (Nursery). Bare mineral soil is another important ground cover, with mean importance values ranging from 10.08% (Gonzales) to 2.45% (Nursery).

4.2 Habitat Inundation

Table 2 provides information regarding the USGS stream gages used to select streamflow data for wetted-surface classifications at the G&BR study sites and reaches. Stream gages are identified as to dates when their data is applicable to classifications completed for the four study areas. Distances (stream miles) are included between the gages and their respective riparian study sites, in order to estimate flow-event travel times used to extrapolate which USGS mean daily discharge data are applicable to classifications at a given study site.

For each of the 30-mile river study reaches (Figure 2), inundation was measured for two miles from the river channel centerline, for a total width of four miles. In this way, area (ha) and percent of habitat inundation were determined for approximately 120 square miles (31,079.88 ha) along each study reach. In order to avoid error while using habitat acreages based on the point-in-time (2007) TPWD-TES data (Elliott, L.F., et al. 2014), habitat inundation was not included where the main river channel meandered more than 50 m laterally. During the wetted-surface classifications, habitat inundation connected to the main river channel and total floodplain inundation were separately quantified. Though the entire four-mile wide riparian buffer was classified for each reach, channel-connected inundation did not occur further than 0.5 or 1.0 mile from the river centerline, depending on the specific site.

Current habitat-inundation results are presented in Tables 12-20. Less than 0.5% of flow events had usable Landsat data, which required expanding the remote sensing effort into the leaf-on seasons. This, in turn, resulted in re-analysis of imagery, to correct for canopy effects and marginal cloud cover.

Brief synopses of inundation results for bottomland, open water, and total habitats, by mean daily river discharge, are provided in Tables 12-14. Habitat inundation is given separately for channel-connected (15-17) and all habitats (Tables 18-20). For each study reach, the overall ranges for total inundated habitats and river discharge are:

| | | Total Habitat Inundation (ha): | |
|---|---|---|---|
| Site | Mean Daily Discharge (cfs) | Channel-Connected | All |
| Victoria-Nursery | 465 - 22,400 | 57.96 - 274.61 | 271.86 - 1,087.84 |
| Gonzales | 446-7,650 | 68.67 - 171.91 | 82.39 - 322.65 |
| Hearne | 85 - 36,300 | 148.89 - 682.66 | 441.70 - 1,405.29 |

Including both channel-connected and total inundation, Figures 5-10 are graphs that summarize the reach-specific relationships between habitat inundation (ha) and mean daily discharge (cfs). The figures indicate rate of change in habitat inundation accelerates at flows of approximately 16,900 cfs and 36,300 cfs, respectively, at the Victoria-Nursery and Hearne study reaches. This indicates overbank flows may begin at these general levels. In contrast, the rate of habitat inundation versus flow at Gonzales does not show a similar inflection, which indicates overbank flows do not occur at 7,650 cfs at this site.

Again including both channel-connected and total inundation, Figures 11.1-13.7 are detailed maps of habitats flooded at low, medium, and high flows for each of the three study reaches. As discussed above, gaps in mapped habitat inundation allow areas of significant lateral movement by meanders to be avoided, in order to minimize error.

Due to flooding and other delays, the Texas Parks and Wildlife Department (TPWD) has been unable to collect any elevation data for the G&BR transects, which prevents the comparison of river stage elevations to the distribution of plant species down the vegetation-transect topographic profiles.

## 5. Discussion

### 5.1 Forest Status

Forest plots were inventoried to quantify current plant species composition, using methods similar to Alldredge and Moore's (2012) work in east Texas. Based on inundation requirements of dominant species within each forest habitat, environmental flows necessary to maintain floodplain habitats were evaluated. Alldredge and Moore's (2012) inventory method is based on the relative importance of wetland-adapted and flood-intolerant upland species along elevational gradients within floodplain plant communities. At the larger reach scale of this riparian study, plant population metrics sensitive to the long-term effect of a changing flow pattern include species composition, canopy cover, the ratio of relative importance values for live trees versus snags, and the percentage of wetland indicator species among dominant plant species (Merritt et al. 2010).

Commonly described based on plant composition, riparian habitats include herbaceous (marshes and wet grasslands) and woody communities (hardwood forests and shrublands). Regulatory wetlands are delineated as areas where wetland indicator plant species are dominant, which means more than 50% of species in the obligate (OBL), facultative wetland (FACW), or facultative (FAC) category (USACE 1987, Lichvar et al. 2014). FAC- plant species are not considered wetland indicators. However, soil and hydrology are also important and sometimes overriding indicators of regulatory wetlands.

Like the Guadalupe and Brazos Rivers, different rivers in the Coastal Prairies ecoregion share the same tree species, with the relative importance of these species measuring the magnitude of substrate disturbance due to floods at each site. Higher importance of black willow, boxelder, and eastern cottonwood indicate active flood regime creating new alluvial surfaces (Davis and Smith 2013).

The species composition of the G&BR study sites is in transition. Especially in the three Guadalupe River study sites, upland species are increasing in the forest understory relative to wetland indicators. Though overall the most dominant species in the Guadalupe River sites is sandpaper tree, an upland species that is an increasing in importance, wetland indicator species still remain dominant among tree species within riparian habitats at all G&BR study sites.

5.1.1 Tree Layer

As also found by Davis and Smith (2013) on the nearby Mission and San Antonio Rivers, hackberry, cedar elm, sandpaper tree (anacua), and box elder are important tree species on the lower Guadalupe River. Along rivers near the middle and lower Guadalupe River, researchers have shown that decreased flood disturbance results in mid- to late-successional riparian mixed forest dominated by cedar elm, hackberry, and sandpaper tree (Bush and Richter 2006, Davis and Smith 2013, Van Auken and Bush 1985). Decreased flooding allows cedar elm and hackberry to dominate. In this way, extended periods of low flows decrease the species diversity of riparian forests on the lower Guadalupe river (Davis and Smith 2013).

Of serious concern is the dominance of Chinese tallow, an exotic invasive species, in the tree layer at the Victoria study site. If mortality of native riparian tree species continues, the more open forest canopy and lack of competition may allow this species to increase along the lower Guadalupe River.

Dominant tree species that are wetland indicators, which are decreasing due to relatively high mortality compared to recruitment (Table 5), include eastern cottonwood, box elder, and green ash. The hydroperiod requirements of these three riparian tree species may not be available, as evidenced by their high mortality rates.

In contrast, the Hearne site on the middle Brazos River has more mesic complement of tree species with many dominants, including slippery elm, box elder, roughleaf dogwood, and black willow (Tables 3.4 and 4.4). However, plot inventories at the Hearne site show that green ash and eastern cottonwood, important tree species indicative of higher flows and flood disturbance, are in sharp decline (Table 5). Though a larger river with a broader and more environmentally diverse riparian zone compared to the Guadalupe River, the Brazos River may no longer produce sufficient overbank flooding to maintain the geomorphic disturbance necessary for high riparian productivity.

Possibly due to their relatively long lived seeds, the dispersal of box elder and green ash is more responsive to floods. SARA et al. (2015) found that these two species dispersed throughout the riparian area following a flood event, while black willow remained confined to the area of base flow inundation. Enhanced seed dispersal may contribute to box elder and green ash occupying all four G&BR sites.

Similar to this study's Gonzales study site, SARA et al. (2015) found the distribution of boxelder and green ash at Gonzales to coincide, extending several m up the river bank for a horizontal distance approximately 20 m from the river. However, black willow, normally the most frequent co-dominant with box elder, is absent this study's tree sample at Gonzales (Tables 3.3 and 4.3). On the lower Guadalupe River, black willow may lose its status as a codominant with boxelder on the first levee and the flat between the first and second levees. As discussed previously, black willow may be declining at the G&BR study sites, due to more precise germination requirements of its short-lived seeds, which depend upon the April-July river stage during seed fall rising to or somewhat above the mean high water mark (MHWM).

### 5.1.2 Shrub-Sapling Layer

A striking message conveyed by the inventory results for the shrub-sapling layer at the three Guadalupe River study sites is the emerging dominance of upland tree species among saplings, including hardy orange, sandpaper tree, Mexican buckeye, and chinaberry. More upland saplings presage a drier species composition for future riparian forests along the lower Guadalupe River.

In contrast, the only upland species sampled in the shrub-sapling layer at Hearne on the Brazos River is the non-dominant invasive exotic chinaberry. Due to its more active flow regime, the riparian forest at Hearne has twice as many species in the shrub-sapling layer than any TCS study site on the lower Guadalupe River, all but one of which is a wetland indicator.

### 5.1.3 Herb-Seedling Layer

The dominant tree species in the herb-seedling layer at all three Guadalupe River study sites is sandpaper tree, an upland species. Also of note at the Guadalupe River sites is the complete absence of tree seedlings of wetland indicators characteristic of naturally variable flow regimes, such as box elder, black willow, and eastern cottonwood. The unimportance of these keystone riparian tree species indicates significant flood disturbance is not occurring as required to sustain early successional habitats and higher species diversity. In contrast, the Hearne site with the larger and more variable flow regime of the Brazos River has a much larger species diversity for tree seedlings, dominated by box elder and other wetland indicators.

### 5.2 Riparian Hydrology

Habitat inundation results indicate that flood events may not connect with significant portions of the floodplain, unless streamflow rates are sufficient to overtop the incised channels of the Brazos and Guadalupe Rivers. Based on preliminary habitat-inundation analyses (Tables 12-17), within the G&BR inundation-study reaches, mean daily discharge rates that initiate extensive habitat inundation are the following:

Hearne: 36,300 cfs

Nursery-Victoria: 16,200 cfs

The lack of usable Landsat data for flow events above 7,650 cfs at Hearne prevent an assessment of flow rates that initiate overbank flows.

The operation of upstream reservoirs may reduce inundation of riparian habitats, due to both lower regulated flows and channel incision. In addition, the area of inundation may not be directly related to daily mean river discharge for several reasons. Both temporary and permanent obstructions within side channels may be responsible. Temporary side-channel blockage may include logs and other woody debris and deposited sediment of varying amounts following high flow events either in the main river channel or tributaries.

Variable tributary inflow during local rain events may also confound a direct relationship between habitat inundation and daily mean river discharge. These tributary inflows back up depending on the stage elevation of the main river channel, which leads to variable inundation for a given river discharge. More permanent impediments to the connection of river floodwaters to floodplain backwater habitats include local geomorphic factors, such as the elevations of intervening natural levees that segment the floodplain and berm elevations within side channels.

This study focuses on the connection of high and overbank flows to riparian habitats, in order to examine how the frequency and duration of environmental flows may maximize riparian benefits, as water availability may decrease. Due to the large coordinated effort required to modify the flow regime of major rivers, floodplain restoration has mostly been implemented through smaller local projects, where disturbed vegetation and hydrology are re-established (King et al. 2009). For individual sites, flow re-establishment is not overly difficult. Research by Hunter et al. (2008) demonstrated that simply placing flashboard risers in drainage ditches re-created a hydroperiod and wetland functions similar to natural riparian forests.

However, riparian restoration at the current study's reach and landscape scales requires significantly more effort than at the local scale, including collaborations with multiple agencies and stakeholders, baseline vegetation and hydrology data, development and implementation of environmental-flow regimes, and long-term hydrologic and vegetation monitoring.

## 6. Conclusion

The sustainability of riparian forests and other wetlands is important to maintain buffers to absorb sediments and nutrients transported by rivers and lessen agricultural inflows (King et al. 2009). In addition to aquatic ecosystems, healthy riparian forests maintain prime wildlife habitats, including hunting leases that support private landowners.

Study results quantify the discharge rates needed to inundate important riparian habitats within the G&BR study reaches. Along the four G&BR reaches, the rate of habitat inundation remains low and variable until flows exceed 20,000 cfs. At Gonzales and Victoria along the Guadalupe River, channel incision and lower regulated flows may be responsible for riparian forest succession, from dominance by black willow, box elder, green ash, slippery elm, and eastern cottonwood, to a drier forest dominated by sandpaper tree, cedar elm, and hackberry.

### 6.1 Future Research Needs

Similar to the findings of SARA et al. (2015) for the Guadalupe River at Gonzales and Victoria, the results of this study indicate that TCEQ implementation of environmental flow standards is insufficient to sustain riparian forests near these two locations.

An important result of this riparian assessment is the initiation of long-term inundation and forest-plot studies, in order to relate riparian vegetation dynamics and hydrology. Davis and Smith (2013) demonstrate the significance of reference study sites, in order to both guide restoration and track long-term changes in forest composition due to flow and disturbance regimes. SARA et al. (2015) also propose that a permanent riparian research site be located near Gonzales.

Recommendations for future research and implementation include the following:

**(1)** Elevation profiles along the vegetation transects need to be completed as soon as floods cease, in order to relate extrapolated stage elevations at the study sites to the distribution of plant species within study plots.

**(2)** Long-term monitoring of riparian tree species and forest habitats (functional guilds) should be linked to historical streamflow, floodplain integrity, and related floodplain processes. For example, knowing the long-term status of black willow and box elder, which dominate riverside locations with increased inundation, allows one to determine the width of the most frequently flooded zone. Due to their dominance in sustainable riparian forests and their ongoing decline in G&BR riparian forests, eastern cottonwood and green ash reproduction should also be targeted during monitoring. Sugarberry and sandpaper tree should also be monitored, since their heightened importance may be due to drier conditions and increased disturbance.

**(3)** Increased focus on inundation mapping and vegetation-flow response guilds should be the focus of future research, so that riparian assessments and associated restoration techniques may become broadly applicable (Merritt et al. 2010). A shift in the species composition of guilds usually indicates long-term change of an environmental variable, such as streamflow or geomorphic flood damage. The box elder-black willow guild is an example of a response guild sensitive to both hydrological and geomorphic change, within the G&BR study reaches.

**(4)** Empirical and quantitative performance standards are needed to confirm success in terms of ecosystem functions, within the overall riparian zone and for local restoration efforts that may become increasingly needed in the future.

**(5)** Basin- and reach-specific objectives for resizing restored riparian corridors should be developed, in order to maximize critical ecosystem processes as flow regimes are altered (Rood et al. 2005).

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# Appendix 1: Tables

Table 1 Representative Species List *
G&BR Study Sites: Victoria, Nursery, Gonzales, and Hearne

| Scientific Name | Common Name | Wetland | Family | Envi | Life Form | Study Site Abundance Codes | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | G | N | V | H |
| *Acalypha ostryifolia* | pineland three-seed mercury | UPL | Euphorbiaceae | B | H | U | | | |
| *Acer negundo* | box elder | FAC | Aceraceae | B,R | T | A | A | A | A |
| *Aesculus pavia* | red buckeye | FACU | Hippocastanaceae | B | S | L | A | A | |
| *Agalinus sp.* | slenderleaf false foxglove | FACU | Scropulariaceae | B | H | | | | R |
| *Allium sp.* | onion | NA | Alliaceae | R | H | C | C | C | C |
| *Ambrosia psilostachya* | cuman ragweed | FAC | Asteraceae | R | H | | | | R |
| *Ambrosia trifida* | giant ragweed | FAC | Asteraceae | B,R | H | | | | A |
| *Ammannia coccinea* | valley redstem | OBL | Lythraceae | R,W,A | H | | | | C |
| *Amorpha fruticosa* | false indigo | FACW | Fabaceae | B | S | | | | C |
| *Ampelopsis arborea* | peppervine | FAC | Vitaceae | R | WV | C | C | C | C |
| *Ampelopsis cordata* | heart-leaf ampelopsis | FAC | Vitaceae | B,R | WV | | | U | U |
| *Apocynum cannabinum* | dogbane | FACU | Apocynaceae | B,R | H | | | | R |
| *Argomone albiflora* | white prickly-poppy | UPL | Papaverae | B,R | H | | R | | |
| *Aster subulatus* | hierba del marrano | OBL | Asteraceae | R,W,A | H | | | | C |
| *Bacopia monnieri* | coastal water-hyssop | OBL | Scrophulariaceae | R,W | H | | | | C |
| *Bignonia capreolata* | crossvine | FAC | Bignonaceae | B | WV | | | U | |
| *Boerhavia cylindrica* | smallspike false nettle | UPL | Urticaceae | R,W | H | C | C | R | R |
| *Bumelia sideroxylon* | gum bully | UPL | Sapotaceae | B | S/T | | | | R |
| *Callicarpa americana* | American beautyberry | FACU | Verbenaceae | B | S | L | U | C | U |
| *Calyptocarpus vialis* | horseherb | FAC | Asteraceae | B | H | A | A | A | |
| *Campsis radicans* | trumpet creeper | FAC | Bignoniaceae | B | WV | | | | A |

* Sources (scientific & common names): Ladybird Johnson Wildflower Center 2015 (primary) & USDA, NRCS 2015 (secondary)

Environment codes: A-aquatic, B-bottomland forest, R-riverbank, W-wetland

Life Form Codes: T-tree, S-shrub, H-herb, WV-woody vine, HV-herbaceous vine

Study Sites: Gonzales (G), Nursery (N), Victoria (V), and Hearne (H)

Abundance Codes: A-abundant, C-common, U-uncomon, R-rare, L-likely but not seen, blank-not found

Wetland indicator status codes (USDA 2015): OBL- Obligate Wetland, FACW- Facultative Wetland, FAC- Facultative, FACU- Facultative Upland, UPL- Obligate Upland, NA- Not Available

Table 1 Representative Species List (continued)
G&BR Study Sites: Victoria, Nursery, Gonzales, and Hearne

| Scientific Name | Common Name | Wetland | Family | Envi | Life Form | Study Site Abundance Codes | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | G | N | V | H |
| *Carex sp.* | caric sedge | NA | Cyperaceae | B | H | C | | | |
| *Carya illinoinensis* | pecan | FACU | Juglandaceae | B | T | A | A | A | C |
| *Celtis laevigata* | hackberry | FACW | Ulmaceae | B,R | T | A | A | A | A |
| *Cephalanthus occidentallis* | buttonbush | OBL | Rubiceae | R,W | S | | R | | |
| *Chasmanthium latifolium* | inland sea oats | FAC | Poaceae | B,R,W | H | C | A | A | A |
| *Chenopodium sp.* | goosefoot | FACU | Chenopodiaceae | B,R | H | | | | R |
| *Chloracantha spinosa* | spiny chloracantha | FACW | Asteraceae | B,R | H | A | A | A | A |
| *Clematis pitcheri* | Leatherflower | FACU | Ranunculaceae | B | HV | | | R | |
| *Cocculus carolinus* | Carolina snailseed | FAC | Menispermaceae | B | WV | | | R | U |
| *Colocasia esculenta* | elephant ear, taro | FACW | Araceae | B,R | H | | U | U | |
| *Conyza canadensis* | horseweed | UPL | Asteraceae | B | H | | | | A |
| *Cornus drummondii* | roughleaf dogwood | FAC | Cornaceae | B | T | L | C | C | A |
| *Crataegus sp.* | hawthorn | NA | Rosaceae | B,W | T | U | R | L | |
| *Cucurbita texana* | Texas gourd | UPL | Cucurbitaceae | B | HV | | R | | |
| *Cynodon dactylon* | bermuda grass | FACU | Poaceae | B | H | C | C | C | C |
| *Cyperus sp.* | flatsedge | NA | Cyperaceae | R,W | H | C | C | C | C |
| *Desmodium canadense* | showy tick trefoil | FAC | Fabaceae | B,R | H | | | | U |
| *Desmodium sessilifolium* | sissleleaf ticktrefoil | UPL | Fabaceae | B,R | H | | | | R |
| *Diospyros texana* | Texas persimmon | UPL | Ebenaceae | B | S/T | U | | | |
| *Eclipta prostrata* | pie-plant | FACW | Asteraceae | B,R | H | | | | C |
| *Ehretia anacua* | sandpaper tree | UPL | Boraginaceae | B | T | A | A | A | |
| *Elymus virginicus* | Virginia wild rye | FAC | Poaceae | B | H | A | A | A | |
| *Conoclinium coelestinum* | blue-mist flower | FAC | Asteraceae | B | H | H | | | R |
| *Eupatorium incarnatum* | pink boneset | FACU | Asteraceae | B | H | H | | | C |
| *Eupatorium serotinum* | lateflowering boneset | FAC | Asteraceae | B | H | U | R | L | C |
| *Fleischmannia incarnata* | pink thoroughwort | FACU | Asteraceae | B | H | | | | A |
| *Forestiera acuminata* | eastern swamp-privet | OBL | Oleaceae | R,W,A | S | | L | R | R |

Table 1 Representative Species List (continued)
G&BR Study Sites: Victoria, Nursery, Gonzales, and Hearne

| Scientific Name | Common Name | Wetland | Family | Envi | Life Form | Study Site Abundance Codes | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | G | N | V | H |
| *Fraxinus pennsylvanica* | green ash | FACW | Oleaceae | B,R | T | C | A | A | A |
| *Gleditsia triacanthos* | honey locust | FAC | Fabaceae | B | T | | C | C | U |
| *Helianthus annus* | common sunflower | FAC | Asteraceae | B,R | H | | | | R |
| *Heliotropum indicum* | turnsole | FAC | Boraginaceae | B,R | H | | | | R |
| *Heterantheca subaxillaris* | camphorweed | UPL | Asteraceae | B | H | | | | U |
| *Hydrocotyle verticillata* | whorled marshpennywort | OBL | Umbelliferae | R | H | U | R | L | |
| *Ilex decidua* | deciduous holly | FACW | Aquifoliaceae | B | T | C | C | C | U |
| *Ilex vomitoria* | yaupon holly | FAC | Aquifoliaceae | B | T | L | R | | U |
| *Ipomoea wrightii* | Wright morning-glory | FACW | Convolulaceae | B,R | HV | | | R | |
| *Iva annua* | annual marshelder | FAC | Asteraceae | R | H | L | C | R | C |
| *Juniperus virginiana* | eastern red cedar | FACU | Cupressaceae | B | T | | | | C |
| *Leucospora multifida* | narrowleaf paleseed | OBL | Scrophulariaceae | R,W | H | | | | A |
| *Ludwigia peploides* | water-primrose | OBL | Onagraceae | R,W,A | H | | | | R |
| *Macfadyena unguis-cati* | cat-claw vine | UPL | Bignoniaceae | B | HV | | U | U | |
| *Maclura pomifera* | osage orange | FACU | Moraceae | B | T | C | C | U | U |
| *Malvaviscus arboreus* var. *drummondii* | Turk's cap | UPL | Malvaceae | B | H | A | A | A | |
| *Matelea sp.* | milk-vine | NA | Ascleferaceae | B | HV | | | | R |
| *Melia azedarach* | Chinaberry | UPL | Meliaceae | B | T | U | C | C | C |
| *Melothria pendula* | speckled gourd | FAC | Cucurbitaceae | B,R | H | | C | | R |
| *Morus alba* | white mulberry | FACU | Moraceae | B,R | T | R | | | |
| *Morus rubra* | red mulberry | FACU | Moraceae | B,R | T | | U | C | C |
| *Nicotiana repanda* | fiddle-leaf | FAC | Solanaceae | B | H | | R | | |
| *Oplismenus hirtellus* | basketgrass | FAC | Poaceae | B,W | H | A | A | A | |
| *Oxalis dillenii* | slender yellow woodsorrel | FACU | Oxalidaceae | B | H | R | L | L | |
| *Parietaria pensylvanica* | Pennsylvania cucumber plant | FACU | Urticaceae | B | H | A | R | | |
| *Parkinsonia aculeata* | retama | FAC | Fabaceae | B,R | T | | | R | |

Table 1 Representative Species List (continued)
G&BR Study Sites: Victoria, Nursery, Gonzales, and Hearne

| Scientific Name | Common Name | Wetland | Family | Envi | Life Form | Study Site Abundance Codes | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | G | N | V | H |
| *Parthenium hysterophorus* | false ragweed | FAC | Asteraceae | R | H | L | C | U | |
| *Parthenocissus quinquefolia* | Virginia creeper | FACU | Vitaceae | B | V | A | A | A | A |
| *Paspalum langei* | rustyseed paspalum | UPL | Poaceae | B | H | C | | | |
| *Passiflora incarnata* | purple passionflower | UPL | Pasifloraceae | B,R | HV | | | | C |
| *Phyla lanceolata* | lanceleaf frogfruit | OBL | Verbenaceae | R,W | H | A | | | |
| *Physalis sp.* | yellow ground cherry | NA | Solanaceae | B | H | R | | | R |
| *Phytolacca americana* | pigeonberry | FACU | Phytolaccaceae | B | H | U | | | U |
| *Platanus occidentalis* | sycamore | FACW | Plantanaceae | B,R | T | C | C | C | R |
| *Polygonum ramosissimum* | bushy knotweed | FACU | Polygonaceae | B | H/S | | | | R |
| *Polygonum sp.* | smartweed | NA | Polygonaceae | R,W | H | C | C | C | C |
| *Poncirus trifoliata* | trifoliate orange | UPL | Rutaceae | B,W | S | | R | A | |
| *Populus deltoides* | eastern cottonwood | FAC | Salicaceae | B,R | T | | | | A |
| *Prosopis glandulosa* | honey mesquite | UPL | Fabaceae | B,R | T | | U | | |
| *Ptelea trifoliata* | wafer ash | FACU | Rutaceae | B | S/T | | R | C | |
| *Quercus macrocarpa* | bur oak | FACU | Fagaceae | B | T | C | C | C | |
| *Ranunculus sceleratus* | cursed buttercup | OBL | Ranunculaceae | R,W | H | | | | C |
| *Rapistrum rugosum* | bastard cabbage | UPL | Brassicaceae | B | H | R | R | | R |
| *Ricinus communis* | castor bean | FACU | Euphorbiaceae | B,R,W | H | | A | C | |
| *Rivina humilis* | pigeonberry | UPL | Phytolaccaceae | B,R | H | | U | | U |
| *Rosa bracteata* | Macartney rose | UPL | Rosaceae | B,W | S | | | A | |
| *Rubus trivialis* | dewberry | FACU | Rosaceae | B | S | C | U | U | A |
| *Sabal minor* | palmetto | FACW | Araceae | B,R | S | L | L | | |
| *Sabal texana* | Texas palm | UPL | Araceae | B,R | T | | | R | |
| *Salix interior* | sand-bar willow | OBL | Salicaceae | B,R,W | T | | C | A | |
| *Salix nigra* | black willow | OBL | Salicaceae | R,W,A | T | C | C | A | A |
| *Salvia coccinea* | scarlet sage | UPL | Lamiaceae | B | H | L | C | C | |

Table 1 Representative Species List (continued)
G&BR Study Sites: Victoria, Nursery, Gonzales, and Hearne

| Scientific Name | Common Name | Wetland | Family | Envi | Life Form | Study Site Abundance Codes | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | G | N | V | H |
| *Samolus parviflorus* | thin-leaf brookweed | OBL | Primulaceae | R,W,A | H | | | | U |
| *Sapindus saponaria* | Wingleaf soapberry | FACU | Sapindaceae | B | T | R | U | A | A |
| *Sapium sebiferum* | Chinese tallow | FAC | Euphorbiaceae | B,R | T | | C | C | |
| *Sesbania herbacea* | bigpod sesbania | NA | Fabaceae | R,W | H | | | | P |
| *Sideroxylon lanuginosum* | gum bumelia | FACU | Sapotaceae | B | T | R | U | U | C |
| *Smilax bona-nox* | saw greenbrier | FAC | Smilacaceae | B,R | WV | A | A | A | A |
| *Smilax tamnoides* | bristly greenbrier | FAC | Smilacaceae | B,R | WV | | | | U |
| *Solanum elaeagnifolium* | silverleaf nightshade | UPL | Solanaceae | B,R | H | C | R | | |
| *Solidago altissima* | Canadian goldenrod | FACU | Asteraceae | B | H | | A | | C |
| *Spigelia texana* | Texas pinkroot | UPL | Loganiaceae | B | H | | C | U | |
| *Sphenoclea zeylanica* | chickenspike | FACW | Sphenocleaceae | B,R | H | | | | R |
| *Strophostyles helvola* | amberique-bean | FAC | Fabaceae | B | H | U | | | C |
| *Symphoricarpos orbiculatus* | coralberry | FACU | Oleaceae | B | S | | | | C |
| *Symphyotrichum lanceolatum* | white panicle aster | FACW | Asteraceae | B,R | H | | | | R |
| *Taxodium distichum* | bald cypress | OBL | Cupressaceae | R,W,A | T | R | U | C | |
| *Teucrium canadense* | Canada germander | FACW | Lamiaceae | B,R | H | U | A | C | C |
| *Teucrium cubense* | coast germander | UPL | Lamiaceae | B | H | | | C | |
| *Tillandsia usenoides* | Spanish moss | FAC | Bromeliaceae | B | H | | | A | |
| *Toxicodendron radicans* | poison ivy | FAC | Anacardiaceae | B,R | S/V | A | A | A | A |
| *Tragia sp.* | noseburn | NA | Euphorbiaceae | B | H | | | C | |
| *Ulmus americana* | American elm | FAC | Ulmaceae | B | T | | | | P |
| *Ulmus crassifolia* | cedar elm | FAC | Ulmaceae | B | T | A | A | A | P |
| *Ulmus rubra* | slippery elm | FAC | Ulmaceae | B | T | | | | P |
| *Ungnadia speciosa* | Mexican buckeye | UPL | Sapindaceae | B,R | T | R | C | C | |
| *Verbena halei* | Texas verain | UPL | Verbenaceae | B | H | | | | R |
| *Verbesina encelioides* | cowpen daisy | FAC | Asteraceae | B,W | H | U | C | U | |

Table 1 Representative Species List (concluded)
G&BR Study Sites: Victoria, Nursery, Gonzales, and Hearne

| Scientific Name | Common Name | Wetland | Family | Envi | Life Form | Study Site Abundance Codes | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | G | N | V | H |
| *Verbesina virginica* | frostweed | FACU | Asteraceae | B,W | H | A | A | A | C |
| *Viburnum rufidulum* | rusty blackhaw | UPL | Caprifoliaceae | B,R | S/T | | R | | R |
| *Viola sp.* | violet | NA | Violaceae | B | H | U | | | |
| *Vitex agnus-castus* | Lavender Chaste Tree | UPL | Verbenaceae | B | S/T | | | | R |
| *Vitis aestivalis* | long grape | FACU | Vitaceae | B, R | WV | | | | A |
| *Vitis cinerea* | winter grape | FAC | Vitaceae | B, R | WV | | | | A |
| *Vitis mustangensis* | mustang grape | UPL | Vitaceae | B, R | WV | C | A | A | A |
| *Vitis vulpina* | frost grape | FAC | Vitaceae | B, R | WV | | | | R |
| *Xanthium strumarium* | rough cockleburr | FAC | Asteraceae | B, R | H | C | R | L | A |

Table 2 USGS Stream Gages Used to Select Flow Events
Periods of Record, IFS Sites, and Stream Distances to Study Sites:
Victoria, Nursery, Gonzales, and Hearne

| **Gage #** | **Name** | **Available Data** | **County** | **IFS Sites** | **Stream Distance*: Gage to Study Site** |
|---|---|---|---|---|---|
| **Guadalupe USGS Stream Gages: Victoria, Nursery, and Gonzales** | | | | | |
| 8176500 | GR at Victoria, TX | 12/1/1934-pres | Victoria | Nursery & Victoria (full) | Victoria: ~ 5.6 mi US<br>Nursery: ~ 12.5 mi US |
| 8173900 | GR at Gonzales, TX | 10/1/1996-pres | Gonzales | Gonzales (1996-pres) | Gonzales: ~ 7.7 mi DS |
| **Brazos USGS Stream Gage: Hearne (IFS # 12080)** | | | | | |
| 8098290 | BR nr Highbank, TX | 10/1/65-pres | Falls | 12080 (full) | Hearne: ~ 23.8 mi DS |

* DS: Downstream, US: Upstream

Table 3.1 Summary of Tree Layer Field Data
Victoria Study Site

| Common Name | Scientific Name | Basal Area $m^2$/ha | Frequency 5m increments | Density trees/ha | % Relative Values * | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Basal Area | Frequency | Density | Importance |
| **Live:** | | | | | | | | |
| sandpaper tree | *Ehretia anacua* | 4.27 | 28.75% | 187.50 | 19.95% | 21.30% | 31.25% | 24.17% |
| cedar elm | *Ulmus crassifolia* | 3.17 | 22.50% | 67.50 | 14.82% | 16.67% | 11.25% | 14.24% |
| Chinese tallow | *Sapium sebiferum* | 1.94 | 18.75% | 72.50 | 9.06% | 13.89% | 12.08% | 11.68% |
| hackberry | *Celtis laevigata* | 2.49 | 12.50% | 42.50 | 11.66% | 9.26% | 7.08% | 9.33% |
| black willow | *Salix nigra* | 2.19 | 8.75% | 32.50 | 10.25% | 6.48% | 5.42% | 7.38% |
| pecan | *Carya illinoensis* | 2.00 | 8.75% | 20.00 | 9.36% | 6.48% | 3.33% | 6.39% |
| osage orange | *Maclura pomifera* | 0.89 | 5.00% | 47.50 | 4.16% | 3.70% | 7.92% | 5.26% |
| sycamore | *Platanus occidentalis* | 2.07 | 3.75% | 7.50 | 9.70% | 2.78% | 1.25% | 4.58% |
| box elder | *Acer negundo* | 0.49 | 7.50% | 30.00 | 2.31% | 5.56% | 5.00% | 4.29% |
| deciduous holly | *Ilex decidua* | 0.18 | 6.25% | 40.00 | 0.86% | 4.63% | 6.67% | 4.05% |
| sand-bar willow | *Salix interior* | 0.29 | 3.75% | 32.50 | 1.37% | 2.78% | 5.42% | 3.19% |
| Texas ash | *Fraxinus albicans* | 0.82 | 2.50% | 5.00 | 3.84% | 1.85% | 0.83% | 2.18% |
| slippery elm | *Ulmus rubra* | 0.31 | 3.75% | 7.50 | 1.47% | 2.78% | 1.25% | 1.83% |
| green ash | *Fraxinus pennsylvanica* | 0.25 | 2.50% | 7.50 | 1.18% | 1.85% | 1.25% | 1.43% |
| | **Live totals:** | 21.39 | NA | 600.00 | 100.00% | 100.00% | 100.00% | 100.00% |
| **Snags:** | | | | | | | | |
| unknown | *unknown* | 2.00 | 3.75% | 7.50 | 63.42% | 50.00% | 42.86% | 52.09% |
| hackberry | *Celtis laevigata* | 0.89 | 1.25% | 2.50 | 28.33% | 16.67% | 14.29% | 19.76% |
| cedar elm | *Ulmus crassifolia* | 0.03 | 1.25% | 5.00 | 1.08% | 16.67% | 28.57% | 15.44% |
| honey locust | *Gleditsia triacanthos* | 0.23 | 1.25% | 2.50 | 7.17% | 16.67% | 14.29% | 12.71% |
| | **Snag totals:** | 3.15 | 7.50% | 17.50 | 100.00% | 100.00% | 100.00% | 100.00% |

Table 3.2 Summary of Tree Layer Field Data
Nursery Study Site

| Common Name | Scientific Name | Basal Area $m^2$/ha | Frequency 5m increments | Density trees/ha | % Relative Values * | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Basal Area | Frequency | Density | Importance |
| box elder | *Acer negundo* | 4.10 | 35.00% | 192.50 | 14.96% | 23.53% | 31.93% | 23.47% |
| sandpaper tree | *Ehretia anacua* | 6.66 | 23.75% | 115.00 | 24.30% | 15.97% | 19.08% | 19.78% |
| hackberry | *Celtis laevigata* | 3.64 | 23.75% | 70.00 | 13.27% | 15.97% | 11.61% | 13.61% |
| black willow | *Salix nigra* | 4.60 | 11.25% | 40.00 | 16.80% | 7.56% | 6.64% | 10.33% |
| sycamore | *Platanus occidentalis* | 3.99 | 11.25% | 45.00 | 14.55% | 7.56% | 7.46% | 9.86% |
| cedar elm | *Ulmus crassifolia* | 1.41 | 13.75% | 37.50 | 5.15% | 9.24% | 6.22% | 6.87% |
| green ash | *Fraxinus pennsylvanica* | 1.40 | 6.25% | 20.00 | 5.10% | 4.20% | 3.32% | 4.20% |
| pecan | *Carrya illinoensis* | 0.59 | 6.25% | 22.50 | 2.15% | 4.20% | 3.73% | 3.36% |
| red mulberry | *Morus rubra* | 0.11 | 3.75% | 25.00 | 0.40% | 2.52% | 4.15% | 2.36% |
| gum bumelia | *Sideroxylon lanuginosum* | 0.19 | 3.75% | 10.00 | 0.69% | 2.52% | 1.66% | 1.62% |
| bald cypress | *Taxodium distichum* | 0.40 | 1.25% | 2.50 | 1.44% | 0.84% | 0.41% | 0.90% |
| bur oak | *Quercus macrocarpa* | 0.04 | 2.50% | 5.00 | 0.16% | 1.68% | 0.83% | 0.89% |
| slippery elm | *Ulmus rubra* | 0.02 | 2.50% | 5.00 | 0.06% | 1.68% | 0.83% | 0.86% |
| honey locust | *Gleditsia triacanthos* | 0.23 | 1.25% | 2.86 | 0.85% | 0.84% | 0.47% | 0.72% |
| deciduous holly | *Ilex decidua* | 0.02 | 1.25% | 5.00 | 0.08% | 0.84% | 0.83% | 0.58% |
| Mexican buckeye | *Ungnadia speciosa* | 0.01 | 1.25% | 5.00 | 0.04% | 0.84% | 0.83% | 0.57% |
| | **Live totals:** | 27.41 | 148.75% | 602.86 | 100.00% | 100.00% | 100.00% | 100.00% |
| **Snags:** | | | | | | | | |
| box elder | *Acer negundo* | 0.20 | 2.86% | 8.57 | 35.11% | 33.33% | 42.86% | 37.10% |
| unknown | *unknown* | 0.31 | 1.43% | 2.86 | 55.24% | 16.67% | 14.29% | 28.73% |
| sycamore | *Platanus occidentalis* | 0.02 | 1.43% | 2.86 | 4.00% | 16.67% | 14.29% | 11.65% |
| Mexican buckeye | *Ungnadia speciosa* | 0.02 | 1.43% | 2.86 | 2.89% | 16.67% | 14.29% | 11.28% |
| red mulberry | *Morus rubra* | 0.02 | 1.43% | 2.86 | 2.76% | 16.67% | 14.29% | 11.24% |
| | **Snag totals:** | 0.56 | 8.57% | 20.00 | 100.00% | 100.00% | 100.00% | 100.00% |

* % Rel = (Species total/All-species Total)*100

Table 3.3 Summary of Tree Layer Field Data
Gonzales Study Site

| Common Name | Scientific Name | Basal Area $m^2$/ha | Frequency 5m increments | Density trees/ha | % Relative Values * | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Basal Area | Frequency | Density | Importance |
| **Live:** | | | | | | | | |
| sandpaper tree | *Ehretia anacua* | 8.28 | 55.71% | 328.57 | 30.42% | 29.10% | 38.46% | 32.7% |
| cedar elm | *Ulmus crassifolia* | 5.42 | 41.43% | 180.00 | 19.90% | 21.64% | 21.07% | 20.9% |
| hackberry | *Celtis laevigata* | 2.14 | 30.00% | 100.00 | 7.86% | 15.67% | 11.71% | 11.7% |
| green ash | *Fraxinus pennsylvanica* | 4.54 | 10.00% | 31.43 | 16.69% | 5.22% | 3.68% | 8.5% |
| pecan | *Carya illinoensis* | 2.58 | 15.71% | 48.57 | 9.48% | 8.21% | 5.69% | 7.8% |
| box elder | *Acer negundo* | 0.47 | 7.14% | 65.71 | 1.72% | 3.73% | 7.69% | 4.4% |
| chinaberry | *Meliz azedarac* | 1.19 | 7.14% | 17.14 | 4.39% | 3.73% | 2.01% | 3.4% |
| deciduous holly | *Ilex decidua* | 0.10 | 7.14% | 42.86 | 0.37% | 3.73% | 5.02% | 3.0% |
| osage orange | *Maclura pomifera* | 0.71 | 4.29% | 11.43 | 2.61% | 2.24% | 1.34% | 2.1% |
| bur oak | *Quercus macrocarpa* | 1.33 | 1.43% | 2.86 | 4.89% | 0.75% | 0.33% | 2.0% |
| hawthorn | *Crataegus sp.* | 0.06 | 5.71% | 14.29 | 0.21% | 2.99% | 1.67% | 1.6% |
| red mulberry | *Morus rubra* | 0.30 | 1.43% | 2.86 | 1.09% | 0.75% | 0.33% | 0.7% |
| slippery elm | *Ulmus rubra* | 0.08 | 1.43% | 2.86 | 0.29% | 0.75% | 0.33% | 0.5% |
| roughleaf dogwood | *Cornus drummondii* | 0.01 | 1.43% | 2.86 | 0.05% | 0.75% | 0.33% | 0.4% |
| gum bumelia | *Sideroxylon lanuginosum* | 0.01 | 1.43% | 2.86 | 0.02% | 0.75% | 0.33% | 0.4% |
| | **Live totals:** | 27.22 | 191.43% | 854.29 | 100.0% | 100.0% | 100.0% | 100.0% |
| **Snags:** | | | | | | | | |
| unknown | *unknown* | 0.05 | 2.86% | 8.57 | 29.73% | 33.30% | 33.30% | 32.11% |
| hackberry | *Celtis laevigata* | 0.04 | 2.86% | 8.57 | 23.12% | 33.30% | 33.30% | 29.90% |
| box elder | *Acer negundo* | 0.02 | 1.43% | 5.71 | 10.15% | 22.20% | 22.20% | 18.18% |
| cedar elm | *Ulmus crassifolia* | 0.03 | 1.43% | 2.86 | 16.70% | 11.10% | 11.10% | 12.97% |
| sandpaper tree | *Ehretia anacua* | 0.04 | 1.43% | 0.03 | 20.30% | 0.11% | 0.11% | 6.84% |
| | **Snag totals:** | 0.18 | 10.00% | 25.74 | 100.00% | 100.00% | 100.00% | 100.00% |

* % Rel = (Species total/All-species Total)*100

Table 3.4 Summary of Tree Layer Field Data
Hearne Study Site

| Common Name | Scientific Name | Basal Area $m^2$/ha | Frequency 5m increments | Density trees/ha | % Relative Values * | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Basal Area | Frequency | Density | Importance |
| **Live:** | | | | | | | | |
| slippery elm | *Ulmus rubra* | 3.15 | 40.00% | 292.50 | 17.53% | 20.25% | 29.10% | 22.30% |
| box elder | *Acer negundo* | 2.76 | 35.00% | 192.50 | 15.34% | 17.72% | 19.15% | 17.41% |
| roughleaf dogwood | *Cornus drummondii* | 1.35 | 35.00% | 227.50 | 7.52% | 17.72% | 22.64% | 15.96% |
| black willow | *Salix nigra* | 4.53 | 22.50% | 97.50 | 25.22% | 11.39% | 9.70% | 15.44% |
| hackberry | *Celtis laevigata* | 1.50 | 33.75% | 110.00 | 8.37% | 17.09% | 10.95% | 12.13% |
| eastern cottonwood | *Populus deltoides* | 3.19 | 7.50% | 15.00 | 17.77% | 3.80% | 1.49% | 7.69% |
| chinaberry | *Meliz azedarac* | 0.29 | 8.75% | 27.50 | 1.62% | 4.43% | 2.74% | 2.93% |
| American elm | *Ulmus americana* | 0.29 | 5.00% | 12.50 | 1.63% | 2.53% | 1.24% | 1.80% |
| sycamore | *Platanus occidentalis* | 0.77 | 1.25% | 2.50 | 4.27% | 0.63% | 0.25% | 1.72% |
| green ash | *Fraxinus pennsylvanica* | 0.05 | 3.75% | 10.00 | 0.27% | 1.90% | 1.00% | 1.05% |
| soap berry | *Saponicus saponaria* | 0.02 | 1.25% | 7.50 | 0.13% | 0.63% | 0.75% | 0.50% |
| red mulberry | *Morus rubra* | 0.02 | 1.25% | 5.00 | 0.09% | 0.63% | 0.50% | 0.41% |
| honey locust | *Gleditsia triacanthos* | 0.04 | 1.25% | 2.50 | 0.21% | 0.63% | 0.25% | 0.37% |
| deciduous holly | *Ilex decidua* | 0.00 | 1.25% | 2.50 | 0.03% | 0.63% | 0.25% | 0.30% |
| | **Live totals:** | 17.97 | 197.50% | 1005.00 | 100.00% | 100.00% | 100.00% | 100.00% |
| **Snags:** | | | | | | | | |
| box elder | *Acer negundo* | 0.58 | 16.25% | 52.50 | 13.69% | 42.00% | 42.00% | 32.56% |
| eastern cottonwood | *Populus deltoides* | 2.75 | 6.25% | 12.50 | 64.39% | 10.00% | 10.00% | 28.13% |
| roughleaf dogwood | *Cornus drummondii* | 0.32 | 7.50% | 30.00 | 7.43% | 24.00% | 24.00% | 18.48% |
| slippery elm | *Ulmus rubra* | 0.51 | 10.00% | 25.00 | 11.90% | 20.00% | 20.00% | 17.30% |
| green ash | *Fraxinus pennsylvanica* | 0.07 | 1.25% | 2.50 | 1.66% | 2.00% | 2.00% | 1.89% |
| black willow | *Salix nigra* | 0.04 | 1.25% | 2.50 | 0.93% | 2.00% | 2.00% | 1.64% |
| | **Snag totals:** | 4.27 | 42.50% | 125.00 | 100.00% | 100.00% | 100.00% | 100.00% |

* % Rel = (Species total/All-species Total)*100

# Table 4.1 Summary of Tree Layer Transect Data
## Victoria Study Site

| Common Name | Scientific Name | 1 | | | 2 | | | 4 | | | 6 | | | 7A | | | 7B | | | 11A | | | 11B | | | % Relative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | BA | Frq | Den | BA | Frq | Den | BA | Frq | Den | BA | Frq | Den | BA | Frq | Den | BA | Frq | Den | BA | Frq | Den | BA | Frq | Den | Importance |
| **Live:** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| sandpaper tree | *Ehretia anacua* | 12.3 | 30.0% | 400.0 | 8.2 | 60.0% | 380.0 | 9.6 | 70.0% | 380.0 | 0.1 | 10.0% | 20.0 | 1.5 | 30.0% | 160.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 2.4 | 30.0% | 160.0 | 24.2% |
| cedar elm | *Ulmus crassifolia* | 6.9 | 20.0% | 40.0 | 6.4 | 10.0% | 20.0 | 0.1 | 10.0% | 20.0 | 1.6 | 40.0% | 120.0 | 0.0 | 0.0% | 0.0 | 6.1 | 60.0% | 180.0 | 0.0 | 0.0% | 0.0 | 4.2 | 40.0% | 160.0 | 14.2% |
| Chinese tallow | *Sapium sebiferum* | 0.0 | 0.0% | 0.0 | 1.5 | 40.0% | 100.0 | 3.3 | 20.0% | 120.0 | 0.0 | 0.0% | 0.0 | 1.4 | 20.0% | 80.0 | 0.5 | 10.0% | 40.0 | 7.2 | 50.0% | 200.0 | 1.6 | 10.0% | 40.0 | 11.7% |
| hackberry | *Celtis laevigata* | 1.1 | 10.0% | 20.0 | 3.1 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 6.1 | 40.0% | 160.0 | 1.8 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 7.9 | 30.0% | 120.0 | 9.3% |
| black willow | *Salix nigra* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 2.6 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 2.5 | 20.0% | 40.0 | 0.0 | 0.0% | 0.0 | 12.5 | 40.0% | 200.0 | 0.0 | 0.0% | 0.0 | 7.4% |
| pecan | *Carrya illinoensis* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 10.1 | 20.0% | 40.0 | 0.0 | 0.0% | 0.0 | 4.6 | 30.0% | 60.0 | 0.0 | 0.0% | 0.0 | 1.3 | 20.0% | 60.0 | 6.4% |
| osage orange | *Maclura pomifera* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.5 | 10.0% | 80.0 | 6.6 | 30.0% | 300.0 | 0.0 | 0.0% | 0.0 | 5.3% |
| sycamore | *Platanus occidentalis* | 0.0 | 0.0% | 0.0 | 9.9 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 6.6 | 10.0% | 20.0 | 0.0 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 4.6% |
| box elder | *Acer negundo* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 3.3 | 30.0% | 140.0 | 0.0 | 0.0% | 0.0 | 0.6 | 20.0% | 60.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.1 | 10.0% | 40.0 | 4.3% |
| deciduous holly | *Ilex decidua* | 0.0 | 0.0% | 0.0 | 0.8 | 20.0% | 160.0 | 0.0 | 0.0% | 0.0 | 0.7 | 30.0% | 160.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 4.1% |
| sand-bar willow | *Salix interior* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 2.3 | 30.0% | 260.0 | 0.0 | 0.0% | 0.0 | 3.2% |
| Texas ash | *Fraxinus albicans* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 6.6 | 20.0% | 40.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 2.2% |
| slippery elm | *Ulmus rubra* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.1 | 10.0% | 20.0 | 2.4 | 20.0% | 40.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 1.8% |
| green ash | *Fraxinus pennsylvanica* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.7 | 10.0% | 40.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 1.3 | 10.0% | 20.0 | 1.4% |
| | **Live totals:** | 20.3 | NA | 460.0 | 30.0 | NA | 700.0 | 25.5 | NA | 740.0 | 28.3 | NA | 600.0 | 7.9 | NA | 380.0 | 11.7 | NA | 360.0 | 28.6 | NA | 960.0 | 18.8 | NA | 600.0 | 100.0% |
| **Snags:** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| unknown | *unknown* | 2.2 | 10.0% | 20.0 | | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 10.1 | 10.0% | 20.0 | 1.7 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 52.1% |
| hackberry | *Celtis laevigata* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 7.1 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 19.8% |
| cedar elm | *Ulmus crassifolia* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.3 | 10.0% | 40.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 15.4% |
| honey locust | *Gleditsia triacanthos* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 1.8 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 12.7% |
| | **Snag totals:** | 2.2 | NA | 20.0 | 0.0 | NA | 0.0 | 0.0 | NA | 0.0 | 0.3 | NA | 40.0 | 10.1 | NA | 20.0 | 10.6 | NA | 60.0 | 0.0 | NA | 0.0 | 0.0 | NA | 0.0 | 100.0% |

* Basal Area (BA) = $m^2$/ha, Frequency (Frq) = per 5-m increments, Density (Den) = trees/ha, NA = Not applicable
% Relative value = (Species total/All-species total)*100, % Relative Importance = Average (% Relative basal area, % Relative frequency, % Relative density)

# Table 4.2 Summary of Tree Layer Transect Data
## Nursery Study Site

| Common Name | Scientific Name | 1A | | | 1B | | | 1C | | | 2A | | | 2B | | | 2C | | | 3A | | | 3B | | | % Relative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | BA | Frq | Den | BA | Frq | Den | BA | Frq | Den | BA | Frq | Den | BA | Frq | Den | BA | Frq | Den | BA | Frq | Den | BA | Frq | Den | Importance |
| **Live:** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| box elder | *Acer negundo* | 2.4 | 30.0% | 260.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 9.9 | 100.0% | 600.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 16.6 | 100.0% | 480.0 | 3.8 | 50.0% | 200.0 | 23.5% |
| sandpaper tree | *Ehretia anacua* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 28.9 | 90.0% | 580.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 22.6 | 80.0% | 300.0 | 0.0 | 0.0% | 0.0 | 1.8 | 20.0% | 40.0 | 19.8% |
| hackberry | *Celtis laevigata* | 0.0 | 0.0% | 0.0 | 1.6 | 20.0% | 60.0 | 6.5 | 30.0% | 60.0 | 0.0 | 0.0% | 0.0 | 5.0 | 50.0% | 140.0 | 8.6 | 60.0% | 180.0 | 0.0 | 0.0% | 0.0 | 7.5 | 30.0% | 120.0 | 13.6% |
| black willow | *Salix nigra* | 28.1 | 50.0% | 220.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 7.6 | 30.0% | 80.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 1.1 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 10.3% |
| sycamore | *Platanus occidentalis* | 3.3 | 60.0% | 260.0 | 15.2 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 1.0 | 10.0% | 40.0 | 12.4 | 10.0% | 40.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 9.9% |
| cedar elm | *Ulmus crassifolia* | 0.0 | 0.0% | 0.0 | 2.9 | 40.0% | 140.0 | 3.1 | 20.0% | 40.0 | 0.0 | 0.0% | 0.0 | 4.7 | 10.0% | 40.0 | 0.3 | 30.0% | 60.0 | 0.0 | 0.0% | 0.0 | 0.2 | 10.0% | 20.0 | 6.9% |
| green ash | *Fraxinus pennsylvanica* | 0.0 | 0.0% | 0.0 | 4.6 | 30.0% | 80.0 | 0.0 | 0.0% | 0.0 | 2.4 | 10.0% | 60.0 | 4.2 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 4.2% |
| pecan | *Carya illinoensis* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.6 | 20.0% | 100.0 | 1.9 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 2.2 | 20.0% | 60.0 | 3.4% |
| red mulberry | *Morus rubra* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.9 | 30.0% | 200.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 2.4% |
| gum bumelia | *Sideroxylon lanuginosum* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.3 | 20.0% | 40.0 | 0.0 | 0.0% | 0.0 | 1.2 | 10.0% | 40.0 | 1.6% |
| bald cypress | *Taxodium distichum* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 3.2 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.9% |
| slippery elm | *Ulmus rubra* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.1 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.1 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.9% |
| honey locust | *Gleditsia triacanthos* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | | 1.9 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.7% |
| deciduous holly | *Ilex decidua* | 0.0 | 0.0% | 0.0 | 0.2 | 10.0% | 40.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.6% |
| Mexican buckeye | *Ungnadia speciosa* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.1 | 10.0% | 40.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.6% |
| bur oak | *Quercus macrocarpa* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.3 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.5% |
| overcup oak | *Quercus lyrata* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.1 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.4% |
| | **Live totals:** | 33.9 | NA | 740.0 | 24.5 | NA | 340.0 | 39.8 | NA | 960.0 | 21.5 | NA | 880.0 | 33.2 | NA | 300.0 | 32.0 | NA | 620.0 | 17.7 | NA | 500.0 | 16.7 | NA | 480.0 | 100.0% |
| **Snags:** | | | | | | 0.0% | | | | | | | | | | | | | | | | | | | | |
| box elder | *Acer negundo* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 1.4 | 20.0% | 60.0 | 0.1 | 10.0% | 20.0 | 37.1% |
| unknown | *unknown* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 1.9 | 10.0% | 20.0 | | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 28.7% |
| sycamore | *Platanus occidentalis* | 0.2 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 11.7% |
| Mexican buckeye | *Ungnadia speciosa* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.1 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 11.3% |
| red mulberry | *Morus rubra* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.1 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 11.2% |
| | **Snag totals:** | 0.2 | NA | 20.0 | 0.0 | NA | 0.0 | 0.1 | NA | 20.0 | 0.0 | NA | 0.0 | 0.0 | NA | 0.0 | 2.0 | NA | 40.0 | 1.4 | NA | 60.0 | 0.1 | NA | 20.0 | 100.0% |

* Basal Area (BA) = $m^2$/ha, Frequency (Frq) = per 5-m increments, Density (Den) = trees/ha, NA = Not applicable

% Relative value = (Species total/All-species total)*100, % Relative Importance = Average (% Relative basal area, % Relative frequency, % Relative density)

# Table 4.3 Summary of Tree Layer Transect Data
## Gonzales Study Site

| Common Name | Scientific Name | 1 | | | 2 | | | 3A | | | 3B | | | 4A | | | 4B | | | 4C | | | % Relative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | BA | Frq | Den | BA | Frq | Den | BA | Frq | Den | BA | Frq | Den | BA | Frq | Den | BA | Frq | Den | BA | Frq | Den | Importance |
| **Live:** | | | | | | | | | | | | | | | | | | | | | | | |
| sandpaper tree | *Ehretia anacua* | 11.5 | 90.0% | 600.0 | 7.0 | 50.0% | 220.0 | 13.6 | 50.0% | 620.0 | 6.6 | 70.0% | 280.0 | 2.7 | 20.0% | 0.0 | 15.2 | 70.0% | 400.0 | 1.3 | 40.0% | 180.0 | 32.7% |
| cedar elm | *Ulmus crassifolia* | 0.1 | 10.0% | 20.0 | 5.2 | 50.0% | 220.0 | 0.3 | 10.0% | 20.0 | 4.6 | 50.0% | 120.0 | 4.5 | 40.0% | 120.0 | 1.6 | 40.0% | 100.0 | 21.6 | 90.0% | 660.0 | 20.9% |
| hackberry | *Celtis laevigata* | 3.3 | 30.0% | 120.0 | 3.9 | 30.0% | 80.0 | 1.2 | 30.0% | 160.0 | 1.0 | 20.0% | 60.0 | 2.4 | 30.0% | 80.0 | 0.9 | 40.0% | 120.0 | 2.3 | 30.0% | 80.0 | 11.7% |
| green ash | *Fraxinus pennsylvanica* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 11.3 | 30.0% | 140.0 | 5.9 | 20.0% | 40.0 | 14.7 | 20.0% | 40.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 8.5% |
| pecan | *Carya illinoensis* | 0.0 | 0.0% | 0.0 | 4.1 | 40.0% | 160.0 | 0.0 | 0.0% | 0.0 | 11.6 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 2.2 | 40.0% | 120.0 | 0.2 | 20.0% | 40.0 | 7.8% |
| box elder | *Acer negundo* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.3 | 10.0% | 40.0 | 0.0 | 0.0% | 0.0 | 3.0 | 40.0% | 420.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 4.4% |
| chinaberry | *Meliz azedarac* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 1.9 | 10.0% | 40.0 | 2.0 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 2.7 | 20.0% | 40.0 | 1.7 | 10.0% | 20.0 | 3.4% |
| deciduous holly | *Ilex decidua* | 0.4 | 30.0% | 160.0 | 0.1 | 10.0% | 80.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.2 | 10.0% | 60.0 | 0.0 | 0.0% | 0.0 | 3.0% |
| osage orange | *Maclura pomifera* | 0.5 | 10.0% | 20.0 | 4.4 | 10.0% | 40.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 2.1% |
| bur oak | *Quercus macrocarpa* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 9.3 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 2.0% |
| hawthorn | *Crataegus sp.* | 0.2 | 20.0% | 60.0 | 0.1 | 10.0% | 40.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.2 | 10.0% | 0.0 | 1.6% |
| red mulberry | *Morus rubra* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 2.1 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.7% |
| slippery elm | *Ulmus rubra* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.5 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.5% |
| roughleaf dogwood | *Cornus drummondii* | 0.1 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.4% |
| gum bumelia | *Sideroxylon lanuginosum* | 0.0 | 0.0% | 0.0 | 0.0 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.4% |
| | **Live totals:** | 16.0 | NA | 1000.0 | 24.9 | NA | 860.0 | 29.1 | NA | 1040.0 | 43.1 | NA | 580.0 | 27.3 | NA | 680.0 | 22.8 | NA | 840.0 | 27.4 | NA | 980.0 | 100.0% |
| **Snags:** | | | | | | | | | | | | | | | | | | | | | | | |
| unknown | *unknown* | 0.3 | 10.0% | 40.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.1 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 30.5% |
| hackberry | *Celtis laevigata* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.2 | 10.0% | 40.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.1 | 10.0% | 20.0 | 28.3% |
| box elder | *Acer negundo* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.1 | 10.0% | 40.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 15.5% |
| cedar elm | *Ulmus crassifolia* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.2 | 10.0% | 20.0 | 14.0% |
| sandpaper tree | *Ehretia anacua* | 0.0 | 0.0% | 0.0 | 0.3 | 10.0% | 0.2 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 11.6% |
| | **Snag totals:** | 0.3 | NA | 40.0 | 0.3 | NA | 0.2 | 0.1 | NA | 40.0 | 0.2 | NA | 40.0 | 0.0 | NA | 0.0 | 0.1 | NA | 20.0 | 0.3 | NA | 40.0 | 100.0% |

* Basal Area (BA) = $m^2$/ha, Frequency (Frq) = per 5-m increments, Density (Den) = trees/ha, NA = Not applicable
% Relative value = (Species total/All-species total)*100, % Relative Importance = Average (% Relative basal area, % Relative frequency, % Relative density)

# Table 4.4 Summary of Tree Layer Transect Data
## Hearne Study Site

| Common Name | Scientific Name | 2 | | | 5A | | | 5B | | | 9A | | | 9B | | | 10 | | | 12 | | | 13 | | | % Relative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | BA | Frq | Den | BA | Frq | Den | BA | Frq | Den | BA | Frq | Den | BA | Frq | Den | BA | Frq | Den | BA | Frq | Den | BA | Frq | Den | Importance |
| **Live:** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| slippery elm | *Ulmus rubra* | 7.9 | 60.0% | 640.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 1.8 | 60.0% | 340.0 | 5.4 | 40.0% | 180.0 | 5.3 | 60.0% | 540.0 | 2.1 | 60.0% | 380.0 | 2.6 | 40.0% | 260.0 | 22.3% |
| box elder | *Acer negundo* | 0.7 | 20.0% | 140.0 | 0.1 | 10.0% | 60.0 | 0.0 | 0.0% | 0.0 | 5.3 | 50.0% | 260.0 | 4.1 | 40.0% | 180.0 | 4.5 | 60.0% | 340.0 | 2.6 | 40.0% | 120.0 | 4.7 | 60.0% | 440.0 | 17.4% |
| red mulberry | *Morus rubra* | 2.2 | 70.0% | 920.0 | 6.4 | 30.0% | 160.0 | 1.1 | 70.0% | 300.0 | 0.1 | 10.0% | 60.0 | 0.2 | 20.0% | 100.0 | 0.4 | 30.0% | 100.0 | 0.5 | 50.0% | 180.0 | 0.0 | 0.0% | 0.0 | 16.0% |
| black willow | *Salix nigra* | 0.0 | 0.0% | 0.0 | 7.1 | 50.0% | 280.0 | 0.0 | 0.0% | 0.0 | 12.1 | 50.0% | 200.0 | 0.0 | 0.0% | 0.0 | 1.6 | 10.0% | 40.0 | 5.3 | 10.0% | 60.0 | 10.2 | 60.0% | 200.0 | 15.4% |
| green ash | *Fraxinus pennsylvanica* | 0.0 | 0.0% | 0.0 | 3.9 | 10.0% | 20.0 | 8.1 | 20.0% | 40.0 | 6.0 | 10.0% | 20.0 | 7.5 | 20.0% | 40.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 7.7% |
| eastern cottonwood | *Populus deltoides* | 0.0 | 0.0% | 0.0 | 0.5 | 20.0% | 40.0 | 1.5 | 30.0% | 60.0 | 0.3 | 10.0% | 80.0 | 0.1 | 10.0% | 40.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 2.9% |
| sycamore | *Platanus occidentalis* | 0.0 | 0.0% | 0.0 | 1.3 | 10.0% | 40.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 1.0 | 30.0% | 60.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 1.8% |
| rough dogwood | *Cornus drummondii* | 0.0 | 0.0% | 0.0 | 6.1 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 1.7% |
| hackberry | *Celtis laevigata* | 0.0 | 10.0% | 20.0 | 0.1 | 10.0% | 40.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.2 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 1.1% |
| soap berry | *Saponicus saponaria* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.2 | 10.0% | 60.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.5% |
| honey locust | *Gleditsia triacanthos* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.1 | 10.0% | 40.0 | 0.0 | 0.0% | 0.0 | 0.4% |
| deciduous holly | *Ilex decidua* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.3 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.4% |
| American elm | *Ulmus americana* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.3% |
| | **Live totals:** | 13.1 | NA | 1,800.0 | 26.0 | NA | 700.0 | 15.3 | NA | 620.0 | 25.7 | NA | 1,020.0 | 18.6 | NA | 740.0 | 14.0 | NA | 1,200.0 | 13.6 | NA | 1,060.0 | 17.5 | NA | 900.0 | 100.0% |
| **Snags:** | | | | | | | | | | | | | | | | | | | | | | | | | | |
| box elder | *Acer negundo* | 2.2 | 40.0% | 120.0 | 0.1 | 10.0% | 40.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.1 | 20.0% | 100.0 | 2.0 | 40.0% | 100.0 | 0.3 | 20.0% | 60.0 | 32.6% |
| eastern cottonwood | *Populus deltoides* | 2.4 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 2.3 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 15.1 | 20.0% | 40.0 | 0.0 | 0.0% | 0.0 | 2.3 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 28.1% |
| rough dogwood | *Cornus drummondii* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.6 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 1.9 | 50.0% | 220.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 18.5% |
| slippery elm | *Ulmus rubra* | 0.1 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 3.1 | 30.0% | 80.0 | 0.0 | 10.0% | 20.0 | 0.6 | 10.0% | 40.0 | 0.1 | 20.0% | 40.0 | 0.0 | 0.0% | 0.0 | 17.3% |
| green ash | *Fraxinus pennsylvanica* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.6 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 1.9% |
| black willow | *Salix nigra* | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.3 | 10.0% | 20.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 0.0 | 0.0% | 0.0 | 1.6% |
| | **Snag totals:** | 4.7 | NA | 160.0 | 0.1 | NA | 40.0 | 3.4 | NA | 60.0 | 3.5 | NA | 100.0 | 15.1 | NA | 60.0 | 2.7 | NA | 360.0 | 4.4 | NA | 160.0 | 0.3 | NA | 60.0 | 100.0% |

* Basal Area (BA) = $m^2$/ha, Frequency (Frq) = per 5-m increments, Density (Den) = trees/ha, NA = Not applicable
% Relative value = (Species total/All-species total)*100, % Relative Importance = Average (% Relative basal area, % Relative frequency, % Relative density)

Table 5 Percent Snag Versus Live Tree Layer Data
Hearne, Gonzales, Nursery, and Victoria Study Sites

**Hearne:**

| **Tree Species** | | **% Snag/Live Basal Area** |
|---|---|---|
| green ash | *Fraxinus pennsylvanica* | 148.36% |
| eastern cottonwood | *Populus deltoides* | 86.08% |
| roughleaf dogwood | *Cornus drummondii* | 23.46% |
| box elder | *Acer negundo* | 21.19% |
| slippery elm | *Ulmus rubra* | 16.13% |
| black willow | *Salix nigra* | 0.87% |
| | **All Species:** | 23.75% |

**Gonzales:**

| **Tree Species** | | **% Snag/Live Basal Area** |
|---|---|---|
| box elder | *Acer negundo* | 4.00% |
| hackberry | *Celtis laevigata* | 1.99% |
| cedar elm | *Ulmus crassifolia* | 0.57% |
| sandpaper tree | *Ehretia anacua* | 0.45% |
| unknown | *unknown* | NA |
| | **All Species:** | 0.68% |

**Nursery:**

| **Tree Species** | | **% Snag/Live Basal Area** |
|---|---|---|
| Mexican buckeye | *Ungnadia speciosa* | 159.96% |
| red mulberry | *Morus rubra* | 13.97% |
| box elder | *Acer negundo* | 4.80% |
| sycamore | *Platanus occidentalis* | 0.56% |
| unknown | *unknown* | NA |
| | **All Species:** | 2.05% |

**Victoria:**

| **Tree Species** | | **% Snag/Live Basal Area** |
|---|---|---|
| hackberry | *Celtis laevigata* | 35.78% |
| cedar elm | *Ulmus crassifolia* | 1.07% |
| unknown | *unknown* | NA |
| honey locust | *Gleditsia triacanthos* | NA |
| | **All Species:** | 14.72% |

Table 6 Forest Canopy Cover Data
Hearne, Gonzales, Nursery, and Victoria Study Sites

| **Hearne:** | | **Gonzales:** | | **Nursery:** | | **Victoria:** | |
|---|---|---|---|---|---|---|---|
| Transect: | Average % Canopy | Transect: | Average % Canopy | Transect: | Average % Canopy | Transect: | Average % Canopy |
| 2 | NA | 1 | 77.64% | 1A | 96.56% | 1 | 88.56% |
| 5A | 66.98% | 2 | 87.85% | 1B | 94.28% | 2 | 87.00% |
| 5B | 64.77% | 3A | 75.43% | 1C | 95.26% | 4 | 93.63% |
| 9A | 14.59% | 3B | 76.99% | 2A | 97.53% | 6 | 91.68% |
| 9B | 23.04% | 4A | 78.29% | 2B | 92.53% | 7A | 95.91% |
| 10 | 25.90% | 4B | 76.47% | 2C | 92.27% | 7B | 80.50% |
| 12 | 83.62% | 4C | 69.97% | 3A | 77.58% | 11A | 97.60% |
| 13 | NA | NA | NA | 3B | 85.57% | 11B | 92.40% |
| Site Average: | 46.48% | Site Average: | 77.52% | Site Average: | 91.45% | Site Average: | 90.91% |
| | | | | | | **Four-Site Average:** | **71.82%** |

Table 7.1 Summary of Shrub Layer Field Data
Victoria Study Site

| Common Name | Scientific Name | Cover | Frequency | % Relative Values | | |
|---|---|---|---|---|---|---|
| | | | | Cover | Frequency | Importance |
| hardy orange | *Poncirus trifoliata* | 5.7% | 15.0% | 39.6% | 34.3% | 36.9% |
| box elder | *Acer negundo* | 2.8% | 6.3% | 19.8% | 14.3% | 17.0% |
| sandpaper tree | *Ehretia anacua* | 2.4% | 7.5% | 16.7% | 17.1% | 16.9% |
| Chinese tallow | *Sapium sebiferum* | 1.5% | 5.0% | 10.5% | 11.4% | 11.0% |
| sand-bar willow | *Salix interior* | 0.7% | 2.5% | 4.7% | 5.7% | 5.2% |
| deciduous holly | *Ilex decidua* | 0.5% | 2.5% | 3.3% | 5.7% | 4.5% |
| wingleaf soapberry | *Sapindus saponaria* | 0.4% | 2.5% | 3.0% | 5.7% | 4.3% |
| osage orange | *Maclura pomifera* | 0.4% | 2.5% | 2.5% | 5.7% | 4.1% |
| | **Total** | 14.4% | NA | 100.0% | 100.0% | 100.0% |

Table 7.2 Summary of Shrub Layer Field Data
Nursery Study Site

| Common Name | Scientific Name | Cover | Frequency | % Relative Values | | |
|---|---|---|---|---|---|---|
| | | | | Cover | Frequency | Importance |
| box elder | *Acer negundo* | 12.6% | 17.5% | 60.2% | 35.0% | 47.6% |
| Mexican buckeye | *Ungnadia speciosa* | 1.9% | 7.5% | 9.3% | 15.0% | 12.1% |
| pecan | *Carya illinoensis* | 1.6% | 6.3% | 7.6% | 12.5% | 10.0% |
| red buckeye | *Aesculus pavia* | 1.6% | 5.0% | 7.6% | 10.0% | 8.8% |
| cedar elm | *Ulmus crassifolia* | 0.9% | 3.8% | 4.1% | 7.5% | 5.8% |
| sycamore | *Platanus occidentalis* | 0.6% | 2.5% | 2.8% | 5.0% | 3.9% |
| deciduous holly | *Ilex decidua* | 0.5% | 2.5% | 2.5% | 5.0% | 3.7% |
| chinaberry | *Melia azedarach* | 0.7% | 1.3% | 3.1% | 2.5% | 2.8% |
| sandpaper tree | *Ehretia anacua* | 0.3% | 1.3% | 1.6% | 2.5% | 2.0% |
| green ash | *Fraxinus pennsylvanica* | 0.3% | 1.3% | 1.2% | 2.5% | 1.8% |
| wafer ash | *Ptelea trifoliata* | 0.0% | 1.3% | 0.2% | 2.5% | 1.3% |
| **Total** | | 20.9% | 50.0% | 100.0% | 100.0% | 100.0% |

Table 7.3 Summary of Shrub Layer Field Data
Gonzales Study Site

| Common Name | Scientific Name | Cover | Frequency | % Relative Values | | |
|---|---|---|---|---|---|---|
| | | | | Cover | Frequency | Importance |
| cedar elm | *Ulmus crassifolia* | 2.7% | 18.6% | 20.8% | 37.1% | 28.9% |
| hackberry | *Celtis laevigata* | 4.2% | 7.1% | 32.9% | 14.3% | 23.6% |
| box elder | *Acer negundo* | 2.3% | 8.6% | 18.3% | 17.1% | 17.7% |
| slippery elm | *Ulmus rubra* | 1.1% | 4.3% | 8.8% | 8.6% | 8.7% |
| hawthorn | *Crataegus sp.* | 1.0% | 4.3% | 7.5% | 8.6% | 8.0% |
| pecan | *Carya illinoensis* | 0.8% | 1.4% | 5.9% | 2.9% | 4.4% |
| sandpaper tree | *Ehretia anacua* | 0.4% | 2.9% | 3.0% | 5.7% | 4.4% |
| red buckeye | *Aesculus pavia* | 0.4% | 2.9% | 3.0% | 5.7% | 4.3% |
| **Total** | | 12.8% | 50.0% | 100.0% | 100.0% | 100.0% |

Table 7.4 Summary of Shrub Layer Field Data
Hearne Study Site

| Common Name | Scientific Name | Cover | Frequency | % Relative Values | | |
|---|---|---|---|---|---|---|
| | | | | Cover | Frequency | Importance |
| roughleaf dogwood | *Cornus drummondii* | 23.38% | 51.25% | 48.00% | 38.32% | 43.16% |
| box elder | *Acer negundo* | 7.93% | 25.00% | 16.27% | 18.69% | 17.48% |
| slippery elm | *Ulmus rubra* | 5.49% | 15.00% | 11.27% | 11.21% | 11.24% |
| Virginia creeper | *Parthenocissus quinquefolia* | 2.03% | 6.25% | 4.16% | 4.67% | 4.42% |
| hackberry | *Celtis laevigata* | 1.83% | 6.25% | 3.75% | 4.67% | 4.21% |
| chinaberry | *Melia azedarach* | 2.07% | 5.00% | 4.24% | 3.74% | 3.99% |
| trumpet creeper | *Campsis radicans* | 1.29% | 6.25% | 2.65% | 4.67% | 3.66% |
| pecan | *Carya illinoensis* | 1.68% | 3.75% | 3.44% | 2.80% | 3.12% |
| green ash | *Fraxinus pennsylvanica* | 0.88% | 2.50% | 1.80% | 1.87% | 1.83% |
| black willow | *Salix nigra* | 0.70% | 2.50% | 1.43% | 1.87% | 1.65% |
| American elm | *Ulmus americana* | 0.29% | 2.50% | 0.59% | 1.87% | 1.23% |
| honey locust | *Gleditsia triacanthos* | 0.19% | 2.50% | 0.38% | 1.87% | 1.13% |
| cedar elm | *Ulmus crassifolia* | 0.56% | 1.25% | 1.15% | 0.93% | 1.04% |
| American beautyberry | *Callicarpa americana* | 0.30% | 1.25% | 0.62% | 0.93% | 0.78% |
| snowberry | *Symphoricarpos spp.* | 0.08% | 1.25% | 0.15% | 0.93% | 0.54% |
| poison ivy | *Toxicodendron radicans* | 0.05% | 1.25% | 0.10% | 0.93% | 0.52% |
| | **Total** | 48.71% | NA | 100.00% | 100.00% | 100.00% |

Table 8.1 Summary of Shrub Layer Transect Data
Victoria Study Site

| Common Name | Scientific Name | 1 | | 2 | | 4 | | 6 | | 7A | | 7B | | 11A | | 11B | | Site Averages | | % Relative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Importance |
| hardy orange | *Poncirus trifoliata* | 31.5% | 60.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 6.4% | 20.0% | 7.6% | 40.0% | 0.0% | 0.0% | 0.0% | 0.0% | 5.7% | 15.0% | 36.9% |
| box elder | *Acer negundo* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 2.1% | 10.0% | 0.0% | 0.0% | 6.8% | 20.0% | 13.8% | 20.0% | 2.8% | 6.3% | 17.0% |
| sandpaper tree | *Ehretia anacua* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 4.5% | 20.0% | 5.6% | 20.0% | 0.0% | 0.0% | 0.0% | 0.0% | 9.1% | 20.0% | 2.4% | 7.5% | 16.9% |
| Chinese tallow | *Sapium sebiferum* | 0.0% | 0.0% | 1.2% | 10.0% | 3.5% | 20.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 7.3% | 10.0% | 0.0% | 0.0% | 1.5% | 5.0% | 11.0% |
| sand-bar willow | *Salix interior* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 5.4% | 20.0% | 0.0% | 0.0% | 0.7% | 2.5% | 5.2% |
| deciduous holly | *Ilex decidua* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 3.8% | 20.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.5% | 2.5% | 4.5% |
| wingleaf soapberry | *Sapindus saponaria* | 3.4% | 20.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.4% | 2.5% | 4.3% |
| osage orange | *Maclura pomifera* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 2.9% | 20.0% | 0.0% | 0.0% | 0.4% | 2.5% | 4.1% |
| | **Total** | 34.9% | NA | 1.2% | NA | 3.5% | NA | 8.3% | NA | 14.1% | NA | 7.6% | NA | 22.4% | NA | 22.9% | NA | 14.4% | NA | 100.0% |

Table 8.2 Summary of Shrub Layer Transect Data
Nursery Study Site

| Common Name | Scientific Name | 1A | | 1B | | 1C | | 2A | | 2B | | 2C | | 3A | | 3B | | Site Averages | | % Relative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Importance |
| box elder | *Acer negundo* | 55.8% | 80.0% | 0.0% | 0.0% | 0.0% | 0.0% | 40.5% | 50.0% | 0.0% | 0.0% | 0.0% | 0.0% | 4.1% | 10.0% | 0.0% | 0.0% | 12.6% | 17.5% | 47.6% |
| Mexican buckeye | *Ungnadia speciosa* | 0.0% | 0.0% | 0.0% | 0.0% | 9.4% | 40.0% | 0.0% | 0.0% | 0.0% | 0.0% | 6.1% | 20.0% | 0.0% | 0.0% | 0.0% | 0.0% | 1.9% | 7.5% | 12.1% |
| pecan | *Carrya illinoensis* | 1.2% | 10.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 11.4% | 40.0% | 1.6% | 6.3% | 10.0% |
| red buckeye | *Aesculus pavia* | 0.0% | 0.0% | 5.6% | 20.0% | 7.0% | 20.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 1.6% | 5.0% | 8.8% |
| cedar elm | *Ulmus crassifolia* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 6.9% | 30.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.9% | 3.8% | 5.8% |
| sycamore | *Platanus occidentalis* | 4.7% | 20.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.6% | 2.5% | 3.9% |
| deciduous holly | *Ilex decidua* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 4.1% | 20.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.5% | 2.5% | 3.7% |
| chinaberry | *Melia azedarach* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 5.2% | 10.0% | 0.0% | 0.0% | 0.7% | 1.3% | 2.8% |
| sandpaper tree | *Ehretia anacua* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 2.6% | 10.0% | 0.3% | 1.3% | 2.0% |
| green ash | *Fraxinus pennsylvanica* | 2.0% | 10.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.3% | 1.3% | 1.8% |
| wafer ash | *Ptelea trifoliata* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.3% | 10.0% | 0.0% | 0.0% | 0.0% | 1.3% | 1.3% |
| | **Total** | 63.7% | NA | 5.6% | NA | 16.4% | NA | 40.5% | NA | 0.0% | NA | 17.0% | NA | 9.6% | NA | 14.0% | NA | 20.9% | NA | 100.0% |

Table 8.3 Summary of Shrub Layer Transect Data
Gonzales Study Site

| Common Name | Scientific Name | 1 | | 2 | | 3A | | 3B | | 4A | | 4B | | 4C | | Site Averages | | % Relative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Importance |
| cedar elm | *Ulmus crassifolia* | 0.0% | 0.0% | 8.6% | 50.0% | 3.0% | 10.0% | 2.4% | 20.0% | 0.7% | 10.0% | 1.7% | 10.0% | 2.3% | 30.0% | 2.7% | 18.6% | 28.9% |
| hackberry | *Celtis laevigata* | 1.7% | 10.0% | 4.5% | 20.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 23.3% | 20.0% | 0.0% | 0.0% | 4.2% | 7.1% | 23.6% |
| box elder | *Acer negundo* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 16.4% | 60.0% | 0.0% | 0.0% | 0.0% | 0.0% | 2.3% | 8.6% | 17.7% |
| slippery elm | *Ulmus rubra* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 7.9% | 30.0% | 0.0% | 0.0% | 0.0% | 0.0% | 1.1% | 4.3% | 8.7% |
| hawthorn | *Crataegus sp.* | 0.0% | 0.0% | 6.7% | 30.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 1.0% | 4.3% | 8.0% |
| pecan | *Carrya illinoensis* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 5.3% | 10.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.8% | 1.4% | 4.4% |
| sandpaper tree | *Ehretia anacua* | 0.0% | 0.0% | 0.0% | 0.0% | 2.3% | 10.0% | 0.4% | 10.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.4% | 2.9% | 4.4% |
| red buckeye | *Aesculus pavia* | 2.7% | 20.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.4% | 2.9% | 4.3% |
| | **Total** | 4.4% | NA | 19.9% | NA | 5.3% | NA | 2.8% | NA | 30.3% | NA | 25.0% | NA | 2.3% | NA | 12.8% | NA | 100.0% |

Table 8.4 Summary of Shrub Layer Transect Data
Hearne Study Site

| Common Name | Scientific Name | 2 | | 5A | | 5B | | 9A | | 9B | | 10 | | 12 | | 13 | | Site Averages | | % Relative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Importance |
| roughleaf dogwood | *Cornus drummondii* | 52.7% | 90.0% | 10.4% | 30.0% | 24.6% | 70.0% | 0.0% | 0.0% | 23.0% | 60.0% | 26.2% | 60.0% | 33.2% | 60.0% | 16.9% | 40.0% | 23.4% | 51.3% | 43.2% |
| box elder | *Acer negundo* | 4.0% | 10.0% | 4.7% | 40.0% | 0.0% | 0.0% | 19.0% | 30.0% | 3.4% | 10.0% | 8.5% | 30.0% | 6.1% | 20.0% | 17.7% | 60.0% | 7.9% | 25.0% | 17.5% |
| slippery elm | *Ulmus rubra* | 7.4% | 20.0% | 0.0% | 0.0% | 0.0% | 0.0% | 18.0% | 30.0% | 0.5% | 10.0% | 1.4% | 10.0% | 14.0% | 40.0% | 2.6% | 10.0% | 5.5% | 15.0% | 11.2% |
| Virginia creeper | *Parthenocissus quinquefolia* | 0.0% | 0.0% | 6.0% | 10.0% | 10.2% | 40.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 2.0% | 6.3% | 4.4% |
| hackberry | *Celtis laevigata* | 5.6% | 20.0% | 0.0% | 0.0% | 2.6% | 10.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 5.4% | 10.0% | 1.0% | 10.0% | 1.8% | 6.3% | 4.2% |
| chinaberry | *Melia azedarach* | 0.0% | 0.0% | 8.5% | 30.0% | 0.0% | 0.0% | 8.0% | 10.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 2.1% | 5.0% | 4.0% |
| trumpet creeper | *Campsis radicans* | 4.7% | 20.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 2.2% | 10.0% | 3.4% | 20.0% | 1.3% | 6.3% | 3.7% |
| pecan | *Carrya illinoensis* | 0.0% | 0.0% | 4.4% | 10.0% | 0.0% | 0.0% | 0.0% | 0.0% | 9.0% | 20.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 1.7% | 3.8% | 3.1% |
| green ash | *Fraxinus pennsylvanica* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 2.0% | 10.0% | 0.0% | 0.0% | 0.0% | 0.0% | 5.0% | 10.0% | 0.0% | 0.0% | 0.9% | 2.5% | 1.8% |
| black willow | *Salix nigra* | 0.0% | 0.0% | 3.3% | 10.0% | 0.0% | 0.0% | 2.3% | 10.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.7% | 2.5% | 1.7% |
| American elm | *Ulmus americana* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 2.3% | 20.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.3% | 2.5% | 1.2% |
| honey locust | *Gleditsia triacanthos* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.6% | 10.0% | 0.0% | 0.0% | 0.9% | 10.0% | 0.0% | 0.0% | 0.2% | 2.5% | 1.1% |
| cedar elm | *Ulmus crassifolia* | 0.0% | 0.0% | 4.5% | 10.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.6% | 1.3% | 1.0% |
| American beautyberry | *Callicarpa americana* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 2.4% | 10.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.3% | 1.3% | 0.8% |
| snowberry | *Symphoricarpos spp.* | 0.0% | 0.0% | 0.6% | 10.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.1% | 1.3% | 0.5% |
| poison ivy | *Toxicodendron radicans* | 0.0% | 0.0% | 0.4% | 10.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.1% | 1.3% | 0.5% |
| | **Total** | 74.4% | NA | 42.8% | NA | 37.4% | NA | 49.3% | NA | 38.9% | NA | 38.4% | NA | 66.8% | NA | 41.6% | NA | 48.7% | NA | 100.0% |

Table 9.1 Summary of Herb Layer Field Data
Victoria Study Site

| Common Name | Scientific Name | Cover | Frequency | % Relative Values | | |
|---|---|---|---|---|---|---|
| | | | | **Cover** | **Frequency** | **Importance** |
| frostweed | *Verbesina virginica* | 180.39% | 31.37% | 36.20% | 31.45% | 33.83% |
| inland sea oats | *Chasmanthium latifolium* | 136.27% | 23.53% | 27.35% | 23.59% | 25.47% |
| unknown | *unknown* | 53.92% | 9.07% | 10.82% | 9.09% | 9.96% |
| caric sedge | *Carex sp.* | 40.93% | 9.80% | 8.21% | 9.83% | 9.02% |
| Virginia wild rye | *Elymus virginicus* | 36.27% | 10.54% | 7.28% | 10.57% | 8.92% |
| peppervine | *Ampelopsis arborea* | 10.29% | 1.96% | 2.07% | 1.97% | 2.02% |
| Macartney rose | *Rosa bracteata* | 8.09% | 2.21% | 1.62% | 2.21% | 1.92% |
| switchgrass | *Panicum virgatum* | 10.29% | 1.72% | 2.07% | 1.72% | 1.89% |
| sandpaper tree | *Ehretia anacua* | 6.13% | 1.72% | 1.23% | 1.72% | 1.47% |
| trifoliate orange | *Poncirus trifoliata* | 6.62% | 1.47% | 1.33% | 1.47% | 1.40% |
| slender yellow woodsorrel | *Oxalis dillenii* | 1.47% | 2.45% | 0.30% | 2.46% | 1.38% |
| mustang grape | *Vitis mustangensis* | 3.19% | 1.47% | 0.64% | 1.47% | 1.06% |
| saw greenbrier | *Smilax bona-nox* | 0.74% | 0.74% | 0.15% | 0.74% | 0.44% |
| Virginia creeper | *Parthenocissus quinquefolia* | 1.23% | 0.49% | 0.25% | 0.49% | 0.37% |
| Wright morning-glory | *Ipomoea wrightii* | 1.23% | 0.49% | 0.25% | 0.49% | 0.37% |
| basketgrass | *Oplismenus hirtellus* | 0.98% | 0.49% | 0.20% | 0.49% | 0.34% |
| cat-claw vine | *Macfadyena unguis-cati* | 0.25% | 0.25% | 0.05% | 0.25% | 0.15% |
| | **Total** | 498.28% | NA | 100.00% | 100.00% | 100.00% |

Table 9.2 Summary of Herb Layer Field Data
Nursery Study Site

| Common Name | Scientific Name | Cover | Frequency | % Relative Values | | |
|---|---|---|---|---|---|---|
| | | | | Cover | Frequency | Importance |
| frostweed | *Verbesina virginica* | 202.70% | 39.22% | 52.91% | 41.67% | 47.29% |
| basketgrass | *Oplismenus hirtellus* | 42.89% | 13.24% | 11.20% | 14.06% | 12.63% |
| caric sedge | *Carex sp.* | 29.41% | 10.54% | 7.68% | 11.20% | 9.44% |
| Virginia wild rye | *Elymus virginicus* | 25.74% | 8.58% | 6.72% | 9.11% | 7.92% |
| unknown | *unknown* | 10.54% | 4.17% | 2.75% | 4.43% | 3.59% |
| sandpaper tree | *Ehretia anacua* | 8.33% | 2.94% | 2.18% | 3.13% | 2.65% |
| box elder | *Acer negundo* | 10.78% | 2.21% | 2.82% | 2.34% | 2.58% |
| inland sea oats | *Chasmanthium latifolium* | 9.07% | 2.21% | 2.37% | 2.34% | 2.36% |
| Canadian goldenrod | *Solidago altissima* | 10.29% | 1.72% | 2.69% | 1.82% | 2.26% |
| switchgrass | *Panicum virgatum* | 7.84% | 1.96% | 2.05% | 2.08% | 2.07% |
| castor bean | *Ricinus communis* | 4.41% | 1.72% | 1.15% | 1.82% | 1.49% |
| rustyseed paspalum | *Paspalum langei* | 5.39% | 1.23% | 1.41% | 1.30% | 1.35% |
| red buckeye | *Aesculus pavia* | 6.13% | 0.98% | 1.60% | 1.04% | 1.32% |
| Texas skeleton weed | *Lygodesmia texana* | 4.41% | 0.74% | 1.15% | 0.78% | 0.97% |
| cedar elm | *Ulmus crassifolia* | 2.21% | 0.74% | 0.58% | 0.78% | 0.68% |
| Carolina snailseed | *Cocculus carolinus* | 1.23% | 0.49% | 0.32% | 0.52% | 0.42% |
| horseherb | *Calyptocarpus vialis* | 0.49% | 0.49% | 0.13% | 0.52% | 0.32% |
| pecan | *Carya illinoinensis* | 0.49% | 0.25% | 0.13% | 0.26% | 0.19% |
| roughleaf dogwood | *Cornus drummondii* | 0.25% | 0.25% | 0.06% | 0.26% | 0.16% |
| slender yellow woodsorrel | *Oxalis dillenii* | 0.25% | 0.25% | 0.06% | 0.26% | 0.16% |
| mustang grape | *Vitis mustangensis* | 0.25% | 0.25% | 0.06% | 0.26% | 0.16% |
| | **Total** | 383.09% | NA | 100.00% | 100.00% | 100.00% |

Table 9.3 Summary of Herb Layer Field Data
Gonzales Study Site

| Common Name | Scientific Name | Cover | Frequency | % Relative Values | | |
|---|---|---|---|---|---|---|
| | | | | Cover | Frequency | Importance |
| basketgrass | *Oplismenus hirtellus* | 47.62% | 24.37% | 27.16% | 25.74% | 26.45% |
| horseherb | *Calyptocarpus vialis* | 36.69% | 15.97% | 20.93% | 16.86% | 18.90% |
| unknown | *NA* | 28.29% | 17.93% | 16.13% | 18.93% | 17.53% |
| Turk's cap | *Malvaviscus arboreus var. drummondii* | 17.37% | 9.52% | 9.90% | 10.06% | 9.98% |
| Virginia wild rye | *Elymus virginicus* | 13.17% | 8.68% | 7.51% | 9.17% | 8.34% |
| frostweed | *Verbesina virginica* | 13.73% | 6.16% | 7.83% | 6.51% | 7.17% |
| sedge | *Carex sp.* | 4.48% | 3.64% | 2.56% | 3.85% | 3.20% |
| sandpaper tree | *Ehretia anacua* | 4.48% | 2.80% | 2.56% | 2.96% | 2.76% |
| red buckeye | *Aesculus pavia* | 2.24% | 1.68% | 1.28% | 1.78% | 1.53% |
| cat-claw vine | *Macfadyena unguis-cati* | 1.96% | 0.56% | 1.12% | 0.59% | 0.85% |
| rustyseed paspalum | *Paspalum langei* | 1.40% | 0.84% | 0.80% | 0.89% | 0.84% |
| dewberry | *Rubus trivialis* | 1.12% | 0.56% | 0.64% | 0.59% | 0.62% |
| Pennsylvania cucumber plant | *Parietaria pensylvanica* | 0.84% | 0.56% | 0.48% | 0.59% | 0.54% |
| cedar elm | *Ulmus crassifolia* | 0.84% | 0.56% | 0.48% | 0.59% | 0.54% |
| giant ragweed | *Ambrosia trifida* | 0.56% | 0.28% | 0.32% | 0.30% | 0.31% |
| pigeonberry | *Rivina humilis* | 0.28% | 0.28% | 0.16% | 0.30% | 0.23% |
| chinaberry | *Melia azedarach* | 0.28% | 0.28% | 0.16% | 0.30% | 0.23% |
| | **Total** | 175.35% | 94.68% | 100.00% | 100.00% | 100.00% |

Table 9.4 Summary of Herb Layer Field Data
Hearne Study Site

| Common Name | Scientific Name | Cover | Frequency | % Relative Values | | |
|---|---|---|---|---|---|---|
| | | | | Cover | Frequency | Importance |
| Virginia wild rye | *Elymus virginicus* | 30.64% | 15.20% | 47.35% | 51.58% | 49.46% |
| inland sea oats | *Chasmanthium latifolium* | 11.27% | 2.94% | 17.42% | 9.98% | 13.70% |
| trumpet creeper | *Campsis radicans* | 3.68% | 1.72% | 5.68% | 5.82% | 5.75% |
| mist flower | *Eupatorium colestinum* | 3.92% | 1.47% | 6.06% | 4.99% | 5.53% |
| spiny chloracantha | *Chloracantha spinosa* | 2.94% | 0.74% | 4.55% | 2.50% | 3.52% |
| caric sedge | *Carex sp.* | 1.72% | 1.23% | 2.65% | 4.16% | 3.41% |
| box elder | *Acer negundo* | 2.21% | 0.74% | 3.41% | 2.50% | 2.95% |
| spiny aster | *Xanthium spinosum* | 0.98% | 0.74% | 1.52% | 2.50% | 2.01% |
| bristly greenbriar | *Smilax tamnioides* | 1.47% | 0.49% | 2.27% | 1.66% | 1.97% |
| giant ragweed | *Ambrosia trifida* | 0.98% | 0.49% | 1.52% | 1.66% | 1.59% |
| slippery elm | *Ulmus rubra* | 0.74% | 0.49% | 1.14% | 1.66% | 1.40% |
| inland sea oats | *Chasmanthium latifolium* | 0.49% | 0.49% | 0.76% | 1.66% | 1.21% |
| saw greenbrier | *Smilax bona-nox* | 0.49% | 0.49% | 0.76% | 1.66% | 1.21% |
| unknown | *NA* | 0.49% | 0.49% | 0.76% | 1.66% | 1.21% |
| roughleaf dogwood | *Cornus drummondii* | 0.74% | 0.29% | 1.14% | 1.00% | 1.07% |
| soapberry | *Saponicus saponaria* | 0.49% | 0.25% | 0.76% | 0.83% | 0.79% |
| peppervine | *Ampelopsis arborea* | 0.49% | 0.25% | 0.76% | 0.83% | 0.79% |
| hackberry | *Celtis laevigata* | 0.25% | 0.25% | 0.38% | 0.83% | 0.61% |
| pink boneset | *Eupatorium incarnatum* | 0.25% | 0.25% | 0.38% | 0.83% | 0.61% |
| chinaberry | *Melia azedarach* | 0.25% | 0.25% | 0.38% | 0.83% | 0.61% |
| green ash | *Fraxinus pennsylvanica* | 0.25% | 0.25% | 0.38% | 0.83% | 0.61% |
| | **Total** | 64.71% | NA | 100.00% | 100.00% | 100.00% |

Table 10.1 Summary of Herb Layer Transect Data
Victoria Study Site

| Common Name | Scientific Name | 1 | | 2 | | 4 | | 6 | | 7A | | 7B | | 11A | | 11B | | Site Averages | | % Relative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Importance |
| frostweed | *Verbesina virginica* | 0.0% | 0.0% | 123.5% | 19.6% | 0.0% | 0.0% | 70.6% | 17.6% | 233.3% | 52.9% | 423.5% | 70.6% | 331.4% | 39.2% | 260.8% | 51.0% | 180.4% | 31.4% | 33.8% |
| inland sea oats | *Chasmanthium latifolium* | 215.7% | 39.2% | 178.4% | 37.3% | 178.4% | 27.5% | 431.4% | 54.9% | 37.3% | 9.8% | 0.0% | 0.0% | 0.0% | 0.0% | 49.0% | 19.6% | 136.3% | 23.5% | 25.5% |
| unknown | *unknown* | 72.5% | 15.7% | 74.5% | 13.7% | 0.0% | 0.0% | 13.7% | 3.9% | 213.7% | 17.6% | 0.0% | 0.0% | 0.0% | 0.0% | 56.9% | 21.6% | 53.9% | 9.1% | 10.0% |
| caric sedge | *Carex sp.* | 66.7% | 23.5% | 43.1% | 7.8% | 121.6% | 25.5% | 35.3% | 5.9% | 7.8% | 2.0% | 17.6% | 3.9% | 0.0% | 0.0% | 35.3% | 9.8% | 40.9% | 9.8% | 9.0% |
| Virginia wild rye | *Elymus virginicus* | 52.9% | 19.6% | 76.5% | 15.7% | 9.8% | 7.8% | 11.8% | 3.9% | 25.5% | 7.8% | 41.2% | 11.8% | 25.5% | 5.9% | 47.1% | 11.8% | 36.3% | 10.5% | 8.9% |
| peppervine | *Ampelopsis arborea* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 7.8% | 2.0% | 74.5% | 13.7% | 0.0% | 0.0% | 10.3% | 2.0% | 2.0% |
| Macartney rose | *Rosa bracteata* | 43.1% | 9.8% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 11.8% | 3.9% | 9.8% | 3.9% | 0.0% | 0.0% | 0.0% | 0.0% | 8.1% | 2.2% | 1.9% |
| switchgrass | *Panicum virgatum* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 25.5% | 2.0% | 9.8% | 2.0% | 47.1% | 9.8% | 0.0% | 0.0% | 10.3% | 1.7% | 1.9% |
| sandpaper tree | *Ehretia anacua* | 11.8% | 2.0% | 0.0% | 0.0% | 9.8% | 3.9% | 0.0% | 0.0% | 9.8% | 3.9% | 17.6% | 3.9% | 0.0% | 0.0% | 0.0% | 0.0% | 6.1% | 1.7% | 1.5% |
| trifoliate orange | *Poncirus trifoliata* | 31.4% | 7.8% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 11.8% | 2.0% | 9.8% | 2.0% | 0.0% | 0.0% | 0.0% | 0.0% | 6.6% | 1.5% | 1.4% |
| slender yellow woodsorrel | *Oxalis dillenii* | 11.8% | 19.6% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 1.5% | 2.5% | 1.4% |
| mustang grape | *Vitis mustangensis* | 7.8% | 3.9% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 17.6% | 7.8% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 3.2% | 1.5% | 1.1% |
| saw greenbrier | *Smilax bona-nox* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 2.0% | 2.0% | 3.9% | 3.9% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.7% | 0.7% | 0.4% |
| Virginia creeper | *Parthenocissus quinquefolia* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 9.8% | 3.9% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 1.2% | 0.5% | 0.4% |
| Wright morning-glory | *Ipomoea wrightii* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 5.9% | 2.0% | 3.9% | 2.0% | 0.0% | 0.0% | 0.0% | 0.0% | 1.2% | 0.5% | 0.4% |
| basketgrass | *Oplismenus hirtellus* | 0.0% | 0.0% | 0.0% | 0.0% | 7.8% | 3.9% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 1.0% | 0.5% | 0.3% |
| cat-claw vine | *Macfadyena unguis-cati* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 2.0% | 2.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.2% | 0.2% | 0.1% |
| | **Total** | 513.7% | NA | 496.1% | NA | 327.5% | NA | 576.5% | NA | 603.9% | NA | 541.2% | NA | 478.4% | NA | 449.0% | NA | 498.3% | NA | 100.0% |

Table 10.2 Summary of Herb Layer Transect Data
Nursery Study Site

| Common Name | Scientific Name | 1A | | 1B | | 1C | | 2A | | 2B | | 2C | | 3A | | 3B | | Site Averages | | % Relative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Importance |
| frostweed | *Verbesina virginica* | 80.4% | 17.6% | 227.5% | 37.3% | 9.8% | 3.9% | 105.9% | 25.5% | 0.0% | 0.0% | 329.4% | 70.6% | 423.5% | 80.4% | 445.1% | 78.4% | 202.7% | 39.2% | 47.3% |
| basketgrass | *Oplismenus hirtellus* | 49.0% | 17.6% | 143.1% | 49.0% | 0.0% | 0.0% | 102.0% | 15.7% | 0.0% | 0.0% | 5.9% | 2.0% | 43.1% | 21.6% | 0.0% | 0.0% | 42.9% | 13.2% | 12.6% |
| caric sedge | *Carex sp.* | 29.4% | 7.8% | 51.0% | 19.6% | 21.6% | 5.9% | 2.0% | 2.0% | 94.1% | 31.4% | 29.4% | 11.8% | 0.0% | 0.0% | 7.8% | 5.9% | 29.4% | 10.5% | 9.4% |
| Virginia wild rye | *Elymus virginicus* | 33.3% | 9.8% | 17.6% | 5.9% | 7.8% | 2.0% | 0.0% | 0.0% | 54.9% | 19.6% | 0.0% | 0.0% | 58.8% | 19.6% | 33.3% | 11.8% | 25.7% | 8.6% | 7.9% |
| unknown | *unknown* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 2.0% | 2.0% | 82.4% | 31.4% | 10.5% | 4.2% | 3.6% |
| sandpaper tree | *Ehretia anacua* | 0.0% | 0.0% | 11.8% | 3.9% | 47.1% | 15.7% | 0.0% | 0.0% | 0.0% | 0.0% | 7.8% | 3.9% | 0.0% | 0.0% | 0.0% | 0.0% | 8.3% | 2.9% | 2.7% |
| box elder | *Acer negundo* | 58.8% | 11.8% | 0.0% | 0.0% | 0.0% | 0.0% | 27.5% | 5.9% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 10.8% | 2.2% | 2.6% |
| inland sea oats | *Chasmanthium latifolium* | 0.0% | 0.0% | 72.5% | 17.6% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 9.1% | 2.2% | 2.4% |
| Canadian goldenrod | *Solidago altissima* | 68.6% | 7.8% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 13.7% | 5.9% | 0.0% | 0.0% | 10.3% | 1.7% | 2.3% |
| switchgrass | *Panicum virgatum* | 29.4% | 7.8% | 0.0% | 0.0% | 0.0% | 0.0% | 33.3% | 7.8% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 7.8% | 2.0% | 2.1% |
| castorbean | *Ricinus communis* | 21.6% | 7.8% | 0.0% | 0.0% | 0.0% | 0.0% | 13.7% | 5.9% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 4.4% | 1.7% | 1.5% |
| rustyseed paspalum | *Paspalum langei* | 0.0% | 0.0% | 31.4% | 7.8% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 11.8% | 2.0% | 0.0% | 0.0% | 5.4% | 1.2% | 1.4% |
| red buckeye | *Aesculus pavia* | 0.0% | 0.0% | 49.0% | 7.8% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 6.1% | 1.0% | 1.3% |
| Texas skeleton weed | *Lygodesmia texana* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 35.3% | 5.9% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 4.4% | 0.7% | 1.0% |
| cedar elm | *Ulmus crassifolia* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 5.9% | 2.0% | 3.9% | 2.0% | 0.0% | 0.0% | 7.8% | 2.0% | 2.2% | 0.7% | 0.7% |
| Carolina snailseed | *Cocculus carolinus* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 9.8% | 3.9% | 1.2% | 0.5% | 0.4% |
| horseherb | *Calyptocarpus vialis* | 0.0% | 0.0% | 3.9% | 3.9% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.5% | 0.5% | 0.3% |
| pecan | *Carya illinoinensis* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 3.9% | 2.0% | 0.5% | 0.2% | 0.2% |
| roughleaf dogwood | *Cornus drummondii* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 2.0% | 2.0% | 0.0% | 0.0% | 0.2% | 0.2% | 0.2% |
| slender yellow woodsorrel | *Oxalis dillenii* | 2.0% | 2.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.2% | 0.2% | 0.2% |
| mustang grape | *Vitis mustangensis* | 2.0% | 2.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.2% | 0.2% | 0.2% |
| | **Total** | 374.5% | NA | 607.8% | NA | 86.3% | NA | 319.6% | NA | 154.9% | NA | 376.5% | NA | 554.9% | NA | 590.2% | NA | 383.1% | NA | 100.0% |

Table 10.3 Summary of Herb Layer Transect Data
Gonzales Study Site

| Common Name | Scientific Name | 1 | | 2 | | 3A | | 3B | | 4A | | 4B | | 4C | | Site Averages | | % Relative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Importance |
| basketgrass | *Oplismenus hirtellus* | 0.0% | 0.0% | 31.4% | 23.5% | 49.0% | 33.3% | 84.3% | 47.1% | 0.0% | 0.0% | 0.0% | 0.0% | 168.6% | 66.7% | 47.6% | 24.4% | 26.4% |
| horseherb | *Calyptocarpus vialis* | 9.8% | 3.9% | 9.8% | 9.8% | 94.1% | 41.2% | 25.5% | 7.8% | 23.5% | 13.7% | 27.5% | 13.7% | 66.7% | 21.6% | 36.7% | 16.0% | 18.9% |
| unknown | *unknown* | 43.1% | 35.3% | 39.2% | 33.3% | 2.0% | 2.0% | 0.0% | 0.0% | 78.4% | 31.4% | 35.3% | 23.5% | 0.0% | 0.0% | 28.3% | 17.9% | 17.5% |
| Turk's cap | *Malvaviscus arboreus var. drummondii* | 23.5% | 15.7% | 5.9% | 3.9% | 17.6% | 11.8% | 39.2% | 15.7% | 5.9% | 3.9% | 5.9% | 5.9% | 23.5% | 9.8% | 17.4% | 9.5% | 10.0% |
| Virginia wild rye | *Elymus virginicus* | 21.6% | 15.7% | 5.9% | 5.9% | 11.8% | 7.8% | 7.8% | 5.9% | 11.8% | 3.9% | 7.8% | 3.9% | 25.5% | 17.6% | 13.2% | 8.7% | 8.3% |
| frostweed | *Verbesina virginica* | 35.3% | 13.7% | 0.0% | 0.0% | 2.0% | 2.0% | 0.0% | 0.0% | 13.7% | 9.8% | 41.2% | 15.7% | 3.9% | 2.0% | 13.7% | 6.2% | 7.2% |
| caric sedge | *Carex sp.* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 25.5% | 21.6% | 0.0% | 0.0% | 0.0% | 0.0% | 5.9% | 3.9% | 4.5% | 3.6% | 3.2% |
| sandpaper tree | *Ehretia anacua* | 15.7% | 5.9% | 0.0% | 0.0% | 0.0% | 0.0% | 3.9% | 3.9% | 0.0% | 0.0% | 3.9% | 3.9% | 7.8% | 5.9% | 4.5% | 2.8% | 2.8% |
| red buckeye | *Aesculus pavia* | 15.7% | 11.8% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 2.2% | 1.7% | 1.5% |
| cat-claw vine | *Macfadyena unguis-cati* | 0.0% | 0.0% | 0.0% | 0.0% | 13.7% | 3.9% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 2.0% | 0.6% | 0.9% |
| rustyseed paspalum | *Paspalum langei* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 9.8% | 5.9% | 1.4% | 0.8% | 0.8% |
| dewberry | *Rubus trivialis* | 3.9% | 2.0% | 0.0% | 0.0% | 3.9% | 2.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 1.1% | 0.6% | 0.6% |
| Pennsylvania cucumber plant | *Parietaria pensylvanica* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 5.9% | 3.9% | 0.8% | 0.6% | 0.5% |
| cedar elm | *Ulmus crassifolia* | 0.0% | 0.0% | 5.9% | 3.9% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.8% | 0.6% | 0.5% |
| giant ragweed | *Ambrosia trifida* | 0.0% | 0.0% | 0.0% | 0.0% | 3.9% | 2.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.6% | 0.3% | 0.3% |
| pigeonberry | *Rivina humilis* | 0.0% | 0.0% | 0.0% | 0.0% | 2.0% | 2.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.3% | 0.3% | 0.2% |
| chinaberry | *Melia azedarach* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 2.0% | 2.0% | 0.0% | 0.0% | 0.3% | 0.3% | 0.2% |
| | **Total** | 168.6% | NA | 98.0% | NA | 200.0% | NA | 186.3% | NA | 133.3% | NA | 123.5% | NA | 317.6% | NA | 175.4% | NA | 100.0% |

Table 10.4 Summary of Herb Layer Transect Data
Hearne Study Site

| Common Name | Scientific Name | 2 | | 5A | | 5B | | 9A | | 9B | | 10 | | 12 | | 13 | | Site Averages | | % Relative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Cov | Frq | Importance |
| Virginia wild rye | *Elymus virginicus* | 51.0% | 17.6% | 0.0% | 0.0% | 0.0% | 0.0% | 19.6% | 11.8% | 100.0% | 41.2% | 72.5% | 49.0% | 0.0% | 0.0% | 2.0% | 2.0% | 30.6% | 15.2% | 49.5% |
| inland sea oats | *Chasmanthium latifolium* | 0.0% | 0.0% | 78.4% | 17.6% | 11.8% | 5.9% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 11.3% | 2.9% | 13.7% |
| trumpet creeper | *Campsis radicans* | 23.5% | 7.8% | 0.0% | 0.0% | 0.0% | 0.0% | 2.0% | 2.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 3.9% | 3.9% | 3.7% | 1.7% | 5.8% |
| mist flower | *Eupatorium colestinum* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 31.4% | 11.8% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 3.9% | 1.5% | 5.5% |
| spiny chloracantha | *Chloracantha spinosa* | 0.0% | 0.0% | 23.5% | 5.9% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 2.9% | 0.7% | 3.5% |
| unknown sedge | | 0.0% | 0.0% | 9.8% | 5.9% | 2.0% | 2.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 2.0% | 2.0% | 0.0% | 0.0% | 1.7% | 1.2% | 3.4% |
| box elder | *Acer negundo* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 5.9% | 2.0% | 0.0% | 0.0% | 11.8% | 3.9% | 2.2% | 0.7% | 3.0% |
| spiny aster | *Xanthium spinosum* | 5.9% | 3.9% | 2.0% | 2.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 1.0% | 0.7% | 2.0% |
| bristly greenbriar | *Smilax tamnioides* | 0.0% | 0.0% | 7.8% | 2.0% | 0.0% | 0.0% | 0.0% | 0.0% | 3.9% | 2.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 1.5% | 0.5% | 2.0% |
| giant ragweed | *Ambrosia trifida* | 0.0% | 0.0% | 3.9% | 2.0% | 0.0% | 0.0% | 3.9% | 2.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 1.0% | 0.5% | 1.6% |
| slippery elm | *Ulmus rubra* | 2.0% | 2.0% | 3.9% | 2.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.7% | 0.5% | 1.4% |
| inland sea oats | *Chasmanthium latifolium* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 3.9% | 3.9% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.5% | 0.5% | 1.2% |
| saw greenbrier | *Smilax bona-nox* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 3.9% | 3.9% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.5% | 0.5% | 1.2% |
| unknown dicot | | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 3.9% | 3.9% | 0.0% | 0.0% | 0.5% | 0.5% | 1.2% |
| roughleaf dogwood | *Cornus drummondii* | 0.0% | 0.0% | 2.0% | 2.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 3.9% | 0.4% | 0.0% | 0.0% | 0.7% | 0.3% | 1.1% |
| soapberry | *Saponicus saponaria* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 3.9% | 2.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.5% | 0.2% | 0.8% |
| peppervine | *Ampelopsis arborea* | 0.0% | 0.0% | 3.9% | 2.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.5% | 0.2% | 0.8% |
| hackberry | *Celtis laevigata* | 0.0% | 0.0% | 0.0% | 0.0% | 2.0% | 2.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.2% | 0.2% | 0.6% |
| pink boneset | *Eupatorium incarnatum* | 0.0% | 0.0% | 2.0% | 2.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.2% | 0.2% | 0.6% |
| chinaberry | *Melia azedarach* | 0.0% | 0.0% | 2.0% | 2.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.2% | 0.2% | 0.6% |
| green ash | *Fraxinus pennsylvanica* | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 2.0% | 2.0% | 0.0% | 0.0% | 0.2% | 0.2% | 0.6% |
| | **Total** | 82.4% | NA | 139.2% | NA | 15.7% | NA | 29.4% | NA | 143.1% | NA | 78.4% | NA | 11.8% | NA | 17.6% | NA | 64.7% | NA | 100.0% |

Table 11 Ground-Cover Transect Data
Hearne, Gonzales, Nursery, and Victoria Study Sites

| **Gonzales transects:** | **1** | **2** | **3A** | **3B** | **4A** | **4B** | **4C** | **Mean** | |
|---|---|---|---|---|---|---|---|---|---|
| Forest floor | 86.3% | 94.1% | 54.9% | 86.3% | 58.8% | 84.3% | 76.5% | 77.3% | |
| Bare mineral soil | 2.0% | 2.0% | 41.2% | 2.0% | 23.5% | 0.0% | 0.0% | 10.1% | |
| Woody debris, fine (0.5<10 cm dia.) | 5.9% | 3.9% | 3.9% | 11.8% | 7.8% | 9.8% | 9.8% | 7.6% | |
| Woody debris, coarse (>20 cm dia.) | 2.0% | 0.0% | 0.0% | 0.0% | 7.8% | 2.0% | 11.8% | 3.4% | |
| Woody debris, medium (10<20 cm dia.) | 3.9% | 0.0% | 0.0% | 0.0% | 2.0% | 3.9% | 0.0% | 1.4% | |
| Living tree or shrub bole | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 2.0% | 0.3% | |
| **Total** | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | |
| **Nursery transects:** | **1A** | **1B** | **1C** | **2A** | **2B** | **2C** | **3A** | **3B** | **Mean** |
| Forest floor | 49.0% | 94.1% | 90.2% | 88.2% | 96.1% | 86.3% | 100.0% | 90.2% | 86.8% |
| Woody debris, medium (10<20 cm dia.) | 7.8% | 3.9% | 3.9% | 2.0% | 0.0% | 11.8% | 0.0% | 0.0% | 3.7% |
| Bare mineral soil | 13.7% | 0.0% | 0.0% | 5.9% | 0.0% | 0.0% | 0.0% | 0.0% | 2.5% |
| Disturbed ground | 19.6% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 2.5% |
| Woody debris, coarse (>20 cm dia.) | 2.0% | 2.0% | 5.9% | 0.0% | 3.9% | 0.0% | 0.0% | 3.9% | 2.2% |
| Woody debris, fine (0.5<10 cm dia.) | 7.8% | 0.0% | 0.0% | 3.9% | 0.0% | 2.0% | 0.0% | 5.9% | 2.5% |
| Living tree or shrub bole | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| **Total** | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |
| **Victoria transects:** | **1** | **2** | **4** | **6** | **7A** | **7B** | **11A** | **11B** | **Mean** |
| Forest floor | 74.5% | 74.5% | 64.7% | 70.6% | 66.7% | 64.7% | 45.1% | 82.4% | 67.9% |
| Herbaceous wetland | 0.0% | 19.6% | 13.7% | 11.8% | 19.6% | 5.9% | 3.9% | 0.0% | 9.3% |
| Bare mineral soil | 0.0% | 0.0% | 17.6% | 0.0% | 0.0% | 5.9% | 35.3% | 0.0% | 7.4% |
| Woody debris, coarse (>20 cm dia.) | 13.7% | 5.9% | 0.0% | 2.0% | 11.8% | 13.7% | 5.9% | 3.9% | 7.1% |
| Woody debris, medium (10<20 cm dia.) | 11.8% | 0.0% | 2.0% | 7.8% | 0.0% | 9.8% | 9.8% | 5.9% | 5.9% |
| Woody debris, fine (0.5<10 cm dia.) | 0.0% | 0.0% | 2.0% | 7.8% | 2.0% | 0.0% | 0.0% | 7.8% | 2.5% |
| **Total** | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |
| **Hearne transects:** | **2** | **5A** | **5B** | **9A** | **9B** | **10** | **12** | **13** | **Mean** |
| Forest floor | 84.3% | 88.2% | 76.5% | 76.5% | NA | NA | 94.1% | 74.5% | 82.4% |
| Woody debris, fine (0.5<10 cm dia.) | 0.0% | 7.8% | 7.8% | 11.8% | NA | NA | 2.0% | 13.7% | 7.2% |
| Bare mineral soil | 9.8% | 2.0% | 0.0% | 7.8% | NA | NA | 3.9% | 7.8% | 5.2% |
| Woody debris, coarse (>20 cm dia.) | 5.9% | 0.0% | 11.8% | 0.0% | NA | NA | 0.0% | 2.0% | 3.3% |
| Woody debris, medium (10<20 cm dia.) | 0.0% | 2.0% | 3.9% | 2.0% | NA | NA | 0.0% | 2.0% | 1.6% |
| Living tree or shrub bole | 0.0% | 0.0% | 0.0% | 2.0% | NA | NA | 0.0% | 0.0% | 0.3% |
| **Total** | 100.0% | 100.0% | 100.0% | 100.0% | NA | NA | 100.0% | 100.0% | 100.0% |

Table 12 Inundation Data Synopsis: Habitat Inundation (ha) versus River Flow (cfs)
Guadalupe River: Victoria- Nursery Study Reach
Summary and Detailed Data Available in Companion Spreadsheet: G&BR.TCS.GNGV.Inund.Final.6-6-16

| **Date:** | 01/21/90 | 03/01/07 | 01/17/06 | 02/02/06 | 02/25/94 | 02/04/98 | 01/21/93 | 03/01/10 | 03/22/12 | 11/06/02 | 10/29/02 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mean Daily Discharge (cfs):** | 465 | 763 | 784 | 795 | 955 | 1,740 | 2,190 | 2,350 | 9,690 | 16,900 | 22,400 |
| **Channel-Connnected Habitat Inundation*:** Riparian Habitats within 0.5 Mile of River Centerline** | | | | | | | | | | | |
| **Herbaceous Wetlands (ha):** | 23.74 | 20.05 | 26.24 | 20.15 | 20.83 | 23.89 | 29.01 | 25.93 | 46.62 | 75.25 | 137.29 |
| **Bottomland Forests (ha):** | 25.66 | 18.45 | 25.89 | 18.56 | 19.53 | 20.92 | 28.61 | 22.50 | 44.77 | 47.93 | 105.10 |
| **Total Bottomland Habitats (ha):** | 51.82 | 40.11 | 54.39 | 40.33 | 42.20 | 47.10 | 60.85 | 51.24 | 98.51 | 132.18 | 257.03 |
| **Open Water (ha):** | 5.41 | 5.46 | 6.69 | 5.56 | 4.38 | 4.65 | 5.83 | 5.02 | 9.98 | 9.42 | 13.04 |
| **Total Inundated Habitats (ha):** | 57.96 | 45.92 | 61.71 | 46.36 | 47.12 | 52.47 | 67.63 | 56.87 | 110.34 | 143.64 | 274.61 |
| **All Habitat Inundation*:** Floodplain Habitats within Two Miles of River Centerline | | | | | | | | | | | |
| **Herbaceous Wetlands (ha):** | 87.92 | 93.60 | 106.18 | 92.95 | 109.45 | 128.68 | 130.50 | 118.67 | 125.31 | 249.25 | 556.59 |
| **Bottomland Forests (ha):** | 37.06 | 29.22 | 37.79 | 26.47 | 38.32 | 39.16 | 47.13 | 34.45 | 53.62 | 80.02 | 194.47 |
| **Total Bottomland Habitats (ha):** | 129.57 | 126.98 | 148.70 | 123.08 | 151.97 | 173.24 | 184.38 | 158.01 | 188.14 | 344.87 | 786.32 |
| **Open Water (ha):** | 140.55 | 172.62 | 174.28 | 168.65 | 160.22 | 172.52 | 157.08 | 168.49 | 167.60 | 189.01 | 206.97 |
| **Total Inundated Habitats (ha):** | 271.86 | 322.28 | 342.34 | 311.73 | 313.30 | 353.56 | 346.62 | 353.91 | 390.69 | 557.43 | 1,087.84 |

*** Habitat Types by Ecoregions, Texas Ecological Systems Data: https://tpwd.texas.gov/gis (Elliott, L.F., et al. 2014)**

**** No channel-connected inundation occurred more than 0.5 mi from river centerline**

Table 13 Inundation Data Synopsis: Habitat Inundation (ha) versus River Flow (cfs)
Guadalupe River: Gonzales Study Reach
Summary and Detailed Data Available in Companion Spreadsheet: G&BR.TCS.GG.Inund.Final.6-3-16

| **Date:** | 03/03/14 | 01/16/97 | 03/06/15 | 02/21/07 | 01/09/00 | 03/01/10 | 01/06/02 | 01/14/05 | 03/15/01 | 02/17/03 | 12/31/02 | 01/01/03 | 12/04/04 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mean Daily Discharge (cfs):** | 446 | 512 | 567 | 729 | 864 | 2,510 | 2,570 | 3,450 | 4,480 | 4,980 | 6,160 | 7,220 | 7,650 |
| **Channel-Connnected Habitat Inundation*:** Riparian Habitats within 0.5 Mile of River Centerline** | | | | | | | | | | | | | |
| **Herbaceous Wetlands (ha):** | 23.84 | 23.94 | 26.83 | 27.78 | 33.93 | 28.29 | 29.04 | 33.04 | 36.17 | 40.00 | 34.04 | 42.10 | 45.09 |
| **Bottomland Forests (ha):** | 18.83 | 8.58 | 21.60 | 19.75 | 27.08 | 25.66 | 21.81 | 40.25 | 44.32 | 76.50 | 47.83 | 78.73 | 86.37 |
| **Total Bottomland Habitats (ha):** | 44.15 | 33.74 | 50.37 | 49.40 | 63.45 | 55.66 | 52.81 | 75.98 | 83.73 | 120.39 | 84.75 | 124.78 | 135.71 |
| **Open Water (ha):** | 23.75 | 20.79 | 24.56 | 23.21 | 26.27 | 25.66 | 23.63 | 27.23 | 27.15 | 31.50 | 27.22 | 31.83 | 32.41 |
| **Total Inundated Habitats (ha):** | 68.67 | 55.01 | 75.83 | 73.27 | 90.87 | 82.38 | 77.60 | 104.80 | 112.88 | 154.42 | 113.98 | 160.08 | 171.91 |
| **All Habitat Inundation*:** Floodplain Habitats within Two Miles of River Centerline | | | | | | | | | | | | | |
| **Herbaceous Wetlands (ha):** | 31.02 | 33.10 | 37.21 | 40.81 | 43.21 | 49.61 | 45.58 | 51.29 | 100.17 | 74.18 | 134.85 | 121.49 | 109.15 |
| **Bottomland Forests (ha):** | 20.04 | 9.19 | 22.67 | 20.95 | 27.99 | 27.33 | 23.70 | 43.10 | 50.28 | 85.78 | 57.05 | 92.95 | 97.64 |
| **Total Bottomland Habitats (ha):** | 52.69 | 43.70 | 61.93 | 63.85 | 73.83 | 79.66 | 72.01 | 98.09 | 157.21 | 166.39 | 201.87 | 225.21 | 214.84 |
| **Open Water (ha):** | 25.14 | 22.93 | 26.28 | 27.07 | 28.52 | 30.77 | 26.46 | 32.21 | 32.34 | 37.30 | 32.55 | 38.13 | 37.35 |
| **Total Inundated Habitats (ha):** | 82.39 | 74.01 | 96.54 | 98.60 | 108.89 | 125.21 | 109.19 | 144.67 | 241.72 | 228.23 | 300.80 | 322.65 | 279.12 |

*** Habitat Types by Ecoregions, Texas Ecological Systems Data: https://tpwd.texas.gov/gis (Elliott, L.F., et al. 2014)**

**** No channel-connected inundation occurred more than 0.5 mi from river centerline**

Table 14 Inundation Data Synopsis: Habitat Inundation (ha) versus River Flow (cfs)
Brazos River: Hearne Study Reach
Summary and Detailed Data Available in Companion Spreadsheet: G&BR.TCS.BH.Inund.Final.6-6-16

| **Date:** | 12/09/14 | 12/12/89 | 03/20/14 | 02/01/91 | 01/21/93 | 02/20/98 | 01/14/05 | 01/19/92 |
|---|---|---|---|---|---|---|---|---|
| **Mean Daily Discharge (cfs):** | 85 | 463 | 1,180 | 2,300 | 2,520 | 2,650 | 4,430 | 36,300 |
| **Channel-Connnected Habitat Inundation*:** Riparian Habitats within 0.5 Mile of River Centerline** | | | | | | | | |
| **Herbaceous Wetlands (ha):** | 6.88 | 5.85 | 7.11 | 16.41 | 16.91 | 13.79 | 14.50 | 59.97 |
| **Bottomland Forests (ha):** | 25.54 | 26.77 | 23.23 | 71.33 | 58.04 | 50.66 | 40.07 | 122.00 |
| **Total Bottomland Habitats (ha):** | 32.42 | 32.62 | 30.34 | 87.74 | 74.95 | 64.45 | 54.57 | 181.97 |
| **Open Water (ha):** | 114.64 | 274.79 | 341.89 | 457.14 | 450.95 | 486.90 | 490.03 | 487.46 |
| **Total Inundated Habitats (ha):** | 148.89 | 309.10 | 373.61 | 550.07 | 533.60 | 557.27 | 549.72 | 682.66 |
| **All Habitat Inundation*:** Floodplain Habitats within Two Miles of River Centerline | | | | | | | | |
| **Herbaceous Wetlands (ha):** | 43.41 | 24.55 | 72.23 | 81.34 | 67.81 | 108.11 | 101.17 | 252.28 |
| **Bottomland Forests (ha):** | 46.19 | 38.85 | 70.07 | 117.40 | 89.89 | 105.95 | 80.13 | 272.05 |
| **Total Bottomland Habitats (ha):** | 90.09 | 64.97 | 145.90 | 205.63 | 160.51 | 218.81 | 183.27 | 600.70 |
| **Open Water (ha):** | 344.00 | 310.83 | 437.45 | 524.74 | 509.75 | 575.96 | 610.74 | 556.85 |
| **Total Inundated Habitats (ha):** | 441.70 | 381.84 | 617.13 | 763.69 | 687.08 | 841.98 | 824.22 | 1,405.29 |

*** Habitat Types by Ecoregions, Texas Ecological Systems Data: https://tpwd.texas.gov/gis (Elliott, L.F., et al. 2014)**

**** No channel-connected inundation occurred more than 0.5 mi from river centerline**

Table 15 Channel-Connected Inundation Summary Data: Victoria- Nursery Riparian Study Reach
Summary and Detailed Data Available in Companion Spreadsheet: G&BR.TCS.GNGV.Inund.Final.6-6-16

| Victoria-Nursery Riparian Study Reach: 0-0.5 mi from River Centerline* | Total | 465 cfs | | 763 cfs | | 784 cfs | | 795 cfs | | 955 cfs | | 1,740 cfs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Channel-Connected Inundation versus River Flow | Habitat Area | 01/21/90 | | 03/01/07 | | 01/17/06 | | 02/02/06 | | 02/25/94 | | 02/04/98 | |
| Central Texas/Coastal Bend/Post Oak Savanna Habitat Types** | ha | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % |
| **BOTTOMLAND HABITATS: Totals** | **5,025.7** | **51.8** | **1.0%** | **40.1** | **0.8%** | **54.4** | **1.1%** | **40.3** | **0.8%** | **42.2** | **0.8%** | **47.1** | **0.9%** |
| **Bottomland Forest Subtotals** | **1,927.0** | **25.7** | **1.3%** | **18.4** | **1.0%** | **25.9** | **1.3%** | **18.6** | **1.0%** | **19.5** | **1.0%** | **20.9** | **1.1%** |
| **Bottomland Shrubland Subtotals** | 274.1 | 2.4 | 0.9% | 1.6 | 0.6% | 2.3 | 0.8% | 1.6 | 0.6% | 1.8 | 0.7% | 2.3 | 0.8% |
| **Herbaceous Wetland Subtotals** | **2,824.6** | **23.7** | **0.8%** | **20.0** | **0.7%** | **26.2** | **0.9%** | **20.1** | **0.7%** | **20.8** | **0.7%** | **23.9** | **0.8%** |
| **UPLAND HABITATS: Totals** | 742.4 | 0.2 | 0.0% | 0.1 | 0.0% | 0.2 | 0.0% | 0.1 | 0.0% | 0.2 | 0.0% | 0.2 | 0.0% |
| **Upland Forest/Woodland Subtotals** | 279.3 | 0.1 | 0.1% | 0.1 | 0.0% | 0.2 | 0.1% | 0.1 | 0.0% | 0.1 | 0.0% | 0.2 | 0.1% |
| **Upland Shrubland Subtotals** | 86.9 | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% |
| **Upland Grassland Subtotals** | 376.2 | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% |
| **DISTURBED & INVASIVE HABITATS: Totals** | 775.4 | 0.6 | 0.1% | 0.2 | 0.0% | 0.4 | 0.1% | 0.4 | 0.0% | 0.4 | 0.0% | 0.5 | 0.1% |
| **OPEN WATER:** | 76.4 | 5.4 | 7.1% | 5.5 | 7.1% | 6.7 | 8.7% | 5.6 | 7.3% | 4.4 | 5.7% | 4.7 | 6.1% |
| **INUNDATION GRAND TOTALS:** | **6,619.9** | **58.0** | **0.9%** | **45.9** | **0.7%** | **61.7** | **0.9%** | **46.4** | **0.7%** | **47.1** | **0.7%** | **52.5** | **0.8%** |

| Victoria-Nursery Riparian Study Reach: 0-0.5 mi from River Centerline* | Total | 2,190 cfs | | 2,350 cfs | | 9,690 cfs | | 16,900 cfs | | 22,400 cfs | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Channel-Connected Inundation versus River Flow | Habitat Area | 01/21/93 | | 03/01/10 | | 03/22/12 | | 11/06/02 | | 10/29/02 | |
| Central Texas/Coastal Bend/Post Oak Savanna Habitat Types** | ha | ha | % | ha | % | ha | % | ha | % | ha | % |
| **BOTTOMLAND HABITATS: Totals** | **5,025.7** | **60.8** | **1.2%** | **51.2** | **1.0%** | **98.5** | **2.0%** | **132.2** | **2.6%** | **257.0** | **5.1%** |
| **Bottomland Forest Subtotals** | **1,927.0** | **28.6** | **1.5%** | **22.5** | **1.2%** | **44.8** | **2.3%** | **47.9** | **2.5%** | **105.1** | **5.5%** |
| **Bottomland Shrubland Subtotals** | 274.1 | 3.2 | 1.2% | 2.8 | 1.0% | 7.1 | 2.6% | 9.0 | 3.3% | 14.6 | 5.3% |
| **Herbaceous Wetland Subtotals** | **2,824.6** | **29.0** | **1.0%** | **25.9** | **0.9%** | **46.6** | **1.7%** | **75.2** | **2.7%** | **137.3** | **4.9%** |
| **UPLAND HABITATS: Totals** | 742.4 | 0.3 | 0.0% | 0.2 | 0.0% | 0.7 | 0.1% | 0.5 | 0.1% | 1.3 | 0.2% |
| **Upland Forest/Woodland Subtotals** | 279.3 | 0.3 | 0.1% | 0.1 | 0.0% | 0.1 | 0.0% | 0.2 | 0.1% | 0.7 | 0.3% |
| **Upland Shrubland Subtotals** | 86.9 | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% |
| **Upland Grassland Subtotals** | 376.2 | 0.0 | 0.0% | 0.1 | 0.0% | 0.5 | 0.1% | 0.3 | 0.1% | 0.5 | 0.1% |
| **DISTURBED & INVASIVE HABITATS: Totals** | 775.4 | 0.7 | 0.1% | 0.4 | 0.0% | 1.2 | 0.2% | 1.5 | 0.2% | 3.2 | 0.4% |
| **OPEN WATER:** | 76.4 | 5.8 | 7.6% | 5.0 | 6.6% | 10.0 | 13.1% | 9.4 | 12.3% | 13.0 | 17.1% |
| **INUNDATION GRAND TOTALS:** | **6,619.9** | **67.6** | **1.0%** | **56.9** | **0.9%** | **110.3** | **1.7%** | **143.6** | **2.2%** | **274.6** | **4.1%** |

*** No channel-connected inundation extended more than 0.5 mi from chanel centerline**

**** Habitat Types by Ecoregions, Texas Ecological Systems Data: https://tpwd.texas.gov/gis (Elliott, L.F., et al. 2014)**

Table 16 Channel-Connected Inundation Summary Data: Gonzales Riparian Study Reach
Summary and Detailed Data Available in Companion Spreadsheet: G&BR.TCS.GG.Inund.Final.6-3-16

| Gonzales Riparian Study Reach: 0-0.5 mi from River Centerline** | Total | 446 cfs | | 512 cfs | | 567 cfs | | 729 cfs | | 864 cfs | | 2,510 cfs | | 2,570 cfs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Channel-Connected Inundation versus River Flow** | **Habitat Area** | **03/03/14** | | **01/16/97** | | **03/06/15** | | **02/21/07** | | **01/09/00** | | **03/01/10** | | **01/06/02** | |
| **Central Texas/Post Oak Savanna Habitat Types*** | 0-0.5 mi | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % |
| **BOTTOMLAND HABITATS: Totals** | **4,122.45** | **44.15** | **1.07%** | **33.74** | **0.82%** | **50.37** | **1.22%** | **49.40** | **1.20%** | **63.45** | **1.54%** | **55.66** | **1.35%** | **52.81** | **1.28%** |
| **Bottomland Forest Subtotals** | **1,465.53** | **18.83** | **1.28%** | **8.58** | **0.59%** | **21.60** | **1.47%** | **19.75** | **1.35%** | **27.08** | **1.85%** | **25.66** | **1.75%** | **21.81** | **1.49%** |
| **Bottomland Shrubland Subtotals** | 435.22 | 1.49 | 0.34% | 1.22 | 0.28% | 1.94 | 0.45% | 1.87 | 0.43% | 2.44 | 0.56% | 1.71 | 0.39% | 1.96 | 0.45% |
| **Herbaceous Wetland Subtotals** | **2,221.71** | **23.84** | **1.07%** | **23.94** | **1.08%** | **26.83** | **1.21%** | **27.78** | **1.25%** | **33.93** | **1.53%** | **28.29** | **1.27%** | **29.04** | **1.31%** |
| **UPLAND HABITATS: Totals** | 501.88 | 0.55 | 0.11% | 0.09 | 0.02% | 0.50 | 0.10% | 0.44 | 0.09% | 0.71 | 0.14% | 0.83 | 0.17% | 0.85 | 0.17% |
| **Upland Forest/Woodland Subtotals** | 182.10 | 0.55 | 0.30% | 0.09 | 0.05% | 0.50 | 0.28% | 0.42 | 0.23% | 0.67 | 0.37% | 0.83 | 0.46% | 0.85 | 0.47% |
| **Upland Shrubland Subtotals** | 2.22 | 0.00 | 0.00% | 0.00 | 0.00% | 0.00 | 0.00% | 0.02 | 0.78% | 0.04 | 1.85% | 0.00 | 0.00% | 0.00 | 0.00% |
| **Upland Grassland Subtotals** | 317.56 | 0.00 | 0.00% | 0.00 | 0.00% | 0.00 | 0.00% | 0.00 | 0.00% | 0.00 | 0.00% | 0.00 | 0.00% | 0.00 | 0.00% |
| **DISTURBED & INVASIVE HABITATS: Totals** | 476.51 | 0.22 | 0.05% | 0.38 | 0.08% | 0.40 | 0.08% | 0.22 | 0.05% | 0.43 | 0.09% | 0.23 | 0.05% | 0.30 | 0.06% |
| **OPEN WATER:** | 50.20 | 23.75 | 47.30% | 20.79 | 41.42% | 24.56 | 48.92% | 23.21 | 46.23% | 26.27 | 52.34% | 25.66 | 51.11% | 23.63 | 47.07% |
| **INUNDATION GRAND TOTALS:** | **5,151.05** | **68.67** | **1.33%** | **55.01** | **1.07%** | **75.83** | **1.47%** | **73.27** | **1.42%** | **90.87** | **1.76%** | **82.38** | **1.60%** | **77.60** | **1.51%** |

| Gonzales Riparian Study Reach: 0-0.5 mi from River Centerline** | Total | 3,450 cfs | | 4,480 cfs | | 4,980 cfs | | 6,160 cfs | | 7,220 cfs | | 7,650 cfs | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Channel-Connected Inundation versus River Flow** | **Habitat Area** | **01/14/05** | | **03/15/01** | | **02/17/03** | | **12/31/02** | | **01/01/03** | | **12/04/04** | |
| **Central Texas/Post Oak Savanna Habitat Types*** | 0-0.5 mi | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % |
| **BOTTOMLAND HABITATS: Totals** | **4,122.45** | **75.98** | **1.84%** | **83.73** | **2.03%** | **120.39** | **2.92%** | **84.75** | **2.06%** | **124.78** | **3.03%** | **135.71** | **3.29%** |
| **Bottomland Forest Subtotals** | **1,465.53** | **40.25** | **2.75%** | **44.32** | **3.02%** | **76.50** | **5.22%** | **47.83** | **3.26%** | **78.73** | **5.37%** | **86.37** | **5.89%** |
| **Bottomland Shrubland Subtotals** | 435.22 | 2.68 | 0.62% | 3.24 | 0.74% | 3.90 | 0.90% | 2.88 | 0.66% | 3.95 | 0.91% | 4.25 | 0.98% |
| **Herbaceous Wetland Subtotals** | **2,221.71** | **33.04** | **1.49%** | **36.17** | **1.63%** | **40.00** | **1.80%** | **34.04** | **1.53%** | **42.10** | **1.89%** | **45.09** | **2.03%** |
| **UPLAND HABITATS: Totals** | 501.88 | 1.06 | 0.21% | 1.54 | 0.31% | 1.95 | 0.39% | 1.48 | 0.30% | 2.57 | 0.51% | 2.88 | 0.57% |
| **Upland Forest/Woodland Subtotals** | 182.10 | 1.02 | 0.56% | 1.54 | 0.84% | 1.93 | 1.06% | 1.48 | 0.81% | 2.47 | 1.36% | 2.80 | 1.54% |
| **Upland Shrubland Subtotals** | 2.22 | 0.02 | 0.97% | 0.00 | 0.00% | 0.00 | 0.00% | 0.00 | 0.19% | 0.05 | 2.06% | 0.05 | 2.06% |
| **Upland Grassland Subtotals** | 317.56 | 0.02 | 0.01% | 0.00 | 0.00% | 0.02 | 0.01% | 0.00 | 0.00% | 0.05 | 0.02% | 0.03 | 0.01% |
| **DISTURBED & INVASIVE HABITATS: Totals** | 476.51 | 0.54 | 0.11% | 0.47 | 0.10% | 0.58 | 0.12% | 0.53 | 0.11% | 0.90 | 0.19% | 0.92 | 0.19% |
| **OPEN WATER:** | 50.20 | 27.23 | 54.24% | 27.15 | 54.07% | 31.50 | 62.74% | 27.22 | 54.22% | 31.83 | 63.40% | 32.41 | 64.57% |
| **INUNDATION GRAND TOTALS:** | **5,151.05** | **104.80** | **2.03%** | **112.88** | **2.19%** | **154.42** | **3.00%** | **113.98** | **2.21%** | **160.08** | **3.11%** | **171.91** | **3.34%** |

*** No channel-connected inundation more than 0.5 mi from river centerline**

**** Habitat Types by Ecoregions, Texas Ecological Systems Data: https://tpwd.texas.gov/gis (Elliott, L.F., et al. 2014)**

Table 17 Channel-Connected Inundation Summary Data: Hearne Riparian Study Reach
Summary and Detailed Data Available in Companion Spreadsheet: G&BR.TCS.BH.Inund.Final.6-6-16

| Hearne Riparian Study Reach: 0-0.5 mi from River Centerline* | Total | 85 cfs | | 463 cfs | | 1,180 cfs | | 2,300 cfs | |
|---|---|---|---|---|---|---|---|---|---|
| Channel-Connected Inundation versus River Flow | Habitat Area | 12/09/14 | | 12/12/89 | | 03/20/14 | | 02/01/91 | |
| Columbia Bottomlands/Post Oak Savanna Habitat Types** | 0-0.5 mi | ha | % | ha | % | ha | % | ha | % |
| **BOTTOMLAND HABITATS: Totals** | **5,777.8** | **32.4** | **0.6%** | **32.6** | **0.6%** | **30.3** | **0.5%** | **87.7** | **1.5%** |
| **Swamp Forest Subtotals** | 0.9 | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% |
| **Bottomland Forest Subtotals** | **2,940.7** | **25.5** | **0.9%** | **26.8** | **0.9%** | **23.2** | **0.8%** | **71.3** | **2.4%** |
| **Bottomland Shrubland Subtotals** | 142.2 | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% |
| **Herbaceous Wetland Subtotals** | **2,694.0** | **6.9** | **0.3%** | **5.9** | **0.2%** | **7.1** | **0.3%** | **16.4** | **0.6%** |
| **UPLAND HABITATS: Totals** | 1,320.8 | 1.3 | 0.1% | 0.6 | 0.0% | 0.8 | 0.1% | 1.4 | 0.1% |
| **Upland Forest//Woodland Subtotals** | 235.6 | 1.1 | 0.5% | 0.5 | 0.2% | 0.7 | 0.3% | 1.4 | 0.6% |
| **Upland Grassland Subtotals** | 1,085.2 | 0.2 | 0.0% | 0.0 | 0.0% | 0.2 | 0.0% | 0.0 | 0.0% |
| **DISTURBED & INVASIVE HABITATS: Totals** | 413.0 | 0.5 | 0.1% | 1.1 | 0.3% | 0.5 | 0.1% | 3.8 | 0.9% |
| **OPEN WATER** | 716.8 | 114.6 | 16.0% | 274.8 | 38.3% | 341.9 | 47.7% | 457.1 | 63.8% |
| **GRAND TOTALS:** | **8,228.4** | **148.9** | **1.8%** | **309.1** | **3.8%** | **373.6** | **4.5%** | **550.1** | **6.7%** |

| Hearne Riparian Study Reach: 0-0.5 mi from River Centerline* | Total | 2,520 cfs | | 2,650 cfs | | 4,430 cfs | | 36,300 cfs | |
|---|---|---|---|---|---|---|---|---|---|
| Channel-Connected Inundation versus River Flow | Habitat Area | 01/21/93 | | 02/20/98 | | 01/14/05 | | 01/19/92 | |
| Columbia Bottomlands/Post Oak Savanna Habitat Types** | 0-0.5 mi | ha | % | ha | % | ha | % | ha | % |
| **BOTTOMLAND HABITATS: Totals** | **5,777.8** | **74.9** | **1.3%** | **64.4** | **1.1%** | **54.6** | **0.9%** | **182.0** | **3.1%** |
| **Swamp Forest Subtotals** | 0.9 | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% |
| **Bottomland Forest Subtotals** | **2,940.7** | **58.0** | **2.0%** | **50.7** | **1.7%** | **40.1** | **1.4%** | **122.0** | **4.1%** |
| **Bottomland Shrubland Subtotals** | 142.2 | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% |
| **Herbaceous Wetland Subtotals** | **2,694.0** | **16.9** | **0.6%** | **13.8** | **0.5%** | **14.5** | **0.5%** | **60.0** | **2.2%** |
| **UPLAND HABITATS: Totals** | 1,320.8 | 1.1 | 0.1% | 1.9 | 0.1% | 1.8 | 0.1% | 1.6 | 0.1% |
| **Upland Forest//Woodland Subtotals** | 235.6 | 1.0 | 0.4% | 1.8 | 0.7% | 1.6 | 0.7% | 1.5 | 0.6% |
| **Upland Grassland Subtotals** | 1,085.2 | 0.1 | 0.0% | 0.1 | 0.0% | 0.2 | 0.0% | 0.1 | 0.0% |
| **DISTURBED & INVASIVE HABITATS: Totals** | 413.0 | 6.6 | 1.6% | 4.0 | 1.0% | 3.3 | 0.8% | 11.6 | 2.8% |
| **OPEN WATER** | 716.8 | 451.0 | 62.9% | 486.9 | 67.9% | 490.0 | 68.4% | 487.5 | 68.0% |
| **GRAND TOTALS:** | **8,228.4** | **533.6** | **6.5%** | **557.3** | **6.8%** | **549.7** | **6.7%** | **682.7** | **8.3%** |

*** No channel-connected inundation extended more than 0.5 mi from chanel centerline**

**** Habitat Types by Ecoregions, Texas Ecological Systems Data: https://tpwd.texas.gov/gis (Elliott, L.F., et al. 2014)**

Table 18 All Inundation (0-2 mi) Summary Data: Victoria- Nursery Riparian Study Reach
Summary and Detailed Data Available in Companion Spreadsheet: G&BR.TCS.GNGV.Inund.Final.6-6-16

| Victoria-Nursery Riparian Study Reach: 0-2 mi from River Centerline | Total | | | | 465 cfs | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Inundation versus River Flow | Habitat Area | | | | 32,894.0 | | | | | | | |
| Central Texas/Coastal Bend/Post Oak Savanna Habitat Types* | 0-0.5 mi | 0.5-1 mi | 1-2 mi | 0-2 mi Total | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | |
| | ha | ha | ha | ha | ha | % | ha | % | ha | % | ha | % |
| **BOTTOMLAND HABITATS: Totals** | **5,025.7** | **2,138.8** | **696.3** | **7,860.6** | **60.4** | **1.2%** | **43.8** | **2.0%** | **25.4** | **3.6%** | **129.6** | **1.6%** |
| **Bottomland Forest Subtotals** | **1,927.0** | **618.5** | **281.3** | **2,826.6** | **27.3** | **1.4%** | **5.6** | **0.9%** | **4.1** | **1.5%** | **37.1** | **1.3%** |
| Bottomland Shrubland Subtotals | 274.1 | 131.4 | 66.8 | 472.3 | 2.5 | 0.9% | 1.2 | 0.9% | 0.9 | 1.4% | 4.6 | 1.0% |
| **Herbaceous Wetland Subtotals** | **2,824.6** | **1,388.9** | **348.2** | **4,561.7** | **30.5** | **1.1%** | **37.0** | **2.7%** | **20.4** | **5.9%** | **87.9** | **1.9%** |
| UPLAND HABITATS: Totals | 742.4 | 2,251.8 | 6,785.5 | 9,779.9 | 0.2 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.2 | 0.0% |
| Upland Forest/Woodland Subtotals | 279.3 | 491.0 | 1,073.9 | 1,844.3 | 0.1 | 0.1% | 0.0 | 0.0% | 0.0 | 0.0% | 0.2 | 0.0% |
| Upland Shrubland Subtotals | 86.9 | 200.4 | 326.5 | 613.7 | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% |
| Upland Grassland Subtotals | 376.2 | 1,560.5 | 5,385.2 | 7,321.9 | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.1 | 0.0% |
| DISTURBED & INVASIVE HABITATS: Totals | 775.4 | 1,205.2 | 2,958.0 | 4,938.5 | 0.6 | 0.1% | 0.3 | 0.0% | 0.7 | 0.0% | 1.5 | 0.0% |
| OPEN WATER: | 76.4 | 98.0 | 56.0 | 230.4 | 36.4 | 47.6% | 60.8 | 62.1% | 43.3 | 77.4% | 140.5 | 61.0% |
| **INUNDATION GRAND TOTALS:** | **6,619.9** | **5,693.8** | **10,495.8** | **22,809.4** | **97.5** | **1.5%** | **104.9** | **1.8%** | **69.4** | **0.7%** | **271.9** | **1.2%** |

| Victoria-Nursery Riparian Study Reach: 0-2 mi from River Centerline | 763 cfs | | | | | | | | 784 cfs | | | | | | | | 795 cfs | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Inundation versus River Flow | 39,142.0 | | | | | | | | 38,734.0 | | | | | | | | 38,750.0 | | | | | | | |
| Central Texas/Coastal Bend/Post Oak Savanna Habitat Types* | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | |
| | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % |
| **BOTTOMLAND HABITATS: Totals** | **52.3** | **1.0%** | **49.6** | **2.3%** | **25.1** | **3.6%** | **127.0** | **1.6%** | **74.7** | **1.5%** | **48.6** | **2.3%** | **25.4** | **3.6%** | **148.7** | **1.9%** | **55.6** | **1.1%** | **45.2** | **2.1%** | **22.3** | **3.2%** | **123.1** | **1.6%** |
| **Bottomland Forest Subtotals** | **19.8** | **1.0%** | **6.6** | **1.1%** | **2.9** | **1.0%** | **29.2** | **1.0%** | **28.3** | **1.5%** | **6.1** | **1.0%** | **3.3** | **1.2%** | **37.8** | **1.3%** | **19.6** | **1.0%** | **4.7** | **0.8%** | **2.2** | **0.8%** | **26.5** | **0.9%** |
| Bottomland Shrubland Subtotals | 1.9 | 0.7% | 0.9 | 0.7% | 1.3 | 2.0% | 4.2 | 0.9% | 2.5 | 0.9% | 0.9 | 0.7% | 1.3 | 2.0% | 4.7 | 1.0% | 1.9 | 0.7% | 0.6 | 0.5% | 1.1 | 1.6% | 3.7 | 0.8% |
| **Herbaceous Wetland Subtotals** | **30.6** | **1.1%** | **42.1** | **3.0%** | **20.9** | **6.0%** | **93.6** | **2.1%** | **43.8** | **1.6%** | **41.6** | **3.0%** | **20.8** | **6.0%** | **106.2** | **2.3%** | **34.1** | **1.2%** | **39.9** | **2.9%** | **19.0** | **5.5%** | **93.0** | **2.0%** |
| UPLAND HABITATS: Totals | 0.2 | 0.0% | 0.1 | 0.0% | 0.4 | 0.0% | 0.7 | 0.0% | 0.2 | 0.0% | 0.1 | 0.0% | 0.1 | 0.0% | 0.5 | 0.0% | 0.1 | 0.0% | 0.0 | 0.0% | 0.2 | 0.0% | 0.3 | 0.0% |
| Upland Forest/Woodland Subtotals | 0.1 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.1 | 0.0% | 0.2 | 0.1% | 0.0 | 0.0% | 0.1 | 0.0% | 0.3 | 0.0% | 0.1 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.1 | 0.0% |
| Upland Shrubland Subtotals | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% |
| Upland Grassland Subtotals | 0.1 | 0.0% | 0.1 | 0.0% | 0.4 | 0.0% | 0.6 | 0.0% | 0.0 | 0.0% | 0.1 | 0.0% | 0.1 | 0.0% | 0.2 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.2 | 0.0% | 0.2 | 0.0% |
| DISTURBED & INVASIVE HABITATS: Totals | 13.1 | 1.7% | 8.3 | 0.7% | 0.6 | 0.0% | 22.0 | 0.4% | 13.2 | 1.7% | 4.8 | 0.4% | 0.8 | 0.0% | 18.9 | 0.4% | 12.9 | 1.7% | 6.2 | 0.5% | 0.6 | 0.0% | 19.7 | 0.4% |
| OPEN WATER: | 50.0 | 65.4% | 77.3 | 78.9% | 45.3 | 81.0% | 172.6 | 74.9% | 53.0 | 69.4% | 78.5 | 80.1% | 42.7 | 76.3% | 174.3 | 75.7% | 51.2 | 67.0% | 76.3 | 77.9% | 41.2 | 73.6% | 168.7 | 73.2% |
| **INUNDATION GRAND TOTALS:** | **115.6** | **1.7%** | **135.3** | **2.4%** | **71.4** | **0.7%** | **322.3** | **1.4%** | **141.2** | **2.1%** | **132.1** | **2.3%** | **69.0** | **0.7%** | **342.3** | **1.5%** | **119.8** | **1.8%** | **127.7** | **2.2%** | **64.3** | **0.6%** | **311.7** | **1.4%** |

| Victoria-Nursery Riparian Study Reach: 0-2 mi from River Centerline | Total | | | | 955 cfs | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Inundation versus River Flow | Habitat Area | | | | 34,390.0 | | | | | | | |
| Central Texas/Coastal Bend/Post Oak Savanna Habitat Types* | 0-0.5 mi | 0.5-1 mi | 1-2 mi | 0-2 mi Total | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | |
| | ha | ha | ha | ha | ha | % | ha | % | ha | % | ha | % |
| **BOTTOMLAND HABITATS: Totals** | **5,025.7** | **2,138.8** | **696.3** | **7,860.6** | **65.5** | **1.3%** | **56.0** | **2.6%** | **30.4** | **4.4%** | **152.0** | **1.9%** |
| **Bottomland Forest Subtotals** | **1,927.0** | **618.5** | **281.3** | **2,826.6** | **25.4** | **1.3%** | **8.8** | **1.4%** | **4.1** | **1.5%** | **38.3** | **1.4%** |
| Bottomland Shrubland Subtotals | 274.1 | 131.4 | 66.8 | 472.3 | 2.0 | 0.7% | 0.7 | 0.5% | 1.5 | 2.3% | 4.2 | 0.9% |
| **Herbaceous Wetland Subtotals** | **2,824.6** | **1,388.9** | **348.2** | **4,561.7** | **38.1** | **1.3%** | **46.5** | **3.4%** | **24.8** | **7.1%** | **109.4** | **2.4%** |
| UPLAND HABITATS: Totals | 742.4 | 2,251.8 | 6,785.5 | 9,779.9 | 0.2 | 0.0% | 0.0 | 0.0% | 0.1 | 0.0% | 0.3 | 0.0% |
| Upland Forest/Woodland Subtotals | 279.3 | 491.0 | 1,073.9 | 1,844.3 | 0.1 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.1 | 0.0% |
| Upland Shrubland Subtotals | 86.9 | 200.4 | 326.5 | 613.7 | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% |
| Upland Grassland Subtotals | 376.2 | 1,560.5 | 5,385.2 | 7,321.9 | 0.0 | 0.0% | 0.0 | 0.0% | 0.1 | 0.0% | 0.1 | 0.0% |
| DISTURBED & INVASIVE HABITATS: Totals | 775.4 | 1,205.2 | 2,958.0 | 4,938.5 | 0.4 | 0.0% | 0.3 | 0.0% | 0.1 | 0.0% | 0.8 | 0.0% |
| OPEN WATER: | 76.4 | 98.0 | 56.0 | 230.4 | 38.2 | 50.0% | 76.0 | 77.5% | 46.1 | 82.3% | 160.2 | 69.5% |
| **INUNDATION GRAND TOTALS:** | **6,619.9** | **5,693.8** | **10,495.8** | **22,809.4** | **104.2** | **1.6%** | **132.3** | **2.3%** | **76.7** | **0.7%** | **313.3** | **1.4%** |

| Victoria-Nursery Riparian Study Reach: 0-2 mi from River Centerline | 1,740 cfs | | | | | | | | 2,190 cfs | | | | | | | | 2,350 cfs | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Inundation versus River Flow | 02/04/98 | | | | | | | | 01/21/93 | | | | | | | | 03/01/10 | | | | | | | |
| Central Texas/Coastal Bend/Post Oak Savanna Habitat Types* | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | |
| | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % |
| **BOTTOMLAND HABITATS: Totals** | **77.4** | **1.5%** | **64.9** | **3.0%** | **30.9** | **4.4%** | **173.2** | **2.2%** | **91.2** | **1.8%** | **58.3** | **2.7%** | **34.9** | **5.0%** | **184.4** | **2.3%** | **80.4** | **1.6%** | **53.6** | **2.5%** | **24.1** | **3.5%** | **158.0** | **2.0%** |
| **Bottomland Forest Subtotals** | **24.9** | **1.3%** | **10.4** | **1.7%** | **3.9** | **1.4%** | **39.2** | **1.4%** | **32.7** | **1.7%** | **9.5** | **1.5%** | **4.9** | **1.8%** | **47.1** | **1.7%** | **25.5** | **1.3%** | **6.7** | **1.1%** | **2.3** | **0.8%** | **34.5** | **1.2%** |
| Bottomland Shrubland Subtotals | 2.5 | 0.9% | 1.5 | 1.1% | 1.5 | 2.2% | 5.4 | 1.1% | 3.5 | 1.3% | 1.2 | 0.9% | 2.0 | 3.0% | 6.7 | 1.4% | 3.0 | 1.1% | 1.1 | 0.8% | 0.9 | 1.3% | 4.9 | 1.0% |
| **Herbaceous Wetland Subtotals** | **50.1** | **1.8%** | **53.0** | **3.8%** | **25.6** | **7.4%** | **128.7** | **2.8%** | **55.0** | **1.9%** | **47.6** | **3.4%** | **27.9** | **8.0%** | **130.5** | **2.9%** | **51.9** | **1.8%** | **45.9** | **3.3%** | **20.9** | **6.0%** | **118.7** | **2.6%** |
| UPLAND HABITATS: Totals | 0.2 | 0.0% | 0.2 | 0.0% | 1.6 | 0.0% | 2.1 | 0.0% | 0.4 | 0.1% | 0.0 | 0.0% | 1.9 | 0.0% | 2.3 | 0.0% | 0.3 | 0.0% | 0.3 | 0.0% | 1.4 | 0.0% | 2.0 | 0.0% |
| Upland Forest/Woodland Subtotals | 0.2 | 0.1% | 0.1 | 0.0% | 0.1 | 0.0% | 0.3 | 0.0% | 0.3 | 0.1% | 0.0 | 0.0% | 0.1 | 0.0% | 0.4 | 0.0% | 0.1 | 0.0% | 0.0 | 0.0% | 0.2 | 0.0% | 0.3 | 0.0% |
| Upland Shrubland Subtotals | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% |
| Upland Grassland Subtotals | 0.0 | 0.0% | 0.1 | 0.0% | 1.6 | 0.0% | 1.7 | 0.0% | 0.1 | 0.0% | 0.0 | 0.0% | 1.8 | 0.0% | 1.9 | 0.0% | 0.2 | 0.1% | 0.3 | 0.0% | 1.2 | 0.0% | 1.8 | 0.0% |
| DISTURBED & INVASIVE HABITATS: Totals | 0.5 | 0.1% | 4.5 | 0.4% | 0.7 | 0.0% | 5.7 | 0.1% | 0.8 | 0.1% | 0.8 | 0.1% | 1.3 | 0.0% | 2.9 | 0.1% | 18.3 | 2.4% | 6.3 | 0.5% | 0.7 | 0.0% | 25.4 | 0.5% |
| OPEN WATER: | 45.1 | 59.1% | 81.1 | 82.7% | 46.3 | 82.8% | 172.5 | 74.9% | 40.5 | 53.0% | 68.3 | 69.7% | 48.3 | 86.3% | 157.1 | 68.2% | 50.9 | 66.6% | 75.6 | 77.1% | 42.0 | 75.1% | 168.5 | 73.1% |
| **INUNDATION GRAND TOTALS:** | **123.3** | **1.9%** | **150.7** | **2.6%** | **79.6** | **0.8%** | **353.6** | **1.6%** | **132.9** | **2.0%** | **127.4** | **2.2%** | **86.3** | **0.8%** | **346.6** | **1.5%** | **149.9** | **2.3%** | **135.8** | **2.4%** | **68.2** | **0.6%** | **353.9** | **1.6%** |

| Nursery-Victoria Riparian Study Reach: 0-2 mi from River Centerline | Total | | | | 9,690 cfs | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Inundation versus River Flow | Habitat Area | | | | 03/22/12 | | | | | | | |
| Central Texas/Coastal Bend/Post Oak Savanna Habitat Types* | 0-0.5 mi | 0.5-1 mi | 1-2 mi | 0-2 mi Total | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | |
| | ha | ha | ha | ha | ha | % | ha | % | ha | % | ha | % |
| **BOTTOMLAND HABITATS: Totals** | **5,025.7** | **2,138.8** | **696.3** | **7,860.6** | **122.2** | **2.4%** | **43.2** | **2.0%** | **22.7** | **3.3%** | **188.1** | **2.4%** |
| **Bottomland Forest Subtotals** | **1,927.0** | **618.5** | **281.3** | **2,826.6** | **46.6** | **2.4%** | **4.8** | **0.8%** | **2.3** | **0.8%** | **53.6** | **1.9%** |
| Bottomland Shrubland Subtotals | 274.1 | 131.4 | 66.8 | 472.3 | 7.4 | 2.7% | 0.4 | 0.3% | 1.4 | 2.1% | 9.2 | 1.9% |
| **Herbaceous Wetland Subtotals** | **2,824.6** | **1,388.9** | **348.2** | **4,561.7** | **68.2** | **2.4%** | **38.0** | **2.7%** | **19.1** | **5.5%** | **125.3** | **2.7%** |
| UPLAND HABITATS: Totals | 742.4 | 2,251.8 | 6,785.5 | 9,779.9 | 2.5 | 0.3% | 0.3 | 0.0% | 0.9 | 0.0% | 3.7 | 0.0% |
| Upland Forest/Woodland Subtotals | 279.3 | 491.0 | 1,073.9 | 1,844.3 | 0.1 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.1 | 0.0% |
| Upland Shrubland Subtotals | 86.9 | 200.4 | 326.5 | 613.7 | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% |
| Upland Grassland Subtotals | 376.2 | 1,560.5 | 5,385.2 | 7,321.9 | 2.4 | 0.6% | 0.3 | 0.0% | 0.9 | 0.0% | 3.6 | 0.0% |
| DISTURBED & INVASIVE HABITATS: Totals | 775.4 | 1,205.2 | 2,958.0 | 4,938.5 | 28.3 | 3.6% | 2.9 | 0.2% | 0.1 | 0.0% | 31.3 | 0.6% |
| OPEN WATER: | 76.4 | 98.0 | 56.0 | 230.4 | 55.5 | 72.6% | 72.5 | 74.0% | 39.6 | 70.7% | 167.6 | 72.8% |
| **INUNDATION GRAND TOTALS:** | **6,619.9** | **5,693.8** | **10,495.8** | **22,809.4** | **208.5** | **3.1%** | **118.9** | **2.1%** | **63.3** | **0.6%** | **390.7** | **1.7%** |

| Nursery-Victoria Riparian Study Reach: 0-2 mi from River Centerline | 16,900 cfs | | | | | | | | 22,400 cfs | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Inundation versus River Flow | 11/06/02 | | | | | | | | 10/29/02 | | | | | | | |
| Central Texas/Coastal Bend/Post Oak Savanna Habitat Types* | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | |
| | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % |
| **BOTTOMLAND HABITATS: Totals** | **221.9** | **4.4%** | **93.6** | **4.4%** | **29.4** | **4.2%** | **344.9** | **4.4%** | **500.1** | **10.0%** | **232.8** | **10.9%** | **53.5** | **7.7%** | **786.3** | **10.0%** |
| **Bottomland Forest Subtotals** | **63.4** | **3.3%** | **13.3** | **2.1%** | **3.3** | **1.2%** | **80.0** | **2.8%** | **150.0** | **7.8%** | **34.3** | **5.5%** | **10.2** | **3.6%** | **194.5** | **6.9%** |
| Bottomland Shrubland Subtotals | 11.0 | 4.0% | 3.2 | 2.4% | 1.4 | 2.1% | 15.6 | 3.3% | 22.8 | 8.3% | 8.7 | 6.6% | 3.8 | 5.6% | 35.3 | 7.5% |
| **Herbaceous Wetland Subtotals** | **147.5** | **5.2%** | **77.1** | **5.5%** | **24.7** | **7.1%** | **249.3** | **5.5%** | **327.3** | **11.6%** | **189.8** | **13.7%** | **39.6** | **11.4%** | **556.6** | **12.2%** |
| UPLAND HABITATS: Totals | 1.5 | 0.2% | 1.3 | 0.1% | 2.6 | 0.0% | 5.4 | 0.1% | 2.7 | 0.4% | 2.3 | 0.1% | 4.2 | 0.1% | 9.1 | 0.1% |
| Upland Forest/Woodland Subtotals | 0.2 | 0.1% | 0.2 | 0.0% | 0.2 | 0.0% | 0.6 | 0.0% | 0.8 | 0.3% | 0.3 | 0.1% | 0.4 | 0.0% | 1.4 | 0.1% |
| Upland Shrubland Subtotals | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% |
| Upland Grassland Subtotals | 1.3 | 0.4% | 1.1 | 0.1% | 2.3 | 0.0% | 4.8 | 0.1% | 1.9 | 0.5% | 2.1 | 0.1% | 3.8 | 0.1% | 7.7 | 0.1% |
| DISTURBED & INVASIVE HABITATS: Totals | 7.6 | 1.0% | 8.4 | 0.7% | 2.1 | 0.1% | 18.2 | 0.4% | 37.3 | 4.8% | 43.4 | 3.6% | 4.7 | 0.2% | 85.4 | 1.7% |
| OPEN WATER: | 59.8 | 78.3% | 84.8 | 86.5% | 44.4 | 79.3% | 189.0 | 82.0% | 65.7 | 86.0% | 91.9 | 93.8% | 49.4 | 88.2% | 207.0 | 89.8% |
| **INUNDATION GRAND TOTALS:** | **291.0** | **4.4%** | **188.1** | **3.3%** | **78.5** | **0.7%** | **557.4** | **2.4%** | **605.8** | **9.2%** | **370.5** | **6.5%** | **111.7** | **1.1%** | **1,087.8** | **4.8%** |

* Habitat Types by Ecoregions, Texas Ecological Systems Data: https://tpwd.texas.gov/gis (Elliott, L.F., et al. 2014)

Table 19 All Inundation (0-2 mi) Summary Data: Gonzales Riparian Study Reach
Summary and Detailed Data Available in Companion Spreadsheet: G&BR.TCS.GG.Inund.Final.6-3-16

| Gonzales Riparian Study Reach: | Total Habitat Area (ha) | | | | 446 cfs | | | | | | | | 512 cfs | | | | | | | | 567 cfs | | | | | | | | 729 cfs | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0-2 mi from River Centerline | By Buffer Distance | | | | 03/03/14 | | | | | | | | 01/16/97 | | | | | | | | 03/06/15 | | | | | | | | 02/21/07 | | | | | | | |
| Total Inundation versus River Flow | 0-0.5 mi | 0.5-1 mi | 1-2 mi | 0-2 mi Total | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | |
| Central Texas/Post Oak Savanna Habitat Types* | ha | ha | ha | ha | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % |
| **BOTTOMLAND HABITATS: Totals** | **4,122.45** | **1,157.10** | **790.25** | **6,069.80** | **48.52** | **1.18%** | **0.23** | **0.02%** | **3.94** | **0.50%** | **52.69** | **0.87%** | **38.14** | **0.93%** | **0.80** | **0.07%** | **4.76** | **0.60%** | **43.70** | **0.72%** | **54.95** | **1.33%** | **0.82** | **0.07%** | **6.16** | **0.78%** | **61.93** | **1.02%** | **56.02** | **1.36%** | **0.67** | **0.06%** | **7.17** | **0.91%** | **63.85** | **1.05%** |
| **Bottomland Forest Subtotals** | **1,465.53** | **128.62** | **130.41** | **1,724.56** | **19.77** | **1.35%** | **0.18** | **0.14%** | **0.09** | **0.07%** | **20.04** | **1.16%** | **9.19** | **0.63%** | **0.00** | **0.00%** | **0.00** | **0.00%** | **9.19** | **0.53%** | **22.36** | **1.53%** | **0.24** | **0.19%** | **0.07** | **0.06%** | **22.67** | **1.31%** | **20.59** | **1.40%** | **0.27** | **0.21%** | **0.09** | **0.07%** | **20.95** | **1.21%** |
| Bottomland Shrubland Subtotals | 435.22 | 105.71 | 53.43 | 594.35 | 1.63 | 0.37% | 0.00 | 0.00% | 0.00 | 0.00% | 1.63 | 0.27% | 1.41 | 0.32% | 0.00 | 0.00% | 0.00 | 0.00% | 1.41 | 0.24% | 2.05 | 0.47% | 0.00 | 0.00% | 0.00 | 0.00% | 2.05 | 0.35% | 2.09 | 0.48% | 0.00 | 0.00% | 0.00 | 0.00% | 2.10 | 0.35% |
| **Herbaceous Wetland Subtotals** | **2,221.71** | **922.77** | **606.41** | **3,750.89** | **27.12** | **1.22%** | **0.05** | **0.01%** | **3.84** | **0.63%** | **31.02** | **0.83%** | **27.54** | **1.24%** | **0.80** | **0.09%** | **4.76** | **0.78%** | **33.10** | **0.88%** | **30.54** | **1.37%** | **0.57** | **0.06%** | **6.09** | **1.00%** | **37.21** | **0.99%** | **33.34** | **1.50%** | **0.40** | **0.04%** | **7.08** | **1.17%** | **40.81** | **1.09%** |
| UPLAND HABITATS: Totals | 501.88 | 1,275.72 | 3,325.52 | 5,103.14 | 0.74 | 0.15% | 0.00 | 0.00% | 0.97 | 0.03% | 1.71 | 0.03% | 0.18 | 0.04% | 0.09 | 0.01% | 3.48 | 0.10% | 3.75 | 0.07% | 0.61 | 0.12% | 0.18 | 0.01% | 2.84 | 0.09% | 3.63 | 0.07% | 0.70 | 0.14% | 0.37 | 0.03% | 2.43 | 0.07% | 3.50 | 0.07% |
| Upland Forest/Woodland Subtotals | 182.10 | 150.90 | 293.02 | 626.03 | 0.73 | 0.40% | 0.00 | 0.00% | 0.00 | 0.00% | 0.73 | 0.12% | 0.09 | 0.05% | 0.07 | 0.05% | 0.00 | 0.00% | 0.16 | 0.03% | 0.54 | 0.30% | 0.03 | 0.02% | 0.21 | 0.07% | 0.78 | 0.12% | 0.42 | 0.23% | 0.00 | 0.00% | 0.05 | 0.02% | 0.47 | 0.08% |
| Upland Shrubland Subtotals | 2.22 | 4.18 | 2.41 | 8.82 | 0.00 | 0.00% | 0.00 | 0.00% | 0.00 | 0.00% | 0.00 | 0.00% | 0.00 | 0.00% | 0.00 | 0.00% | 0.00 | 0.00% | 0.00 | 0.00% | 0.00 | 0.04% | 0.00 | 0.00% | 0.00 | 0.00% | 0.00 | 0.01% | 0.02 | 0.78% | 0.00 | 0.00% | 0.00 | 0.00% | 0.02 | 0.20% |
| Upland Grassland Subtotals | 317.56 | 1,120.64 | 3,030.08 | 4,468.29 | 0.01 | 0.00% | 0.00 | 0.00% | 0.97 | 0.03% | 0.98 | 0.02% | 0.09 | 0.03% | 0.02 | 0.00% | 3.48 | 0.11% | 3.59 | 0.08% | 0.07 | 0.02% | 0.15 | 0.01% | 2.63 | 0.09% | 2.85 | 0.06% | 0.26 | 0.08% | 0.37 | 0.03% | 2.38 | 0.08% | 3.01 | 0.07% |
| DISTURBED & INVASIVE HABITATS: Totals | 476.51 | 986.37 | 1,956.76 | 3,419.66 | 0.24 | 0.05% | 0.21 | 0.02% | 2.39 | 0.12% | 2.85 | 0.08% | 0.47 | 0.10% | 0.15 | 0.01% | 3.01 | 0.15% | 3.63 | 0.11% | 0.54 | 0.11% | 0.26 | 0.03% | 3.90 | 0.20% | 4.70 | 0.14% | 0.64 | 0.13% | 0.78 | 0.08% | 2.75 | 0.14% | 4.18 | 0.12% |
| OPEN WATER: | 50.20 | 2.05 | 3.63 | 55.88 | 24.46 | 48.72% | 0.00 | 0.12% | 0.68 | 18.78% | 25.14 | 44.99% | 21.55 | 42.92% | 0.00 | 0.00% | 1.38 | 38.16% | 22.93 | 41.03% | 25.20 | 50.20% | 0.27 | 13.21% | 0.81 | 22.27% | 26.28 | 47.02% | 25.01 | 49.83% | 0.52 | 25.43% | 1.54 | 42.40% | 27.07 | 48.45% |
| **INUNDATION GRAND TOTALS:** | **5,151.05** | **3,421.24** | **6,076.16** | **14,648.48** | **73.97** | **1.44%** | **0.45** | **0.01%** | **7.97** | **0.13%** | **82.39** | **0.56%** | **60.34** | **1.17%** | **1.04** | **0.03%** | **12.64** | **0.21%** | **74.01** | **0.51%** | **81.30** | **1.58%** | **1.53** | **0.04%** | **13.71** | **0.23%** | **96.54** | **0.66%** | **82.38** | **1.60%** | **2.33** | **0.07%** | **13.89** | **0.23%** | **98.60** | **0.67%** |

| Gonzales Riparian Study Reach: | Total Habitat Area (ha) | | | | 864 cfs | | | | | | | | 2,510 cfs | | | | | | | | 2,570 cfs | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0-2 mi from River Centerline | By Buffer Distance | | | | 01/09/00 | | | | | | | | 03/01/10 | | | | | | | | 01/06/02 | | | | | | | |
| Total Inundation versus River Flow | 0-0.5 mi | 0.5-1 mi | 1-2 mi | 0-2 mi Total | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | |
| Central Texas/Post Oak Savanna Habitat Types* | ha | ha | ha | ha | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % |
| **BOTTOMLAND HABITATS: Totals** | **4,122.45** | **1,157.10** | **790.25** | **6,069.80** | **66.02** | **1.60%** | **0.79** | **0.07%** | **7.02** | **0.89%** | **73.83** | **1.22%** | **68.12** | **1.65%** | **2.75** | **0.24%** | **8.79** | **1.11%** | **79.66** | **1.31%** | **62.58** | **1.52%** | **1.44** | **0.12%** | **8.00** | **1.01%** | **72.01** | **1.19%** |
| **Bottomland Forest Subtotals** | **1,465.53** | **128.62** | **130.41** | **1,724.56** | **27.99** | **1.91%** | **0.00** | **0.00%** | **0.00** | **0.00%** | **27.99** | **1.62%** | **26.92** | **1.84%** | **0.33** | **0.26%** | **0.07** | **0.06%** | **27.33** | **1.58%** | **23.25** | **1.59%** | **0.30** | **0.23%** | **0.15** | **0.12%** | **23.70** | **1.37%** |
| Bottomland Shrubland Subtotals | 435.22 | 105.71 | 53.43 | 594.35 | 2.63 | 0.60% | 0.00 | 0.00% | 0.00 | 0.00% | 2.63 | 0.44% | 2.30 | 0.53% | 0.43 | 0.40% | 0.00 | 0.00% | 2.73 | 0.46% | 2.73 | 0.63% | 0.00 | 0.00% | 0.00 | 0.00% | 2.73 | 0.46% |
| **Herbaceous Wetland Subtotals** | **2,221.71** | **922.77** | **606.41** | **3,750.89** | **35.41** | **1.59%** | **0.78** | **0.08%** | **7.02** | **1.16%** | **43.21** | **1.15%** | **38.90** | **1.75%** | **1.99** | **0.22%** | **8.72** | **1.44%** | **49.61** | **1.32%** | **36.60** | **1.65%** | **1.14** | **0.12%** | **7.84** | **1.29%** | **45.58** | **1.22%** |
| UPLAND HABITATS: Totals | 501.88 | 1,275.72 | 3,325.52 | 5,103.14 | 0.95 | 0.19% | 0.63 | 0.05% | 1.82 | 0.05% | 3.40 | 0.07% | 1.27 | 0.25% | 0.80 | 0.06% | 4.40 | 0.13% | 6.47 | 0.13% | 1.06 | 0.21% | 0.85 | 0.07% | 3.76 | 0.11% | 5.68 | 0.11% |
| Upland Forest/Woodland Subtotals | 182.10 | 150.90 | 293.02 | 626.03 | 0.86 | 0.47% | 0.00 | 0.00% | 0.00 | 0.00% | 0.86 | 0.14% | 0.97 | 0.53% | 0.03 | 0.02% | 0.08 | 0.03% | 1.08 | 0.17% | 0.95 | 0.52% | 0.15 | 0.10% | 0.08 | 0.03% | 1.18 | 0.19% |
| Upland Shrubland Subtotals | 2.22 | 4.18 | 2.41 | 8.82 | 0.04 | 1.89% | 0.00 | 0.00% | 0.00 | 0.00% | 0.04 | 0.48% | 0.00 | 0.04% | 0.00 | 0.00% | 0.00 | 0.00% | 0.00 | 0.01% | 0.00 | 0.04% | 0.00 | 0.00% | 0.00 | 0.00% | 0.00 | 0.01% |
| Upland Grassland Subtotals | 317.56 | 1,120.64 | 3,030.08 | 4,468.29 | 0.04 | 0.01% | 0.63 | 0.06% | 1.82 | 0.06% | 2.49 | 0.06% | 0.30 | 0.09% | 0.77 | 0.07% | 4.33 | 0.14% | 5.39 | 0.12% | 0.11 | 0.03% | 0.71 | 0.06% | 3.68 | 0.12% | 4.50 | 0.10% |
| DISTURBED & INVASIVE HABITATS: Totals | 476.51 | 986.37 | 1,956.76 | 3,419.66 | 0.97 | 0.20% | 0.26 | 0.03% | 1.92 | 0.10% | 3.14 | 0.09% | 1.50 | 0.32% | 1.52 | 0.15% | 5.28 | 0.27% | 8.30 | 0.24% | 0.80 | 0.17% | 0.42 | 0.04% | 3.82 | 0.20% | 5.04 | 0.15% |
| OPEN WATER: | 50.20 | 2.05 | 3.63 | 55.88 | 27.37 | 54.51% | 0.26 | 12.71% | 0.89 | 24.50% | 28.52 | 51.03% | 28.51 | 56.79% | 0.70 | 34.18% | 1.56 | 43.13% | 30.77 | 55.07% | 24.51 | 48.83% | 0.48 | 23.16% | 1.47 | 40.56% | 26.46 | 47.35% |
| **INUNDATION GRAND TOTALS:** | **5,151.05** | **3,421.24** | **6,076.16** | **14,648.48** | **95.30** | **1.85%** | **1.94** | **0.06%** | **11.65** | **0.19%** | **108.89** | **0.74%** | **99.40** | **1.93%** | **5.77** | **0.17%** | **20.04** | **0.33%** | **125.21** | **0.85%** | **88.95** | **1.73%** | **3.19** | **0.09%** | **17.05** | **0.28%** | **109.19** | **0.75%** |

| Gonzales Riparian Study Reach: | Total Habitat Area (ha) | | | | 3,450 cfs | | | | | | | | 4,480 cfs | | | | | | | | 4,980 cfs | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0-2 mi from River Centerline | By Buffer Distance | | | | 01/14/05 | | | | | | | | 03/15/01 | | | | | | | | 02/17/03 | | | | | | | |
| Total Inundation versus River Flow | 0-0.5 mi | 0.5-1 mi | 1-2 mi | 0-2 mi Total | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | |
| Central Texas/Post Oak Savanna Habitat Types* | ha | ha | ha | ha | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % |
| **BOTTOMLAND HABITATS: Totals** | **4,122.45** | **1,157.10** | **790.25** | **6,069.80** | **87.81** | **2.13%** | **1.83** | **0.16%** | **8.45** | **1.07%** | **98.09** | **1.62%** | **125.66** | **3.05%** | **13.07** | **1.13%** | **18.49** | **2.34%** | **157.21** | **2.59%** | **148.58** | **3.60%** | **4.59** | **0.40%** | **13.23** | **1.67%** | **166.39** | **2.74%** |
| **Bottomland Forest Subtotals** | **1,465.53** | **128.62** | **130.41** | **1,724.56** | **42.31** | **2.89%** | **0.36** | **0.28%** | **0.43** | **0.33%** | **43.10** | **2.50%** | **48.35** | **3.30%** | **0.96** | **0.75%** | **0.97** | **0.75%** | **50.28** | **2.92%** | **82.71** | **5.64%** | **1.46** | **1.13%** | **1.62** | **1.24%** | **85.78** | **4.97%** |
| Bottomland Shrubland Subtotals | 435.22 | 105.71 | 53.43 | 594.35 | 3.54 | 0.81% | 0.16 | 0.15% | 0.00 | 0.00% | 3.70 | 0.62% | 5.37 | 1.23% | 1.40 | 1.32% | 0.00 | 0.00% | 6.77 | 1.14% | 5.95 | 1.37% | 0.40 | 0.38% | 0.09 | 0.16% | 6.44 | 1.08% |
| **Herbaceous Wetland Subtotals** | **2,221.71** | **922.77** | **606.41** | **3,750.89** | **41.95** | **1.89%** | **1.31** | **0.14%** | **8.02** | **1.32%** | **51.29** | **1.37%** | **71.95** | **3.24%** | **10.71** | **1.16%** | **17.52** | **2.89%** | **100.17** | **2.67%** | **59.92** | **2.70%** | **2.73** | **0.30%** | **11.53** | **1.90%** | **74.18** | **1.98%** |
| UPLAND HABITATS: Totals | 501.88 | 1,275.72 | 3,325.52 | 5,103.14 | 1.33 | 0.27% | 0.75 | 0.06% | 3.80 | 0.11% | 5.88 | 0.12% | 4.47 | 0.89% | 2.14 | 0.17% | 12.90 | 0.39% | 19.51 | 0.38% | 2.54 | 0.51% | 1.86 | 0.15% | 7.40 | 0.22% | 11.80 | 0.23% |
| Upland Forest/Woodland Subtotals | 182.10 | 150.90 | 293.02 | 626.03 | 1.20 | 0.66% | 0.06 | 0.04% | 0.16 | 0.05% | 1.42 | 0.23% | 1.66 | 0.91% | 0.40 | 0.26% | 0.16 | 0.05% | 2.22 | 0.35% | 2.13 | 1.17% | 0.24 | 0.16% | 0.41 | 0.14% | 2.79 | 0.45% |
| Upland Shrubland Subtotals | 2.22 | 4.18 | 2.41 | 8.82 | 0.02 | 0.97% | 0.00 | 0.00% | 0.00 | 0.00% | 0.02 | 0.25% | 0.00 | 0.04% | 0.00 | 0.00% | 0.00 | 0.00% | 0.00 | 0.01% | 0.06 | 2.80% | 0.00 | 0.00% | 0.00 | 0.00% | 0.06 | 0.70% |
| Upland Grassland Subtotals | 317.56 | 1,120.64 | 3,030.08 | 4,468.29 | 0.11 | 0.03% | 0.68 | 0.06% | 3.64 | 0.12% | 4.43 | 0.10% | 2.81 | 0.88% | 1.75 | 0.16% | 12.74 | 0.42% | 17.30 | 0.39% | 0.34 | 0.11% | 1.62 | 0.14% | 6.99 | 0.23% | 8.95 | 0.20% |
| DISTURBED & INVASIVE HABITATS: Totals | 476.51 | 986.37 | 1,956.76 | 3,419.66 | 1.53 | 0.32% | 2.55 | 0.26% | 4.41 | 0.23% | 8.49 | 0.25% | 3.08 | 0.65% | 9.19 | 0.93% | 20.38 | 1.04% | 32.65 | 0.95% | 1.86 | 0.39% | 5.31 | 0.54% | 5.56 | 0.28% | 12.73 | 0.37% |
| OPEN WATER: | 50.20 | 2.05 | 3.63 | 55.88 | 29.77 | 59.30% | 0.60 | 29.35% | 1.84 | 50.65% | 32.21 | 57.64% | 29.60 | 58.96% | 0.93 | 45.53% | 1.81 | 49.87% | 32.34 | 57.87% | 34.74 | 69.19% | 0.76 | 37.05% | 1.80 | 49.75% | 37.30 | 66.75% |
| **INUNDATION GRAND TOTALS:** | **5,151.05** | **3,421.24** | **6,076.16** | **14,648.48** | **120.44** | **2.34%** | **5.73** | **0.17%** | **18.50** | **0.30%** | **144.67** | **0.99%** | **162.80** | **3.16%** | **25.33** | **0.74%** | **53.58** | **0.88%** | **241.72** | **1.65%** | **187.71** | **3.64%** | **12.52** | **0.37%** | **27.99** | **0.46%** | **228.23** | **1.56%** |

| Gonzales Riparian Study Reach: | Total Habitat Area (ha) | | | | 6,160 cfs | | | | | | | | 7,220 cfs | | | | | | | | 7,650 cfs | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0-2 mi from River Centerline | By Buffer Distance | | | | 12/31/02 | | | | | | | | 01/01/03 | | | | | | | | 12/04/04 | | | | | | | |
| Total Inundation versus River Flow | 0-0.5 mi | 0.5-1 mi | 1-2 mi | 0-2 mi Total | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | |
| Central Texas/Post Oak Savanna Habitat Types* | ha | ha | ha | ha | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % | ha | % |
| **BOTTOMLAND HABITATS: Totals** | **4,122.45** | **1,157.10** | **790.25** | **6,069.80** | **150.60** | **3.65%** | **31.54** | **2.73%** | **19.73** | **2.50%** | **201.87** | **3.33%** | **186.38** | **4.52%** | **17.17** | **1.48%** | **21.66** | **2.74%** | **225.21** | **3.71%** | **165.96** | **4.03%** | **4.11** | **0.36%** | **44.77** | **5.66%** | **214.84** | **3.54%** |
| **Bottomland Forest Subtotals** | **1,465.53** | **128.62** | **130.41** | **1,724.56** | **55.00** | **3.75%** | **1.17** | **0.91%** | **0.88** | **0.68%** | **57.05** | **3.31%** | **89.40** | **6.10%** | **1.70** | **1.32%** | **1.85** | **1.42%** | **92.95** | **5.39%** | **95.30** | **6.50%** | **0.99** | **0.77%** | **1.34** | **1.03%** | **97.64** | **5.66%** |
| Bottomland Shrubland Subtotals | 435.22 | 105.71 | 53.43 | 594.35 | 8.30 | 1.91% | 1.67 | 1.58% | 0.00 | 0.00% | 9.97 | 1.68% | 9.15 | 2.10% | 1.34 | 1.26% | 0.28 | 0.53% | 10.77 | 1.81% | 7.52 | 1.73% | 0.32 | 0.30% | 0.21 | 0.39% | 8.05 | 1.35% |
| **Herbaceous Wetland Subtotals** | **2,221.71** | **922.77** | **606.41** | **3,750.89** | **87.30** | **3.93%** | **28.70** | **3.11%** | **18.85** | **3.11%** | **134.85** | **3.60%** | **87.83** | **3.95%** | **14.13** | **1.53%** | **19.53** | **3.22%** | **121.49** | **3.24%** | **63.14** | **2.84%** | **2.80** | **0.30%** | **43.21** | **7.13%** | **109.15** | **2.91%** |
| UPLAND HABITATS: Totals | 501.88 | 1,275.72 | 3,325.52 | 5,103.14 | 3.62 | 0.72% | 6.06 | 0.47% | 12.10 | 0.36% | 21.78 | 0.43% | 4.70 | 0.94% | 6.26 | 0.49% | 9.55 | 0.29% | 20.51 | 0.40% | 5.20 | 1.04% | 1.23 | 0.10% | 5.40 | 0.16% | 11.84 | 0.23% |
| Upland Forest/Woodland Subtotals | 182.10 | 150.90 | 293.02 | 626.03 | 1.80 | 0.99% | 0.29 | 0.19% | 0.14 | 0.05% | 2.23 | 0.36% | 2.85 | 1.56% | 0.38 | 0.25% | 0.68 | 0.23% | 3.91 | 0.62% | 3.04 | 1.67% | 0.27 | 0.18% | 0.38 | 0.13% | 3.69 | 0.59% |
| Upland Shrubland Subtotals | 2.22 | 4.18 | 2.41 | 8.82 | 0.07 | 3.03% | 0.00 | 0.00% | 0.00 | 0.00% | 0.07 | 0.76% | 0.05 | 2.10% | 0.00 | 0.00% | 0.00 | 0.00% | 0.05 | 0.53% | 0.05 | 2.10% | 0.00 | 0.00% | 0.00 | 0.00% | 0.05 | 0.53% |
| Upland Grassland Subtotals | 317.56 | 1,120.64 | 3,030.08 | 4,468.29 | 1.75 | 0.55% | 5.77 | 0.51% | 11.97 | 0.39% | 19.48 | 0.44% | 1.81 | 0.57% | 5.88 | 0.53% | 8.86 | 0.29% | 16.56 | 0.37% | 2.12 | 0.67% | 0.96 | 0.09% | 5.02 | 0.17% | 8.11 | 0.18% |
| DISTURBED & INVASIVE HABITATS: Totals | 476.51 | 986.37 | 1,956.76 | 3,419.66 | 6.04 | 1.27% | 20.45 | 2.07% | 18.11 | 0.93% | 44.60 | 1.30% | 6.33 | 1.33% | 17.54 | 1.78% | 14.94 | 0.76% | 38.81 | 1.13% | 4.14 | 0.87% | 5.56 | 0.56% | 5.39 | 0.28% | 15.09 | 0.44% |
| OPEN WATER: | 50.20 | 2.05 | 3.63 | 55.88 | 30.17 | 60.10% | 0.75 | 36.36% | 1.63 | 44.97% | 32.55 | 58.25% | 35.21 | 70.13% | 0.82 | 39.86% | 2.10 | 57.90% | 38.13 | 68.23% | 34.83 | 69.37% | 0.76 | 37.16% | 1.76 | 48.43% | 37.35 | 66.83% |
| **INUNDATION GRAND TOTALS:** | **5,151.05** | **3,421.24** | **6,076.16** | **14,648.48** | **190.43** | **3.70%** | **58.80** | **1.72%** | **51.58** | **0.85%** | **300.80** | **2.05%** | **232.61** | **4.52%** | **41.79** | **1.22%** | **48.25** | **0.79%** | **322.65** | **2.20%** | **210.13** | **4.08%** | **11.67** | **0.34%** | **57.32** | **0.94%** | **279.12** | **1.91%** |

* Habitat Types by Ecoregions, Texas Ecological Systems Data: https://tpwd.texas.gov/gis (Elliott, L.F., et al. 2014)

# Table 20 All Inundation (0-2 mi) Summary Data: Hearne Riparian Study Reach

## Summary and Detailed Data Available in Companion Spreadsheet: G&BR.TCS.BH.Inund.Final.6-6-16

| Hearne Riparian Study Reach: 0-2 mi from River Centerline | Total Habitat Area (ha) | | | | 85 cfs | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Inundation versus River Flow | By Buffer Distance | | | | 12/09/14 | | | | | | | |
| Columbia Bottomlands/Post Oak Savanna Habitat Types* | 0-0.5 mi | 0.5-1 mi | 1-2 mi | 0-2 mi Total | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | |
| | ha | ha | ha | ha | ha | % | ha | % | ha | % | ha | % |
| **BOTTOMLAND HABITATS:** | **5,777.8** | **3,234.5** | **4,873.0** | **13,885.7** | **56.0** | **1.0%** | **9.1** | **0.3%** | **25.0** | **0.5%** | **90.1** | **0.6%** |
| Swamp Forest Subtotals | 0.9 | 2.6 | 6.3 | 9.8 | 0.1 | 9.3% | 0.0 | 0.0% | 0.0 | 0.0% | 0.1 | 0.8% |
| **Bottomland Forest Subtotals** | **2,940.7** | **1,186.8** | **1,567.8** | **5,695.4** | **32.0** | **1.1%** | **3.9** | **0.3%** | **10.3** | **0.7%** | **46.2** | **0.8%** |
| Bottomland Shrubland Subtotals | 142.2 | 93.2 | 206.5 | 441.8 | 0.0 | 0.0% | 0.1 | 0.1% | 0.3 | 0.1% | 0.4 | 0.1% |
| **Herbaceous Wetland Subtotals** | **2,694.0** | **1,951.9** | **3,092.5** | **7,738.7** | **23.9** | **0.9%** | **5.1** | **0.3%** | **14.4** | **0.5%** | **43.4** | **0.6%** |
| UPLAND HABITATS: | 1,320.8 | 1,445.1 | 2,187.2 | 4,953.0 | 2.3 | 0.2% | 0.8 | 0.1% | 0.7 | 0.0% | 3.8 | 0.1% |
| Upland Forest//Woodland Subtotals | 235.6 | 95.7 | 20.9 | 352.2 | 1.2 | 0.5% | 0.3 | 0.3% | 0.0 | 0.0% | 1.5 | 0.4% |
| Upland Grassland Subtotals | 1,085.2 | 1,349.4 | 2,166.3 | 4,600.8 | 1.1 | 0.1% | 0.5 | 0.0% | 0.7 | 0.0% | 2.4 | 0.1% |
| DISTURBED & INVASIVE HABITATS: | 413.0 | 920.9 | 2,681.0 | 4,014.9 | 1.7 | 0.4% | 0.1 | 0.0% | 2.0 | 0.1% | 3.8 | 0.1% |
| OPEN WATER | 716.8 | 18.7 | 88.5 | 824.0 | 307.9 | 43.0% | 8.2 | 43.9% | 28.0 | 31.7% | 344.0 | 41.7% |
| **GRAND TOTALS:** | **8,228.4** | **5,619.3** | **9,829.7** | **23,677.7** | **367.9** | **4.5%** | **18.2** | **0.3%** | **55.8** | **0.6%** | **441.7** | **1.9%** |

| Hearne Riparian Study Reach: 0-2 mi from River Centerline | 463 cfs | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Total Inundation versus River Flow | 12/12/89 | | | | | | | |
| Columbia Bottomlands/Post Oak Savanna Habitat Types* | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | |
| | ha | % | ha | % | ha | % | ha | % |
| **BOTTOMLAND HABITATS:** | **42.3** | **0.7%** | **10.9** | **0.3%** | **11.8** | **0.2%** | **65.0** | **0.5%** |
| Swamp Forest Subtotals | 0.1 | 10.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.1 | 0.9% |
| **Bottomland Forest Subtotals** | **30.1** | **1.0%** | **5.1** | **0.4%** | **3.7** | **0.2%** | **38.9** | **0.7%** |
| Bottomland Shrubland Subtotals | 0.1 | 0.1% | 0.9 | 0.9% | 0.5 | 0.2% | 1.5 | 0.3% |
| **Herbaceous Wetland Subtotals** | **12.0** | **0.4%** | **5.0** | **0.3%** | **7.6** | **0.2%** | **24.6** | **0.3%** |
| UPLAND HABITATS: | 0.7 | 0.1% | 0.1 | 0.0% | 0.0 | 0.0% | 0.8 | 0.0% |
| Upland Forest//Woodland Subtotals | 0.6 | 0.3% | 0.1 | 0.1% | 0.0 | 0.0% | 0.7 | 0.2% |
| Upland Grassland Subtotals | 0.1 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.1 | 0.0% |
| DISTURBED & INVASIVE HABITATS: | 4.0 | 1.0% | 0.1 | 0.0% | 1.2 | 0.0% | 5.3 | 0.1% |
| OPEN WATER | 278.0 | 38.8% | 5.3 | 28.4% | 27.5 | 31.1% | 310.8 | 37.7% |
| **GRAND TOTALS:** | **324.9** | **3.9%** | **16.4** | **0.3%** | **40.5** | **0.4%** | **381.8** | **1.6%** |

| Hearne Riparian Study Reach: 0-2 mi from River Centerline | 1,180 cfs | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Total Inundation versus River Flow | 03/20/14 | | | | | | | |
| Columbia Bottomlands/Post Oak Savanna Habitat Types* | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | |
| | ha | % | ha | % | ha | % | ha | % |
| **BOTTOMLAND HABITATS:** | **67.7** | **1.2%** | **18.6** | **0.6%** | **59.6** | **1.2%** | **145.9** | **1.1%** |
| Swamp Forest Subtotals | 0.3 | 34.5% | 0.0 | 0.0% | 0.0 | 0.0% | 0.3 | 3.1% |
| **Bottomland Forest Subtotals** | **37.4** | **1.3%** | **7.8** | **0.7%** | **24.9** | **1.6%** | **70.1** | **1.2%** |
| Bottomland Shrubland Subtotals | 0.0 | 0.0% | 0.7 | 0.7% | 2.6 | 1.3% | 3.3 | 0.7% |
| **Herbaceous Wetland Subtotals** | **29.9** | **1.1%** | **10.2** | **0.5%** | **32.1** | **1.0%** | **72.2** | **0.9%** |
| UPLAND HABITATS: | 2.4 | 0.2% | 2.2 | 0.2% | 2.4 | 0.1% | 7.1 | 0.1% |
| Upland Forest//Woodland Subtotals | 1.0 | 0.4% | 0.4 | 0.5% | 0.0 | 0.0% | 1.4 | 0.4% |
| Upland Grassland Subtotals | 1.5 | 0.1% | 1.8 | 0.1% | 2.4 | 0.1% | 5.7 | 0.1% |
| DISTURBED & INVASIVE HABITATS: | 3.1 | 0.7% | 0.4 | 0.0% | 23.2 | 0.9% | 26.7 | 0.7% |
| OPEN WATER | 392.4 | 54.7% | 9.5 | 50.6% | 35.6 | 40.2% | 437.4 | 53.1% |
| **GRAND TOTALS:** | **465.6** | **5.7%** | **30.7** | **0.5%** | **120.9** | **1.2%** | **617.1** | **2.6%** |

| Hearne Riparian Study Reach: 0-2 mi from River Centerline | 2,300 cfs | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Total Inundation versus River Flow | 02/01/91 | | | | | | | |
| Columbia Bottomlands/Post Oak Savanna Habitat Types* | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | |
| | ha | % | ha | % | ha | % | ha | % |
| **BOTTOMLAND HABITATS:** | **129.1** | **2.2%** | **26.9** | **0.8%** | **0.0** | **0.0%** | **205.6** | **1.5%** |
| Swamp Forest Subtotals | 0.3 | 35.1% | 0.0 | 0.0% | 0.0 | 0.0% | 0.3 | 3.2% |
| **Bottomland Forest Subtotals** | **82.7** | **2.8%** | **14.6** | **1.2%** | **20.1** | **1.3%** | **117.4** | **2.1%** |
| Bottomland Shrubland Subtotals | 0.7 | 0.5% | 2.0 | 2.2% | 3.8 | 1.9% | 6.6 | 1.5% |
| **Herbaceous Wetland Subtotals** | **45.3** | **1.7%** | **10.3** | **0.5%** | **25.7** | **0.8%** | **81.3** | **1.1%** |
| UPLAND HABITATS: | 1.7 | 0.1% | 5.7 | 0.4% | 8.3 | 0.4% | 15.8 | 0.3% |
| Upland Forest//Woodland Subtotals | 1.5 | 0.6% | 0.8 | 0.8% | 0.0 | 0.0% | 2.3 | 0.7% |
| Upland Grassland Subtotals | 0.2 | 0.0% | 4.9 | 0.4% | 8.3 | 0.4% | 13.5 | 0.3% |
| DISTURBED & INVASIVE HABITATS: | 9.0 | 2.2% | 3.4 | 0.4% | 5.1 | 0.2% | 17.5 | 0.4% |
| OPEN WATER | 462.5 | 64.5% | 9.8 | 52.5% | 52.4 | 59.1% | 524.7 | 63.7% |
| **GRAND TOTALS:** | **602.3** | **7.3%** | **45.9** | **0.8%** | **65.8** | **0.7%** | **763.7** | **3.2%** |

| Hearne Riparian Study Reach: 0-2 mi from River Centerline | Total Habitat Area (ha) | | | | 2,520 cfs | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Total Inundation versus River Flow | By Buffer Distance | | | | 01/21/93 | | | | | | | |
| Columbia Bottomlands/Post Oak Savanna Habitat Types* | 0-0.5 mi | 0.5-1 mi | 1-2 mi | 0-2 mi Total | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | |
| | ha | ha | ha | ha | ha | % | ha | % | ha | % | ha | % |
| **BOTTOMLAND HABITATS:** | **5,777.8** | **3,234.5** | **4,873.0** | **13,885.7** | **109.4** | **1.9%** | **14.2** | **0.4%** | **36.9** | **0.8%** | **160.5** | **1.2%** |
| Swamp Forest Subtotals | 0.9 | 2.6 | 6.3 | 9.8 | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% | 0.0 | 0.0% |
| **Bottomland Forest Subtotals** | **2,940.7** | **1,186.8** | **1,567.8** | **5,695.4** | **66.3** | **2.3%** | **7.8** | **0.7%** | **15.7** | **1.0%** | **89.9** | **1.6%** |
| Bottomland Shrubland Subtotals | 142.2 | 93.2 | 206.5 | 441.8 | 0.5 | 0.4% | 1.3 | 1.4% | 1.0 | 0.5% | 2.8 | 0.6% |
| **Herbaceous Wetland Subtotals** | **2,694.0** | **1,951.9** | **3,092.5** | **7,738.7** | **42.6** | **1.6%** | **5.1** | **0.3%** | **20.1** | **0.7%** | **67.8** | **0.9%** |
| UPLAND HABITATS: | 1,320.8 | 1,445.1 | 2,187.2 | 4,953.0 | 1.3 | 0.1% | 1.3 | 0.1% | 1.9 | 0.1% | 4.4 | 0.1% |
| Upland Forest//Woodland Subtotals | 235.6 | 95.7 | 20.9 | 352.2 | 1.0 | 0.4% | 0.4 | 0.5% | 0.0 | 0.2% | 1.5 | 0.4% |
| Upland Grassland Subtotals | 1,085.2 | 1,349.4 | 2,166.3 | 4,600.8 | 0.2 | 0.0% | 0.8 | 0.1% | 1.8 | 0.1% | 2.9 | 0.1% |
| DISTURBED & INVASIVE HABITATS: | 413.0 | 920.9 | 2,681.0 | 4,014.9 | 9.0 | 2.2% | 0.1 | 0.0% | 3.3 | 0.1% | 12.4 | 0.3% |
| OPEN WATER | 716.8 | 18.7 | 88.5 | 824.0 | 455.6 | 63.6% | 11.6 | 62.1% | 42.6 | 48.1% | 509.8 | 61.9% |
| **GRAND TOTALS:** | **8,228.4** | **5,619.3** | **9,829.7** | **23,677.7** | **575.2** | **7.0%** | **27.3** | **0.5%** | **84.6** | **0.9%** | **687.1** | **2.9%** |

| Hearne Riparian Study Reach: 0-2 mi from River Centerline | 2,650 cfs | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Total Inundation versus River Flow | 02/20/98 | | | | | | | |
| Columbia Bottomlands/Post Oak Savanna Habitat Types* | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | |
| | ha | % | ha | % | ha | % | ha | % |
| **BOTTOMLAND HABITATS:** | **125.3** | **2.2%** | **24.4** | **0.8%** | **69.1** | **1.4%** | **218.8** | **1.6%** |
| Swamp Forest Subtotals | 0.5 | 51.2% | 0.0 | 0.0% | 0.0 | 0.0% | 0.5 | 4.7% |
| **Bottomland Forest Subtotals** | **64.0** | **2.2%** | **12.7** | **1.1%** | **29.2** | **1.9%** | **105.9** | **1.9%** |
| Bottomland Shrubland Subtotals | 0.2 | 0.1% | 1.8 | 1.9% | 2.3 | 1.1% | 4.3 | 1.0% |
| **Herbaceous Wetland Subtotals** | **60.6** | **2.3%** | **9.9** | **0.5%** | **37.5** | **1.2%** | **108.1** | **1.4%** |
| UPLAND HABITATS: | 2.9 | 0.2% | 11.0 | 0.8% | 11.8 | 0.5% | 25.6 | 0.5% |
| Upland Forest//Woodland Subtotals | 1.9 | 0.8% | 0.4 | 0.5% | 0.0 | 0.0% | 2.3 | 0.7% |
| Upland Grassland Subtotals | 1.0 | 0.1% | 10.5 | 0.8% | 11.7 | 0.5% | 23.3 | 0.5% |
| DISTURBED & INVASIVE HABITATS: | 8.2 | 2.0% | 1.3 | 0.1% | 12.1 | 0.5% | 21.6 | 0.5% |
| OPEN WATER | 503.5 | 70.2% | 14.7 | 78.5% | 57.8 | 65.3% | 576.0 | 69.9% |
| **GRAND TOTALS:** | **639.8** | **7.8%** | **51.4** | **0.9%** | **150.7** | **1.5%** | **842.0** | **3.6%** |

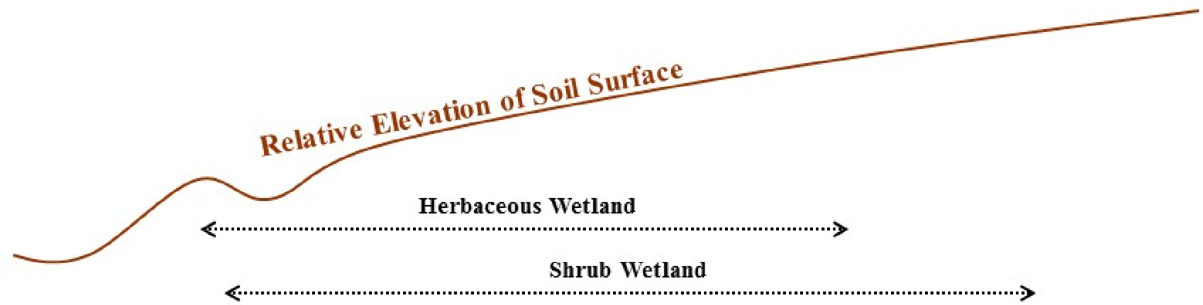
| Hearne Riparian Study Reach: 0-2 mi from River Centerline | 4,430 cfs | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Total Inundation versus River Flow | 01/14/05 | | | | | | | |
| Columbia Bottomlands/Post Oak Savanna Habitat Types* | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | |
| | ha | % | ha | % | ha | % | ha | % |
| **BOTTOMLAND HABITATS:** | **111.3** | **1.9%** | **22.6** | **0.7%** | **49.4** | **1.0%** | **183.3** | **1.3%** |
| Swamp Forest Subtotals | 0.3 | 29.4% | 0.0 | 0.0% | 0.0 | 0.0% | 0.3 | 2.7% |
| **Bottomland Forest Subtotals** | **50.1** | **1.7%** | **11.5** | **1.0%** | **18.5** | **1.2%** | **80.1** | **1.4%** |
| Bottomland Shrubland Subtotals | 0.3 | 0.2% | 1.1 | 1.2% | 0.3 | 0.1% | 1.7 | 0.4% |
| **Herbaceous Wetland Subtotals** | **60.6** | **2.3%** | **10.0** | **0.5%** | **30.6** | **1.0%** | **101.2** | **1.3%** |
| UPLAND HABITATS: | 3.7 | 0.3% | 7.4 | 0.5% | 9.7 | 0.4% | 20.9 | 0.4% |
| Upland Forest//Woodland Subtotals | 1.8 | 0.8% | 0.5 | 0.6% | 0.0 | 0.0% | 2.3 | 0.7% |
| Upland Grassland Subtotals | 1.9 | 0.2% | 6.8 | 0.5% | 9.7 | 0.4% | 18.5 | 0.4% |
| DISTURBED & INVASIVE HABITATS: | 5.9 | 1.4% | 0.8 | 0.1% | 2.7 | 0.1% | 9.4 | 0.2% |
| OPEN WATER | 543.4 | 75.8% | 14.9 | 79.4% | 52.5 | 59.3% | 610.7 | 74.1% |
| **GRAND TOTALS:** | **664.3** | **8.1%** | **45.6** | **0.8%** | **114.3** | **1.2%** | **824.2** | **3.5%** |

| Hearne Riparian Study Reach: 0-2 mi from River Centerline | 36,300 cfs | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Total Inundation versus River Flow | 01/19/92 | | | | | | | |
| Columbia Bottomlands/Post Oak Savanna Habitat Types* | 0-0.5 mi | | 0.5-1 mi | | 1-2 mi | | 0-2 mi Total | |
| | ha | % | ha | % | ha | % | ha | % |
| **BOTTOMLAND HABITATS:** | **273.8** | **4.7%** | **35.4** | **1.1%** | **291.5** | **6.0%** | **600.7** | **4.3%** |
| Swamp Forest Subtotals | 0.2 | 19.3% | 0.0 | 0.0% | 0.0 | 0.0% | 0.2 | 1.8% |
| **Bottomland Forest Subtotals** | **156.6** | **5.3%** | **15.0** | **1.3%** | **100.6** | **6.4%** | **272.0** | **4.8%** |
| Bottomland Shrubland Subtotals | 1.3 | 0.9% | 3.2 | 3.4% | 71.7 | 34.7% | 76.2 | 17.2% |
| **Herbaceous Wetland Subtotals** | **115.8** | **4.3%** | **17.3** | **0.9%** | **119.3** | **3.9%** | **252.3** | **3.3%** |
| UPLAND HABITATS: | 2.0 | 0.1% | 21.2 | 1.5% | 84.5 | 3.9% | 107.7 | 2.2% |
| Upland Forest//Woodland Subtotals | 1.6 | 0.7% | 0.7 | 0.7% | 0.0 | 0.0% | 2.3 | 0.7% |
| Upland Grassland Subtotals | 0.4 | 0.0% | 20.5 | 1.5% | 84.5 | 3.9% | 105.4 | 2.3% |
| DISTURBED & INVASIVE HABITATS: | 14.8 | 3.6% | 8.1 | 0.9% | 117.2 | 4.4% | 140.1 | 3.5% |
| OPEN WATER | 493.6 | 68.9% | 14.3 | 76.4% | 48.9 | 55.3% | 556.9 | 67.6% |
| **GRAND TOTALS:** | **784.2** | **9.5%** | **78.9** | **1.4%** | **542.2** | **5.5%** | **1,405.3** | **5.9%** |

*** Habitat Types by Ecoregions, Texas Ecological Systems Data: https://tpwd.texas.gov/gis (Elliott, L.F., et al. 2014)**

# Appendix 2: Figures

Figure 1.1 Riparian Habitats in the Lower Guadalupe River Study Areas: Victoria, Nursery, and Gonzales Landscape Context, Tree Species, and Hydrology



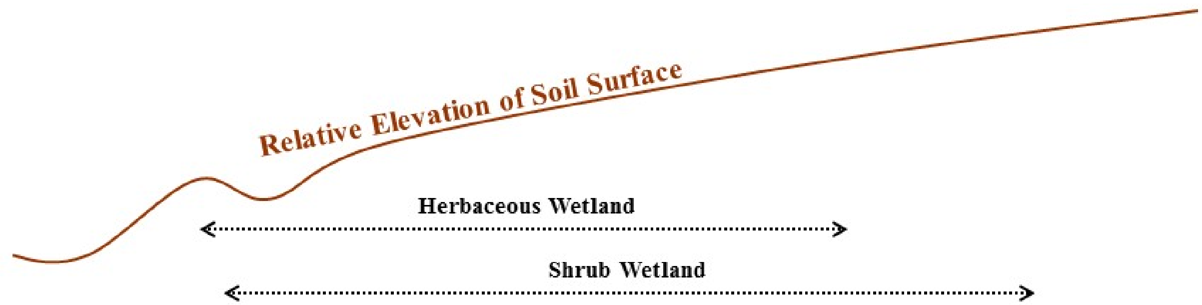

| Bottomland Habitat Types [1]: | Stream & Other Open Water | Forested Wetland: Lower Swamp (Streamside) | Forested Wetland: Upper Swamp (Between 1st & 2nd Levees) | Bottomland Hardwood Forest: Seasonally Flooded Forest (Low flats & backwater areas) | Bottomland Hardwood Forest: Temporarily Flooded Forest (High flats) | Transition to Uplands |
|---|---|---|---|---|---|---|
| **Common Tree Species (In overall order of importance):** | None | Black willow<br>Boxelder | Boxelder<br>Green ash<br>Black willow<br>Slippery elm | Eastern cottonwood<br>Boxelder<br>Green ash<br>Slippery Elm | Eastern cottonwood<br>Slippery elm<br>Rough-leaf dogwood<br>Hackberry | Rough-leaf dogwood<br>Hackberry<br>Cedar elm<br>Chinaberry<br>Post oak<br>Eastern red cedar |
| **Hydrologic Regime [2]:** | Permanently Flooded | Intermittently exposed | Frequently flooded | Seasonally flooded | Temporarily flooded | Intermittently flooded |
| **Flood Frequency-percent of years [2]:** | 100% | ~ 100% | 51-100% | 51-100% | 11-50% | 1-10% |
| **Growing-Season Inundation + Soil Saturation, total duration [2]:** | 100% (~ 8 mos.) | >50% (>4 mos.) | >25% (> 2 mos.) | 12.5-25% (1-2 mos.) | 2-12.5% (5-30 days) | < 2% (< 5 days) |

**Footnotes:** [1] Diamond, D. 2009. FIA Bottomland Summary: East Texas. Unpub. document, Missouri Resource Assessment Partnership, School of Natural Resources, U. Mo. - Columbia.

[2] Huffman, T., and S.W. Forsythe. 1981. Bottomland hardwood forest communities and their relation to anaerobic soil communities. in: Clark, J.R., and J. Benforado. Wetlands of Bottomland Hardwood Forests, Elsevier Scientific Pub. Co., New York, N.Y., pp. 187-196.

Figure created by T. Hayes, 2015

Figure 1.2 Riparian Habitats in the Middle Brazos River Study Area: Hearne Landscape Context, Tree Species, and Hydrology




| Bottomland Habitat Types [1]: | Stream & Other Open Water | Forested Wetland: Lower Swamp (Streamside) | Forested Wetland: Upper Swamp (Between 1st & 2nd Levees) | Bottomland Hardwood Forest: Seasonally Flooded Forest (Low flats & backwater areas) | Bottomland Hardwood Forest: Temporarily Flooded Forest (High flats) | Transition to Uplands |
|---|---|---|---|---|---|---|
| **Common Tree Species (In overall order of importance):** | None | Black willow<br>Boxelder | Boxelder<br>Green ash<br>Black willow<br>Slippery elm | Eastern cottonwood<br>Boxelder<br>Green ash<br>Slippery Elm | Eastern cottonwood<br>Slippery elm<br>Rough-leaf dogwood<br>Hackberry | Rough-leaf dogwood<br>Hackberry<br>Cedar elm<br>Chinaberry<br>Post oak<br>Eastern red cedar |
| **Hydrologic Regime [2]:** | Permanently Flooded | Intermittently exposed | Frequently flooded | Seasonally flooded | Temporarily flooded | Intermittently flooded |
| **Flood Frequency- percent of years [2]:** | 100% | ~ 100% | 51-100% | 51-100% | 11-50% | 1-10% |
| **Growing-Season Inundation + Soil Saturation, total duration [2]:** | 100% (~ 8 mos.) | >50% (>4 mos.) | >25% (> 2 mos.) | 12.5-25% (1-2 mos.) | 2-12.5% (5-30 days) | < 2% (< 5 days) |

**Footnotes:** [1] Diamond, D. 2009. FIA Bottomland Summary: East Texas. Unpub. document, Missouri Resource Assessment Partnership, School of Natural Resources, U. Mo. - Columbia.

[2] Huffman, T., and S.W. Forsythe. 1981. Bottomland hardwood forest communities and their relation to anaerobic soil communities. in: Clark, J.R., and J. Benforado. Wetlands of Bottomland Hardwood Forests, Elsevier Scientific Pub. Co., New York, N.Y., pp. 187-196.

Figure created by T. Hayes, 2015

Figure 2.1 Vicinity Map
Victoria, Nursery, and Gonzales Study Sites

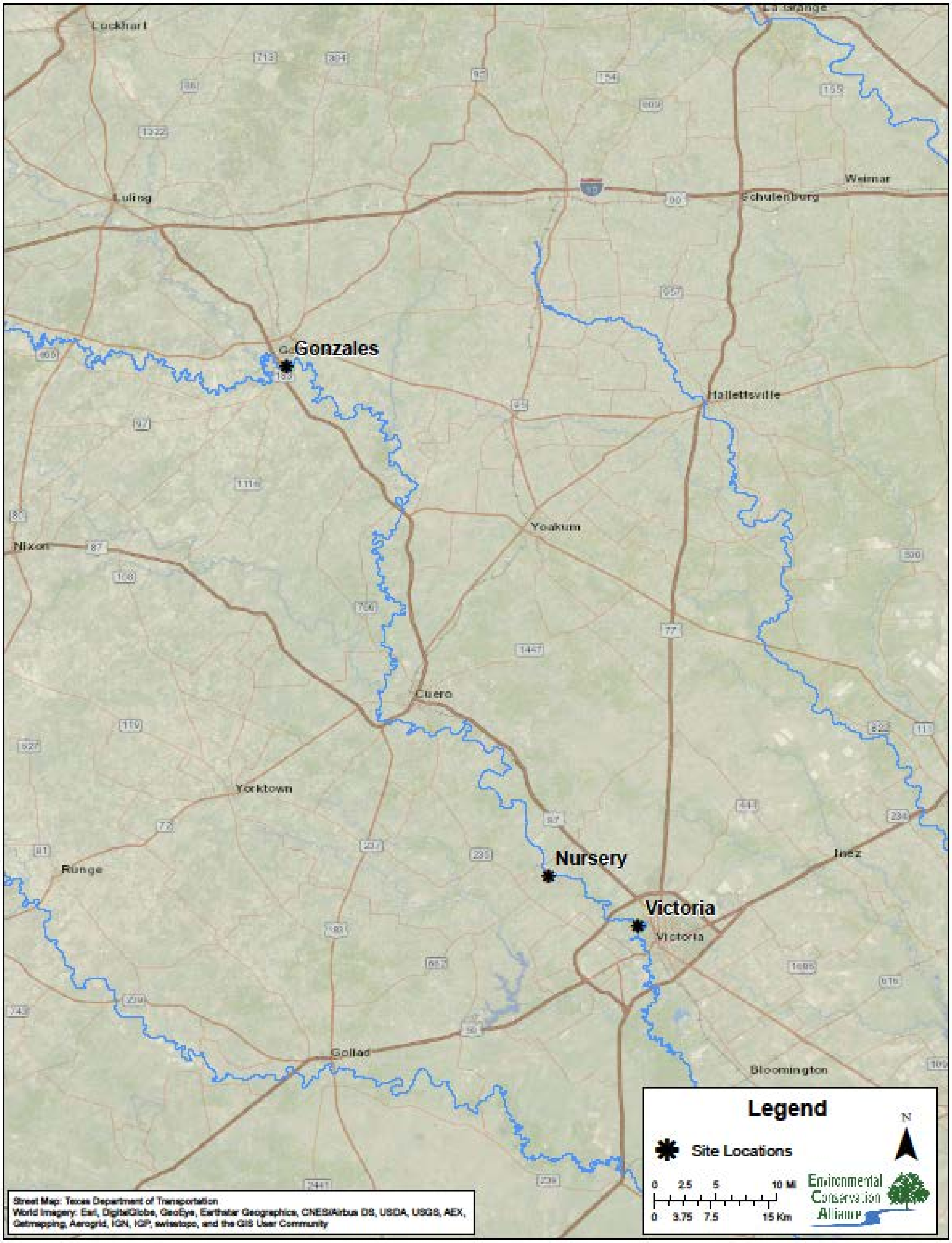


Figure 2.2 Vicinity Map
Hearne Study Site

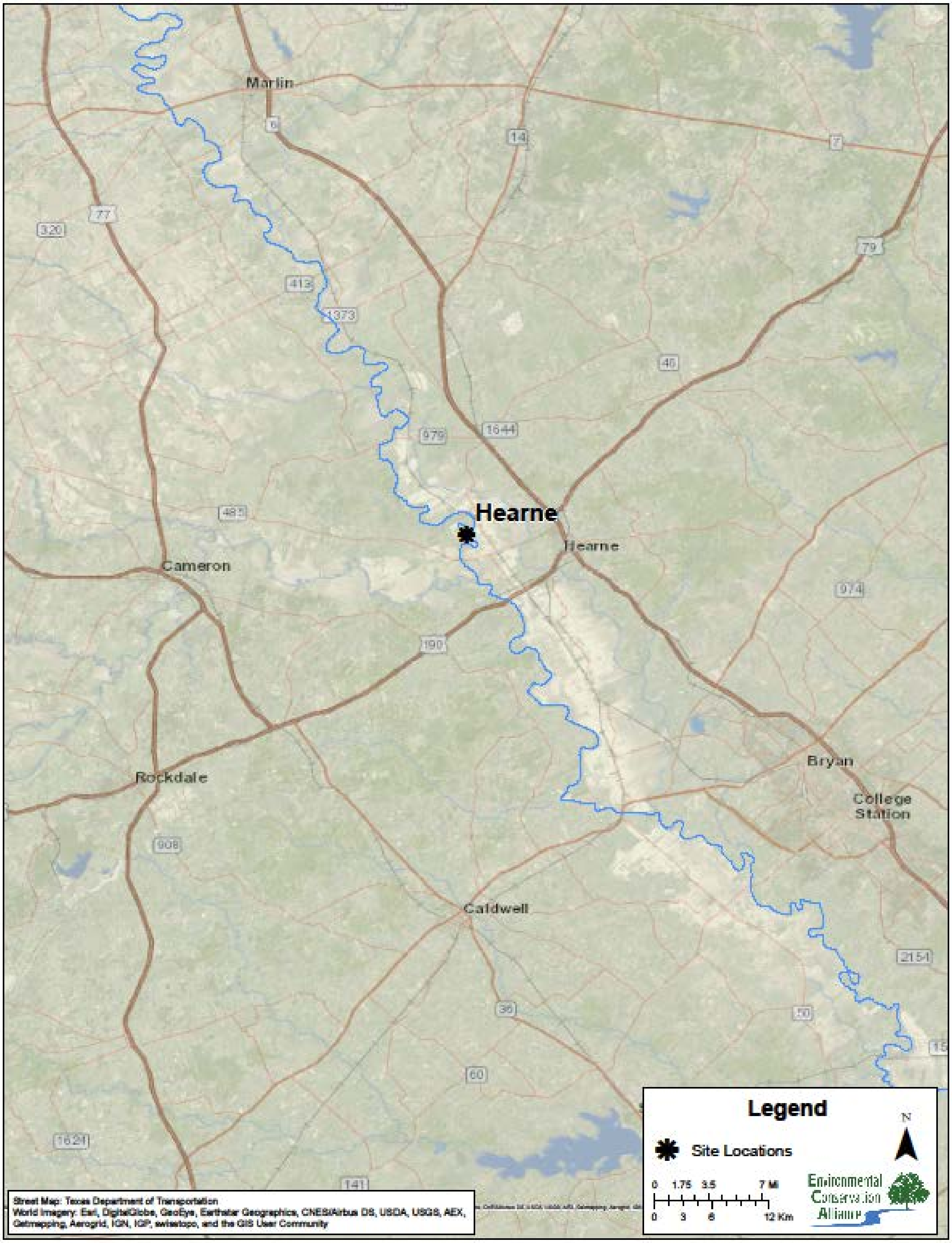


Figure 3.1 Location Map: Victoria Study Site

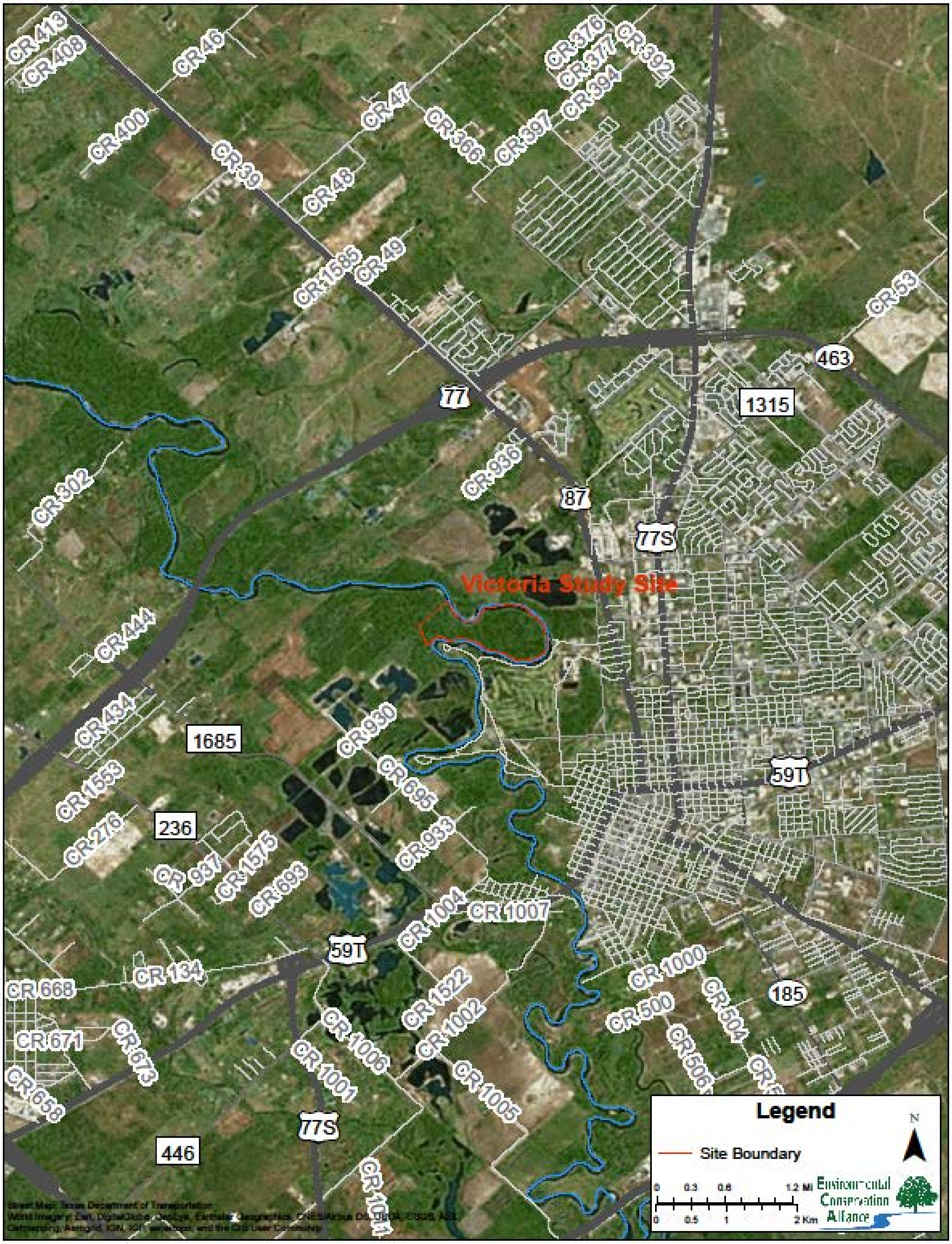


Figure 3.2 Location Map: Nursery Study Site

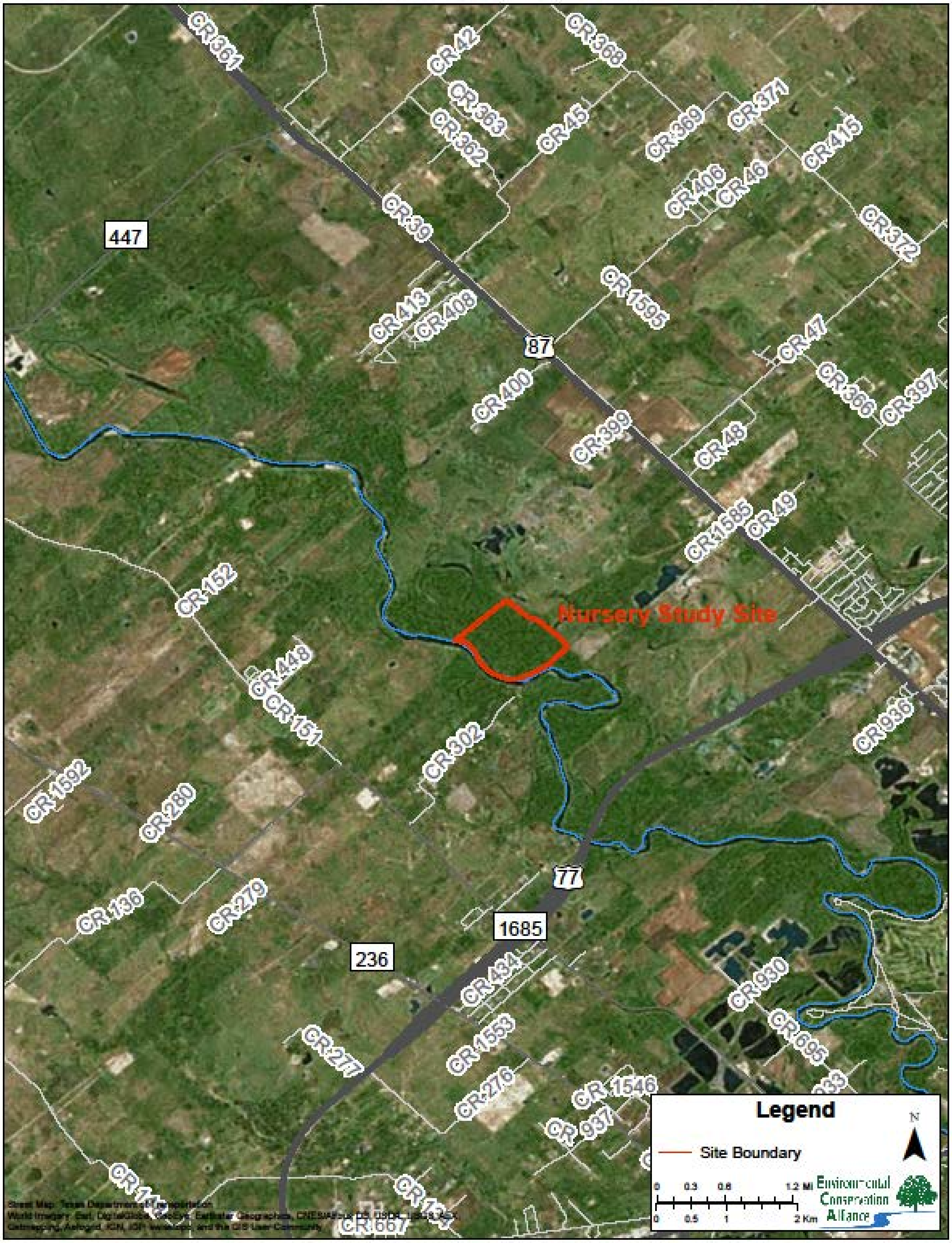


Figure 3.3 Location Map: Gonzales Study Site

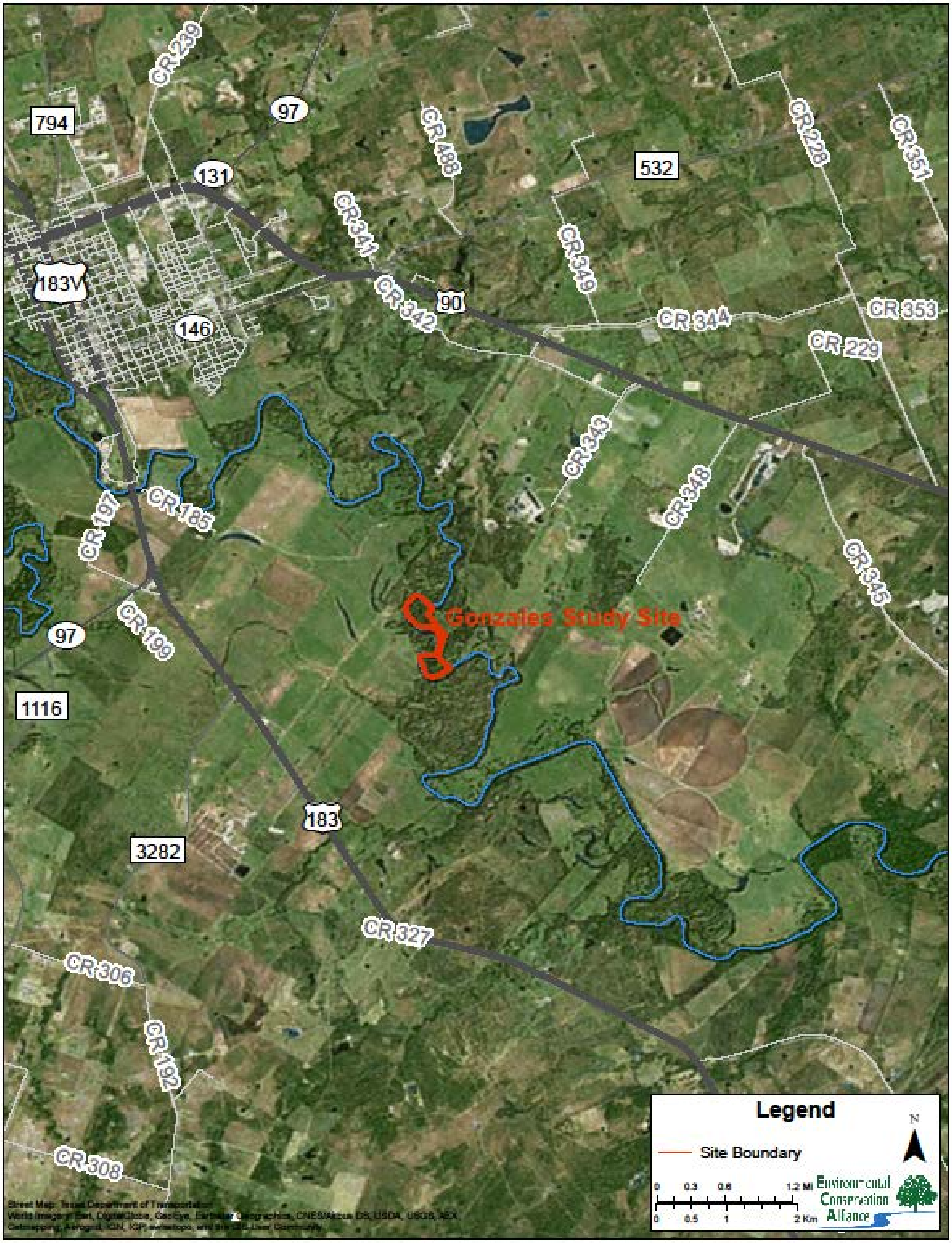


Figure 3.4 Location Map: Hearne Study Site

Figure 4.1 Victoria Study Site: Transect Locations

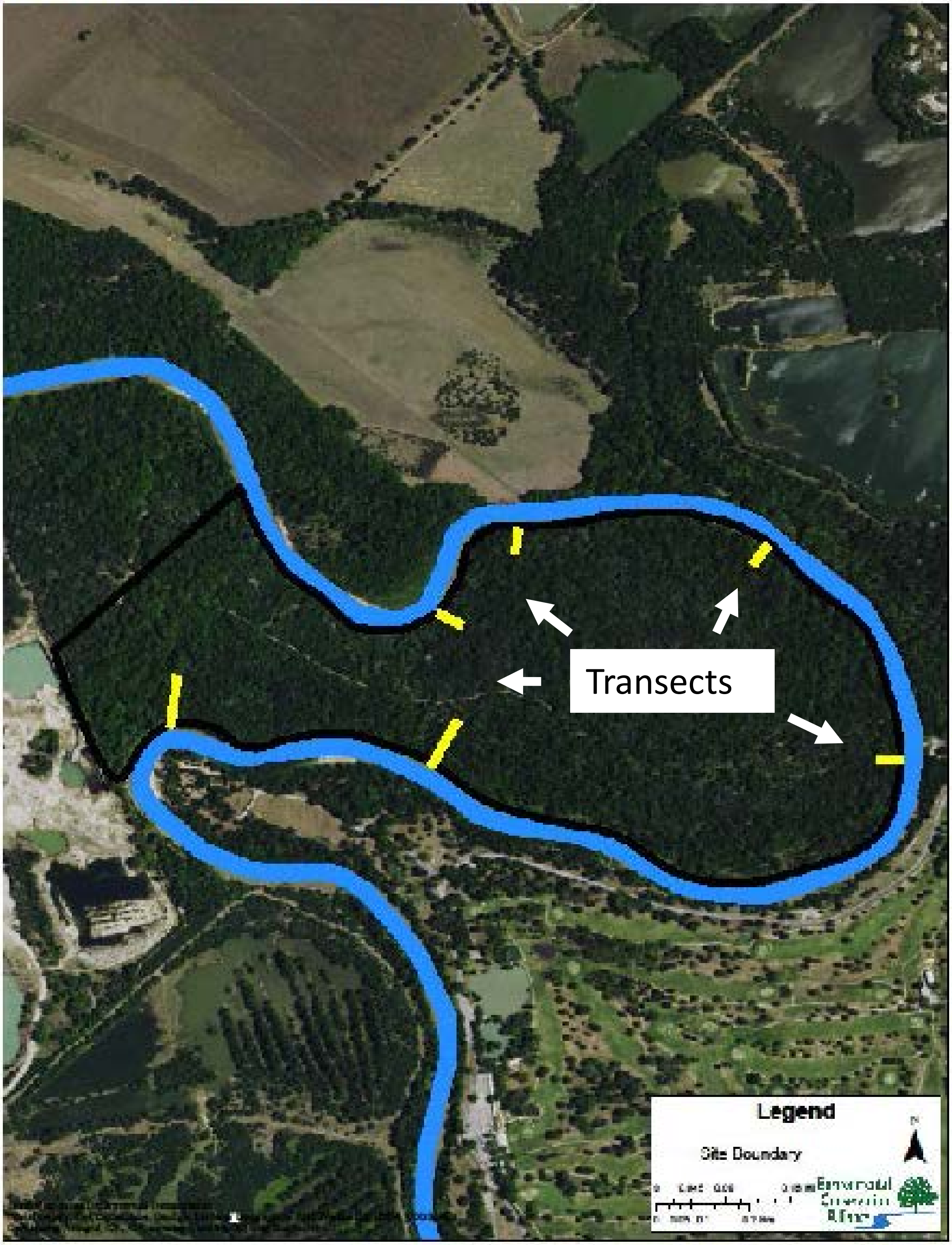


Figure 4.2 Nursery Study Site: Transect Locations

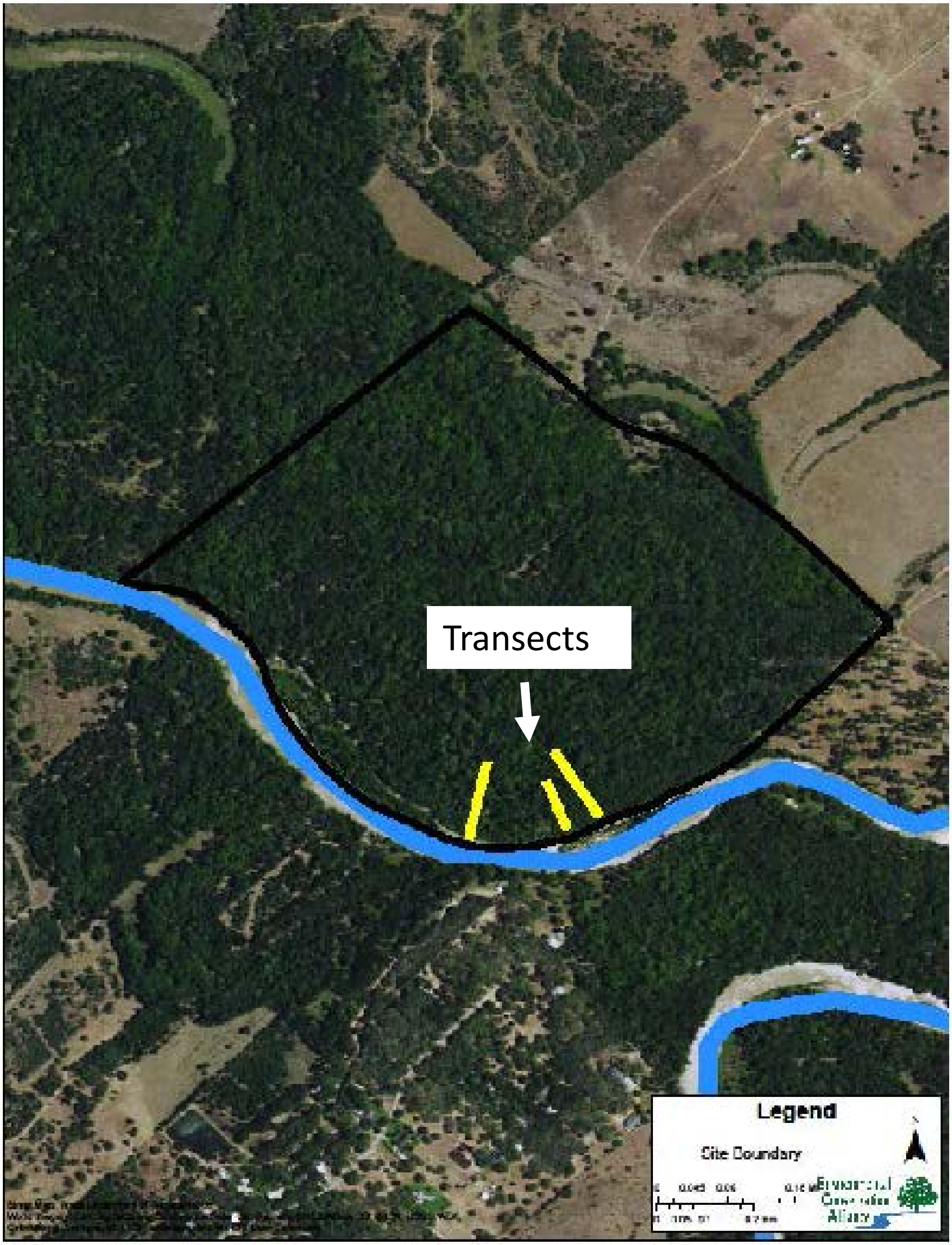


Figure 4.3 Gonzales Study Site: Transect Locations

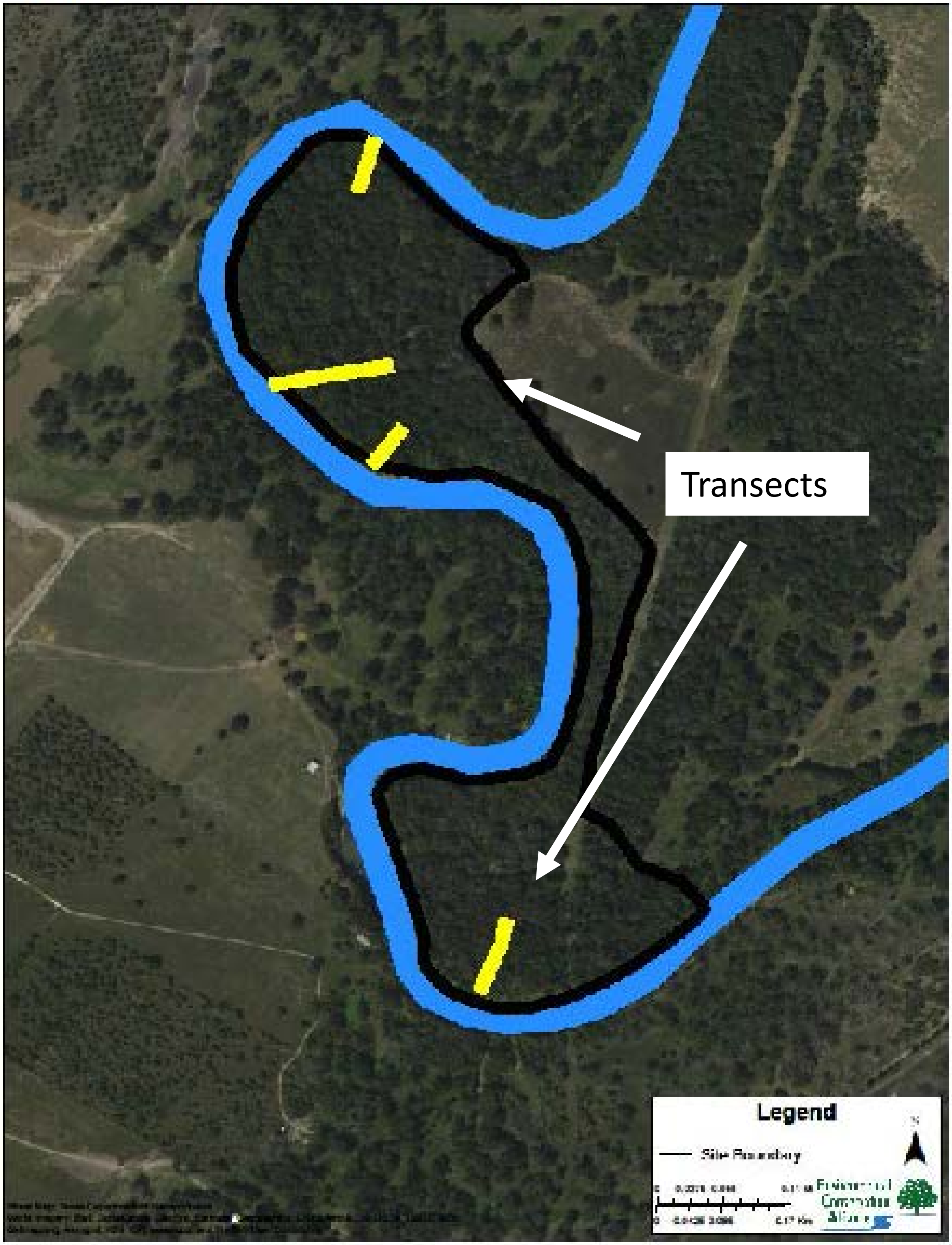


Figure 4.4 Hearne Study Site: Transect Locations

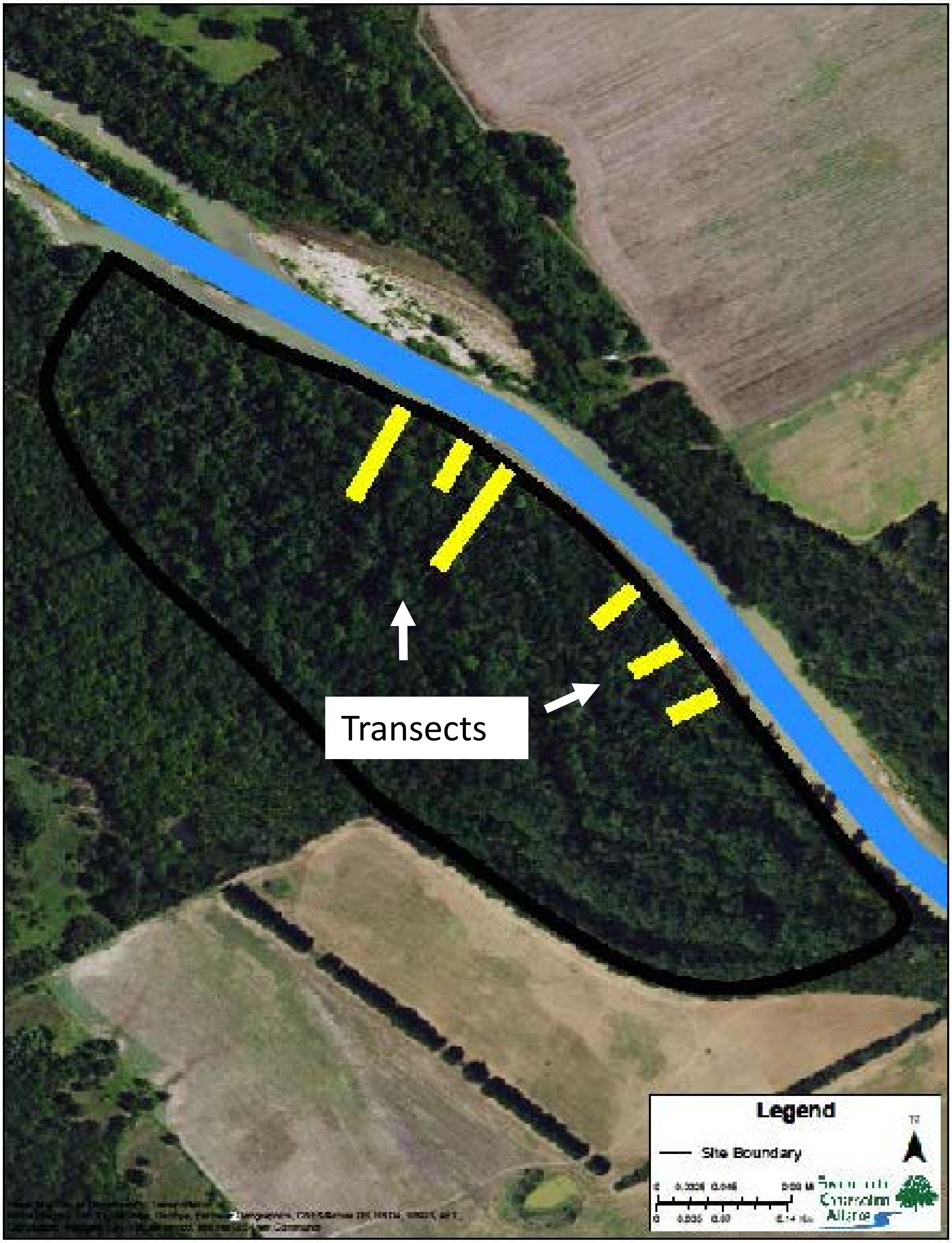


Figure 5 Channel-Connected Inundation: Victoria-Nursery Study Reach
Habitat Inundation (ha) versus Mean Daily Discharge (cfs)

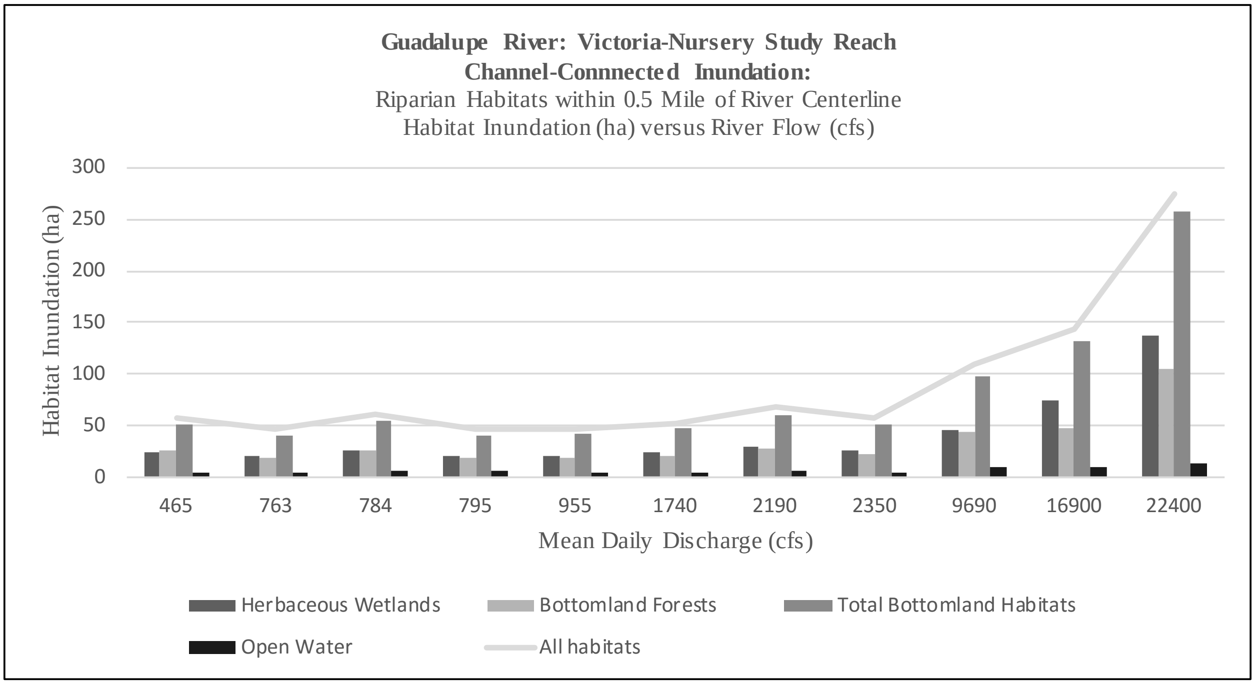



Figure 6 All Inundation: Victoria-Nursery Study Reach
Habitat Inundation (ha) versus Mean Daily Discharge (cfs)

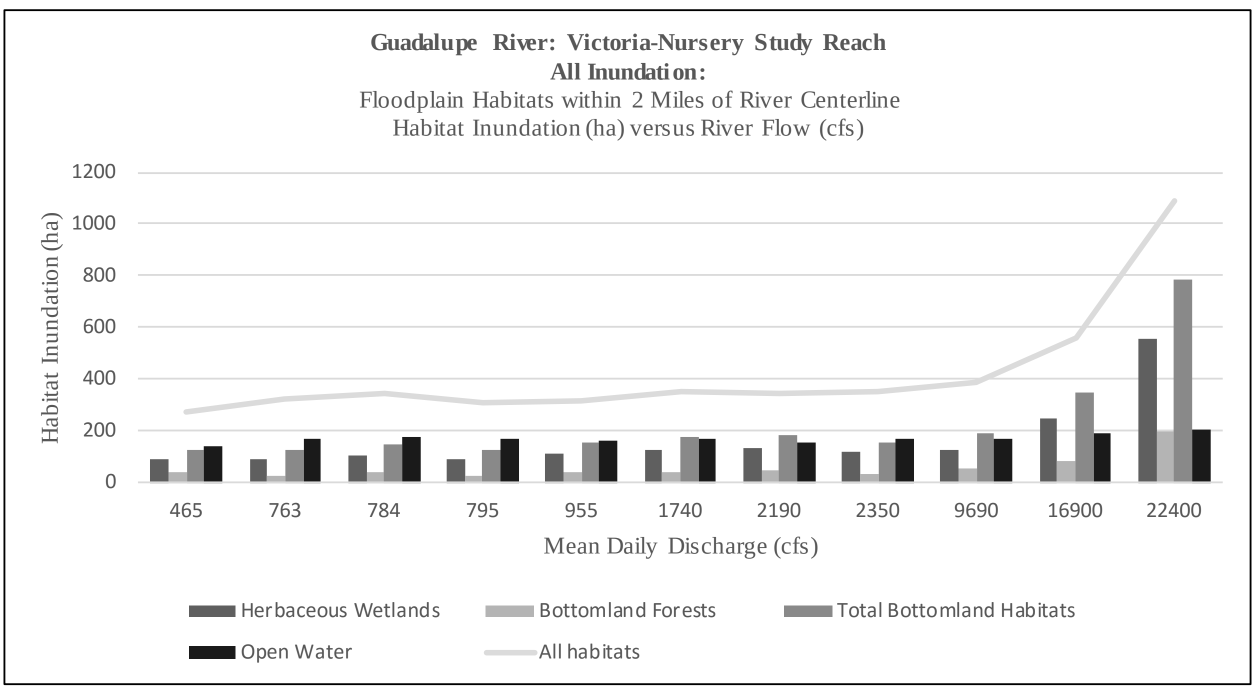


Figure 7 Channel-Connected Inundation: Gonzales Study Reach
Habitat Inundation (ha) versus Mean Daily Discharge (cfs)

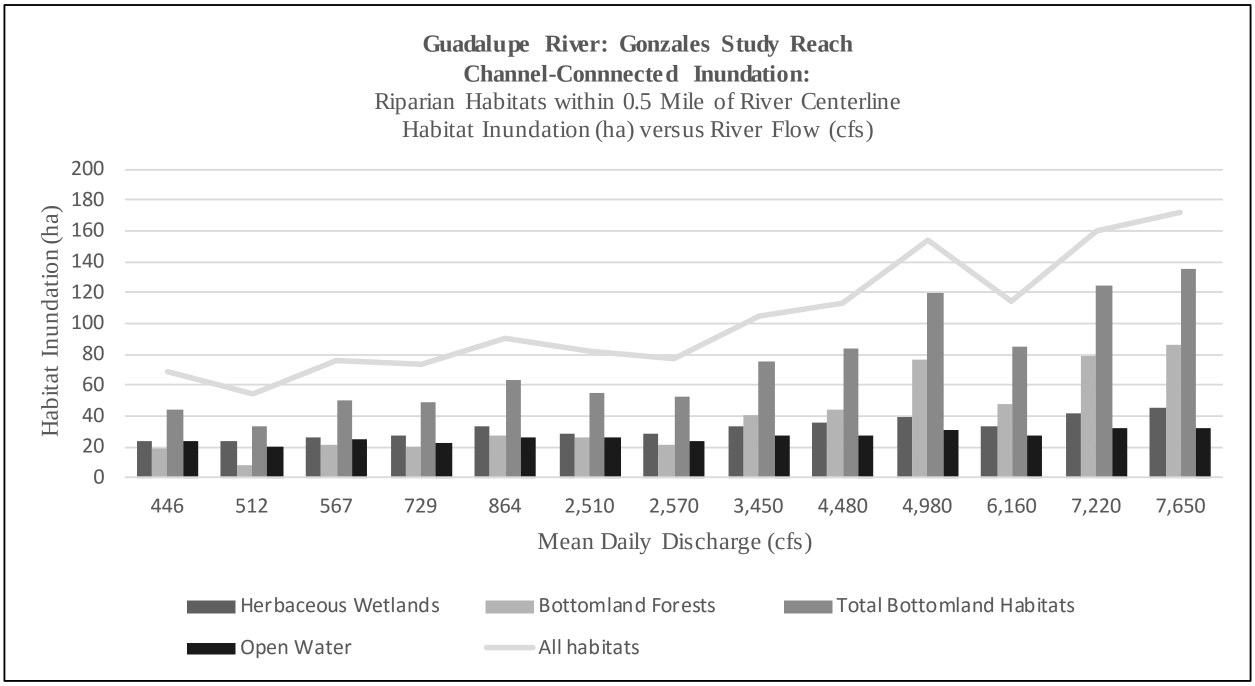



Figure 8 All Inundation: Gonzales Study Reach
Habitat Inundation (ha) versus Mean Daily Discharge (cfs)

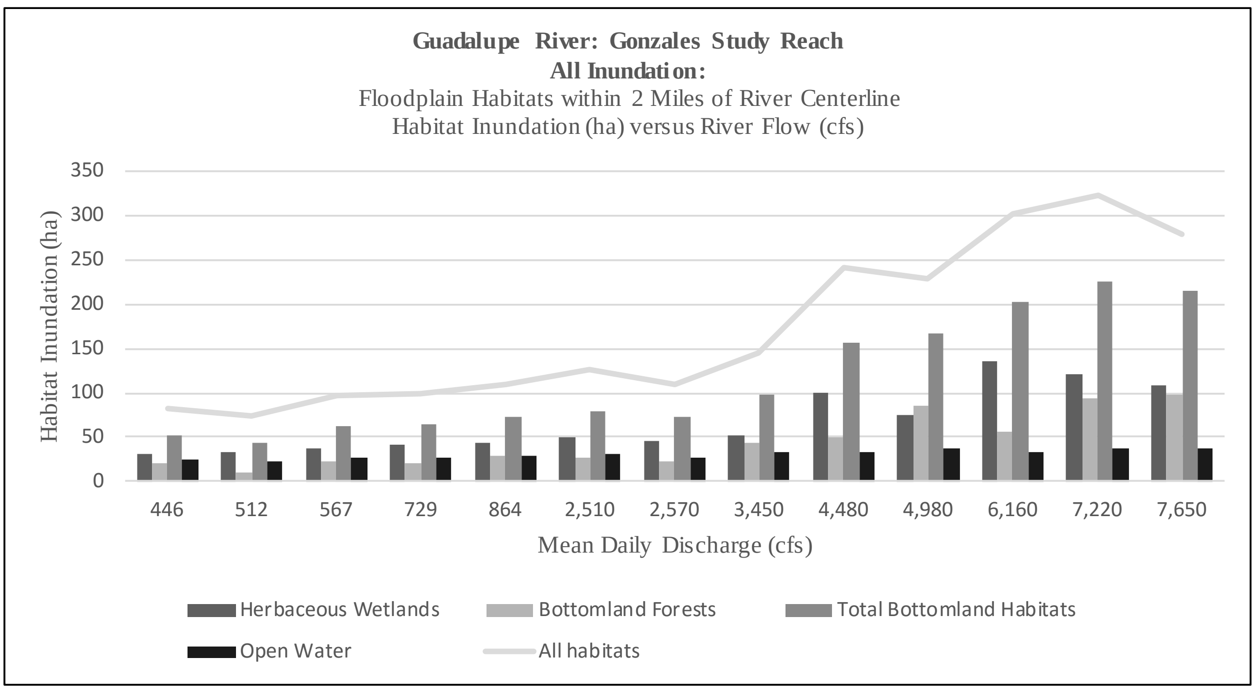


Figure 9 Channel-Connected Inundation: Hearne Study Reach
Habitat Inundation (ha) versus Mean Daily Discharge (cfs)

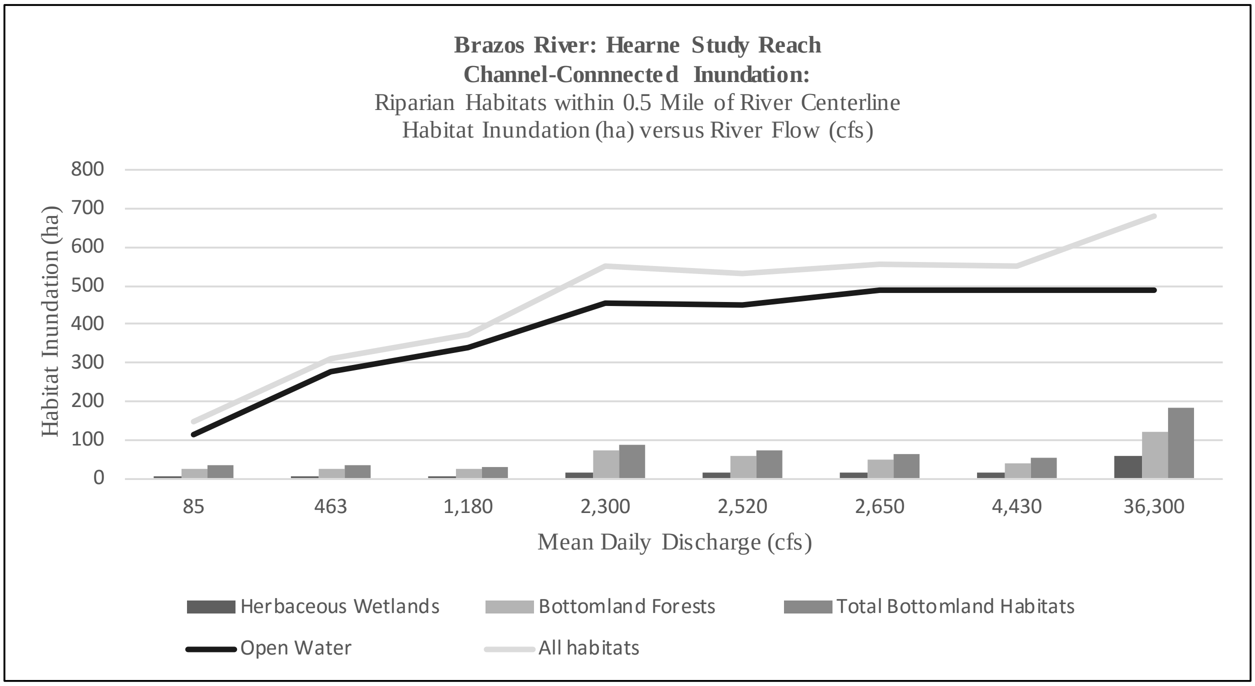



Figure 10 All Inundation: Hearne Study Reach
Habitat Inundation (ha) versus Mean Daily Discharge (cfs)

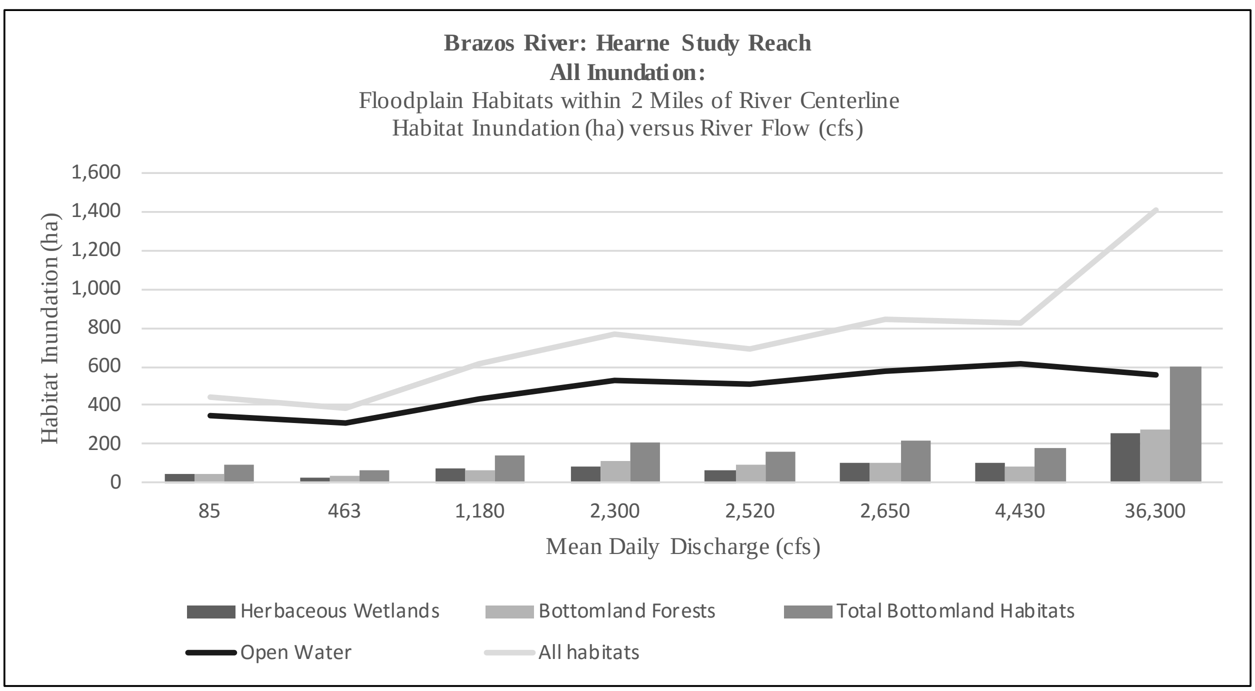


Figure 11.1 Inundation Maps: Victoria-Nursery Study Reach
Legend for Central Texas/Coastal Bend/Post Oak Savanna Habitat Types

**Legend**

**CommonName**

- Blackland Prairie: Disturbance or Tame Grassland
- Central Texas: Floodplain Herbaceous Wetland
- Central Texas: Riparian Herbaceous Wetland
- Central Texas: Floodplain Deciduous Shrubland
- Central Texas: Riparian Deciduous Shrubland
- Central Texas: Floodplain Evergreen Shrubland
- Central Texas: Riparian Evergreen Shrubland
- Central Texas: Floodplain Herbaceous Vegetation
- Central Texas: Riparian Herbaceous Vegetation
- Central Texas: Floodplain Hardwood - Evergreen Forest
- Central Texas: Riparian Hardwood - Evergreen Forest
- Central Texas: Floodplain Hardwood Forest
- Central Texas: Riparian Hardwood Forest
- Central Texas: Floodplain Live Oak Forest
- Central Texas: Riparian Live Oak Forest
- Coastal Bend: Floodplain Herbaceous Wetland
- Coastal Bend: Floodplain Deciduous Shrubland
- Coastal Bend: Riparian Deciduous Shrubland
- Coastal Bend: Floodplain Evergreen Shrubland
- Coastal Bend: Riparian Evergreen Shrubland
- Coastal Bend: Floodplain Hardwood Forest
- Coastal Bend: Riparian Hardwood Forest
- Coastal Bend: Floodplain Live Oak - Hardwood Forest
- Coastal Bend: Riparian Live Oak - Hardwood Forest
- Coastal Bend: Floodplain Live Oak Forest
- Coastal Bend: Riparian Live Oak Forest
- Coastal Bend: Floodplain Grassland
- Coastal Bend: Riparian Grassland
- Coastal Plain: Terrace Sandyland Grassland
- Gulf Coast: Coastal Prairie
- Gulf Coast: Coastal Prairie Pondshore
- Native Invasive: Baccharis Shrubland
- Native Invasive: Common Reed
- Native Invasive: Mesquite Shrubland
- Native Invasive: Deciduous Woodland
- Native Invasive: Huisache Woodland or Shrubland
- Invasive: Evergreen Shrubland
- Non-Native Invasive: Chinese Tallow Forest, Woodland, or Shrubland
- Post Oak Savanna: Live Oak Shrubland
- Post Oak Savanna: Live Oak Slope Forest
- Post Oak Savanna: Post Oak - Live Oak Slope Forest
- Post Oak Savanna: Oak - Hardwood Slope Forest
- Post Oak Savanna: Live Oak Motte and Woodland
- Post Oak Savanna: Post Oak - Live Oak Motte and Woodland
- Post Oak Savanna: Post Oak - Yaupon Motte and Woodland
- Post Oak Savanna: Post Oak Motte and Woodland
- Post Oak Savanna: Savanna Grassland
- South Texas: Clayey Blackbrush Mixed Shrubland
- South Texas: Shallow Dense Shrubland
- South Texas: Shallow Shrubland
- South Texas: Shallow Sparse Shrubland
- Marsh
- Open Water
- Barren
- Row Crops
- Urban Low Intensity
- Urban High Intensity

Figure 11.2 Channel-Connected Inundation Map: Victoria-Nursery Study Reach
10/29/02 Inundation Event: 22,400 cfs

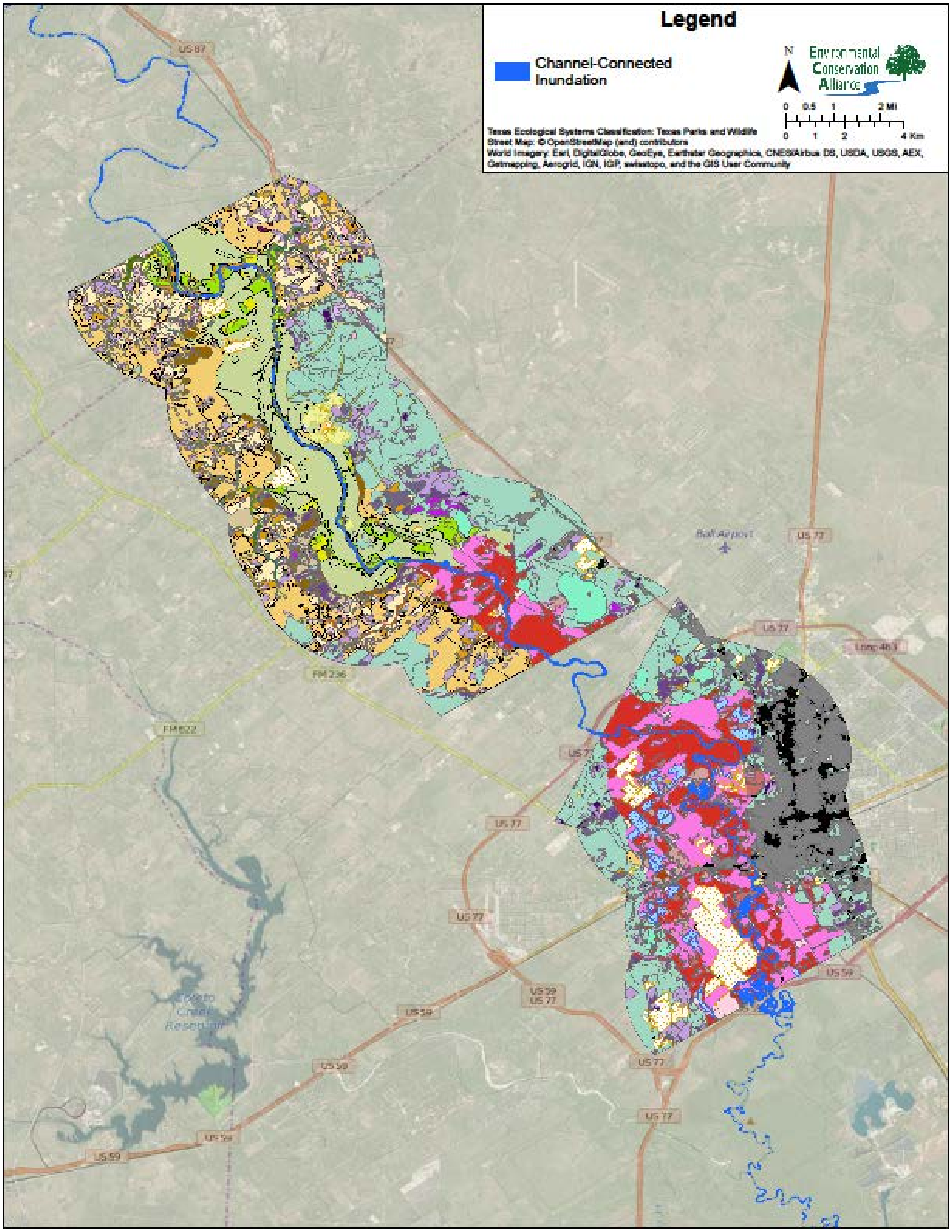


Figure 11.3 Channel-Connected Inundation Map: Victoria-Nursery Study Reach
01/21/93 Inundation Event: 2,190 cfs

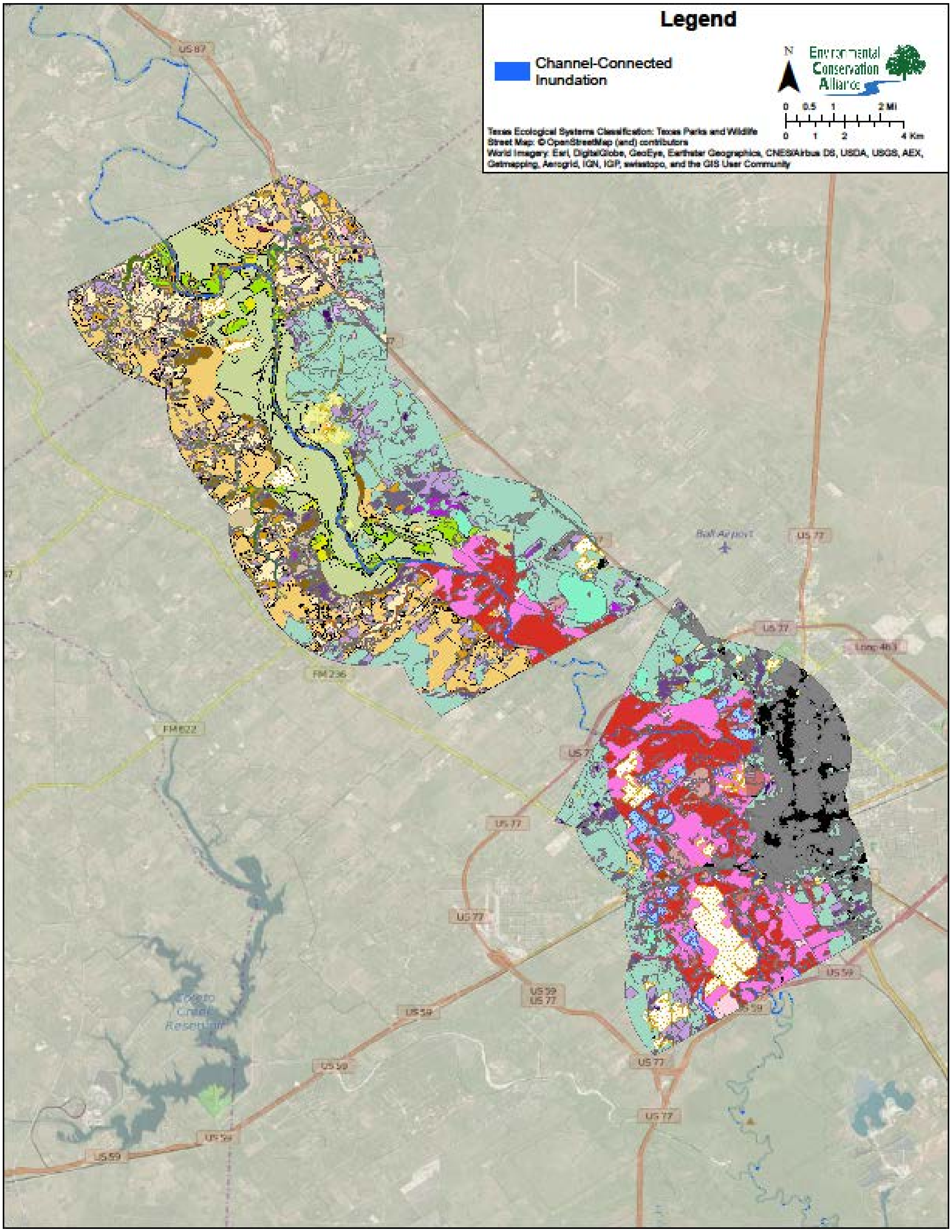


Figure 11.4 Channel-Connected Inundation Map: Victoria-Nursery Study Reach
01/21/90 Inundation Event: 465 cfs

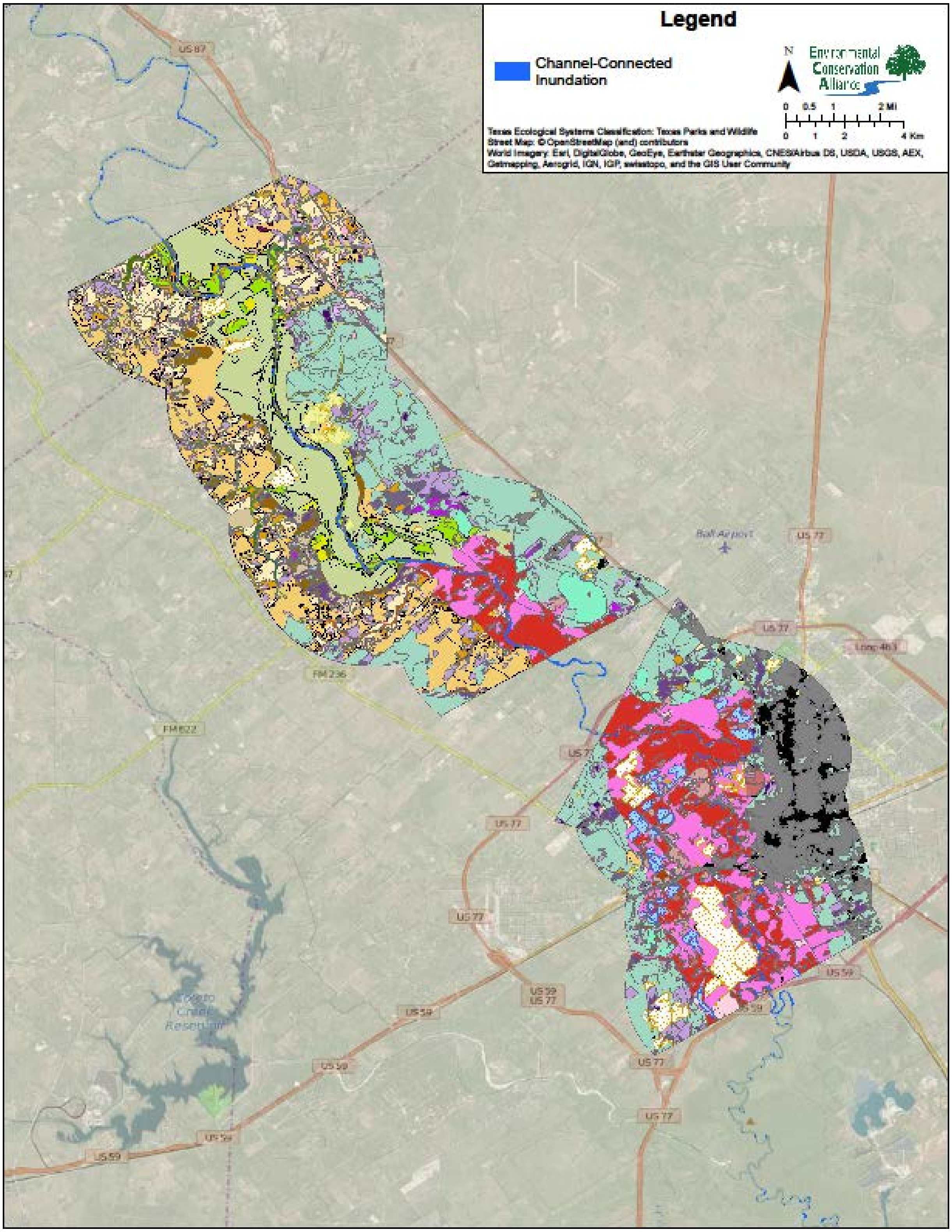


Figure 11.5 All Inundation Map: Victoria-Nursery Study Reach
10/29/02 Inundation Event: 22,400 cfs

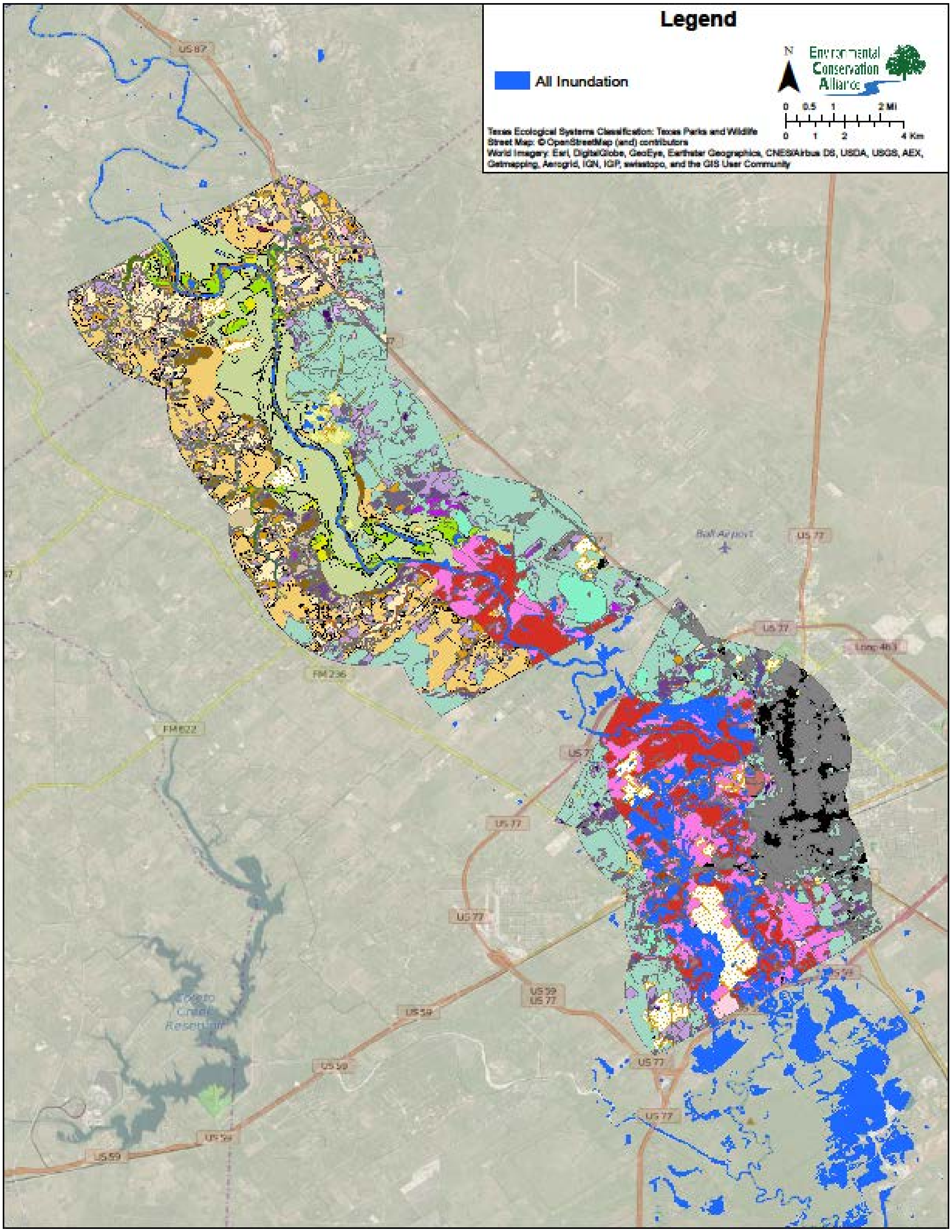


Figure 11.6 All Inundation Map: Victoria-Nursery Study Reach
01/21/93 Inundation Event: 2,190 cfs

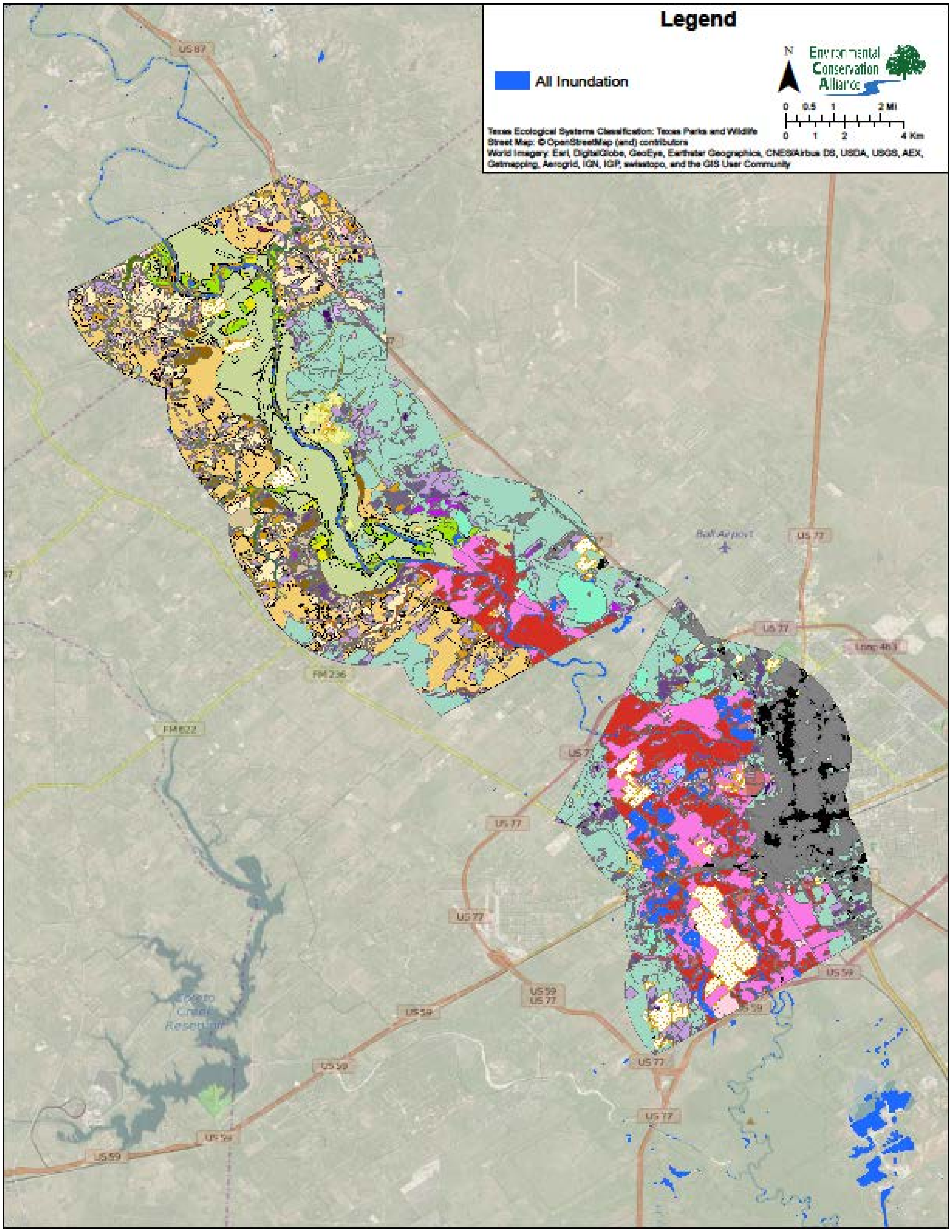


Figure 11.7 All Inundation Map: Victoria-Nursery Study Reach
01/21/90 Inundation Event: 465 cfs

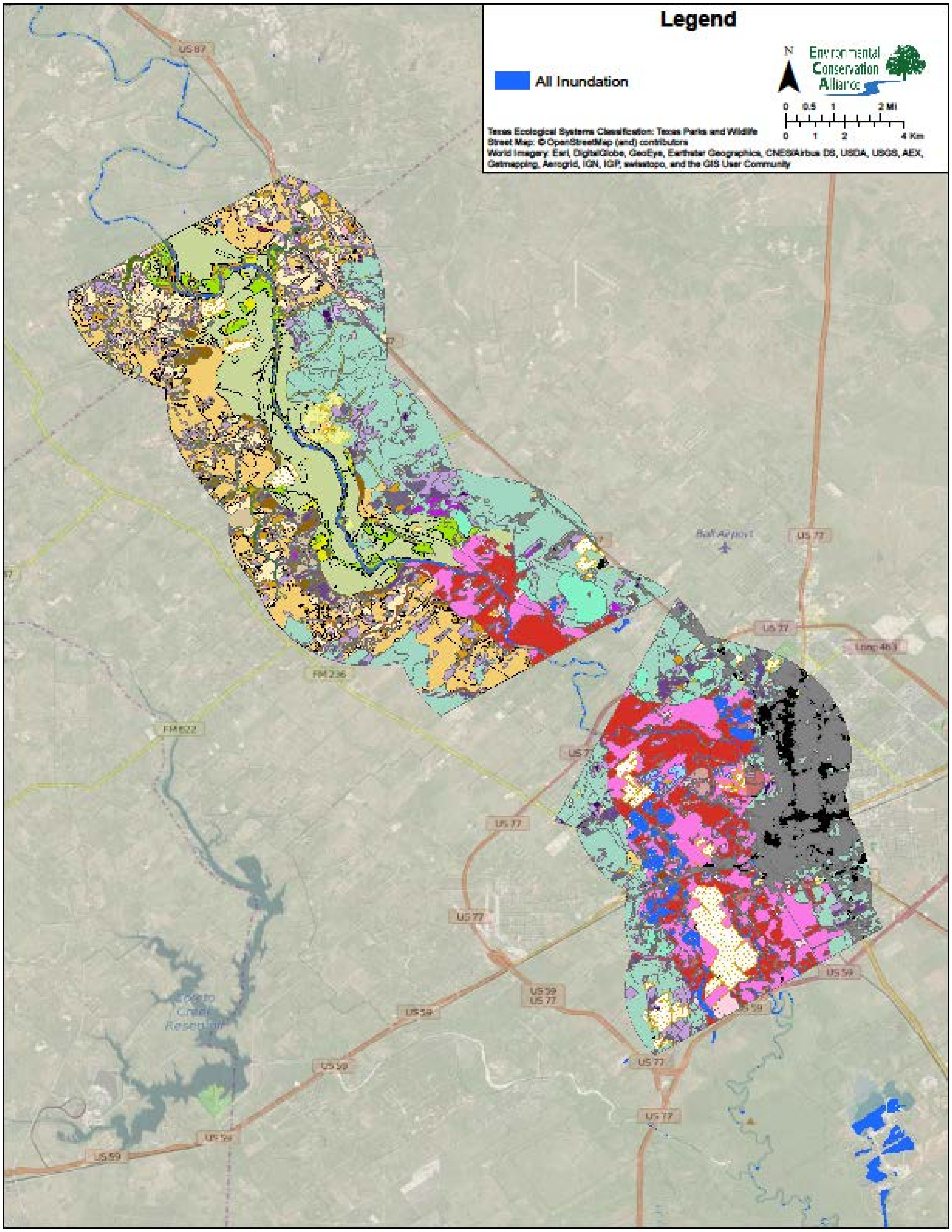


Figure 12.1 Inundation Maps: Gonzales Study Reach
Legend for Central Texas/Post Oak Savanna Habitat Types

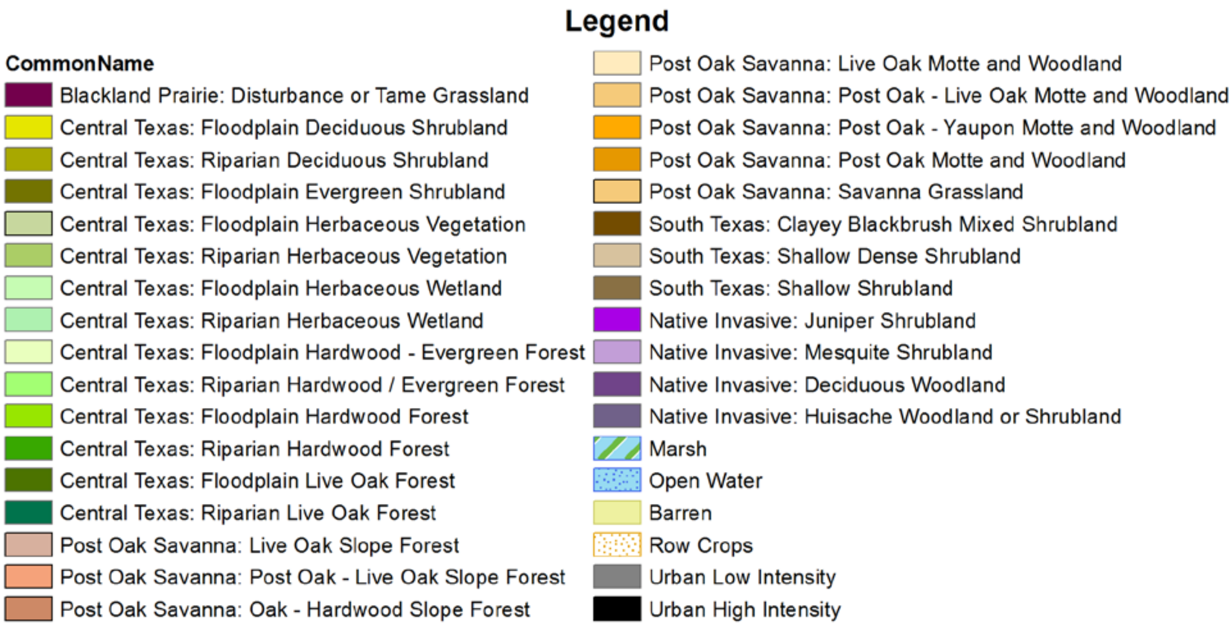


Figure 12.2 Channel-Connected Inundation Map: Gonzales Study Reach
12/04/04 Inundation Event: 7,650 cfs

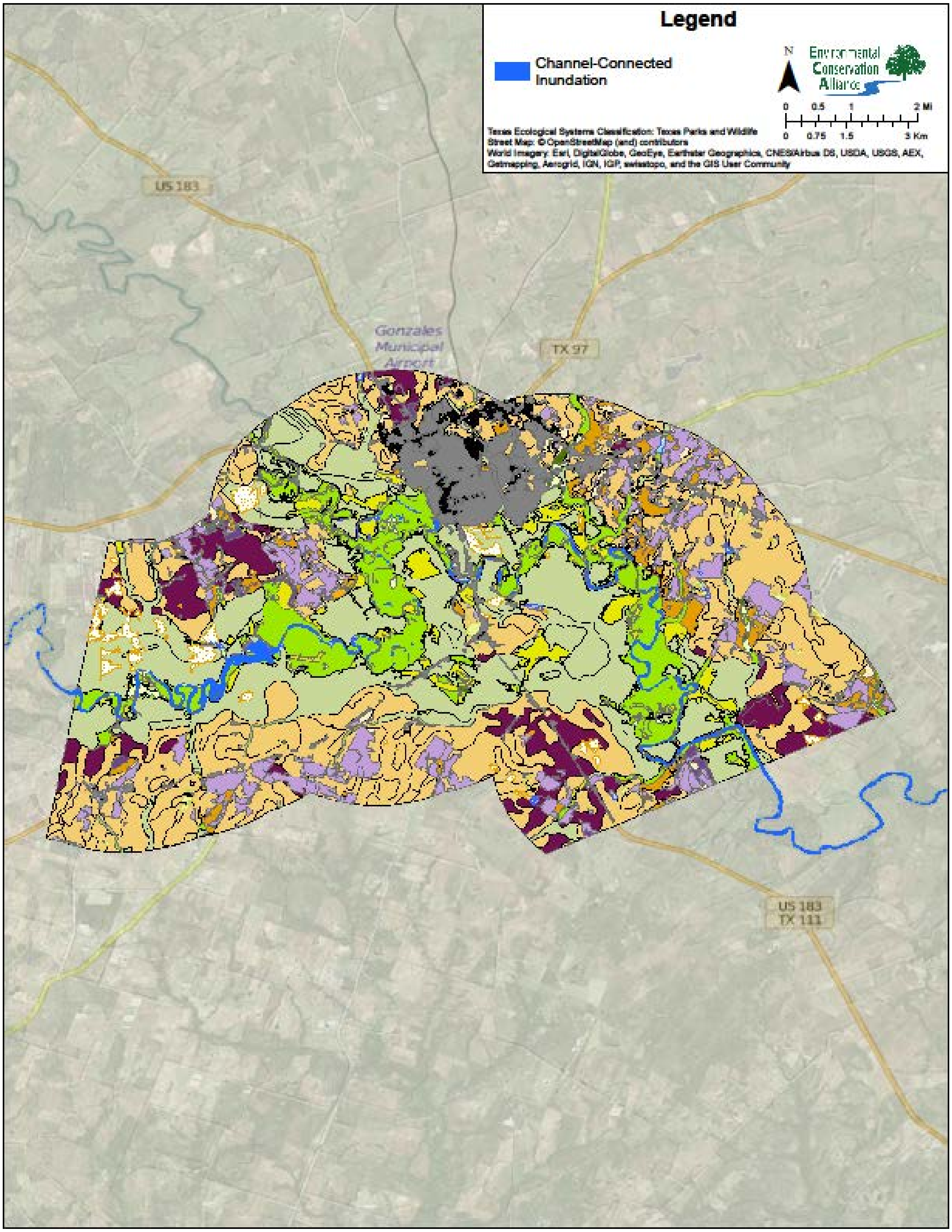


Figure 12.3 Channel-Connected Inundation Map: Gonzales Study Reach
01/14/05 Inundation Event: 3,450 cfs

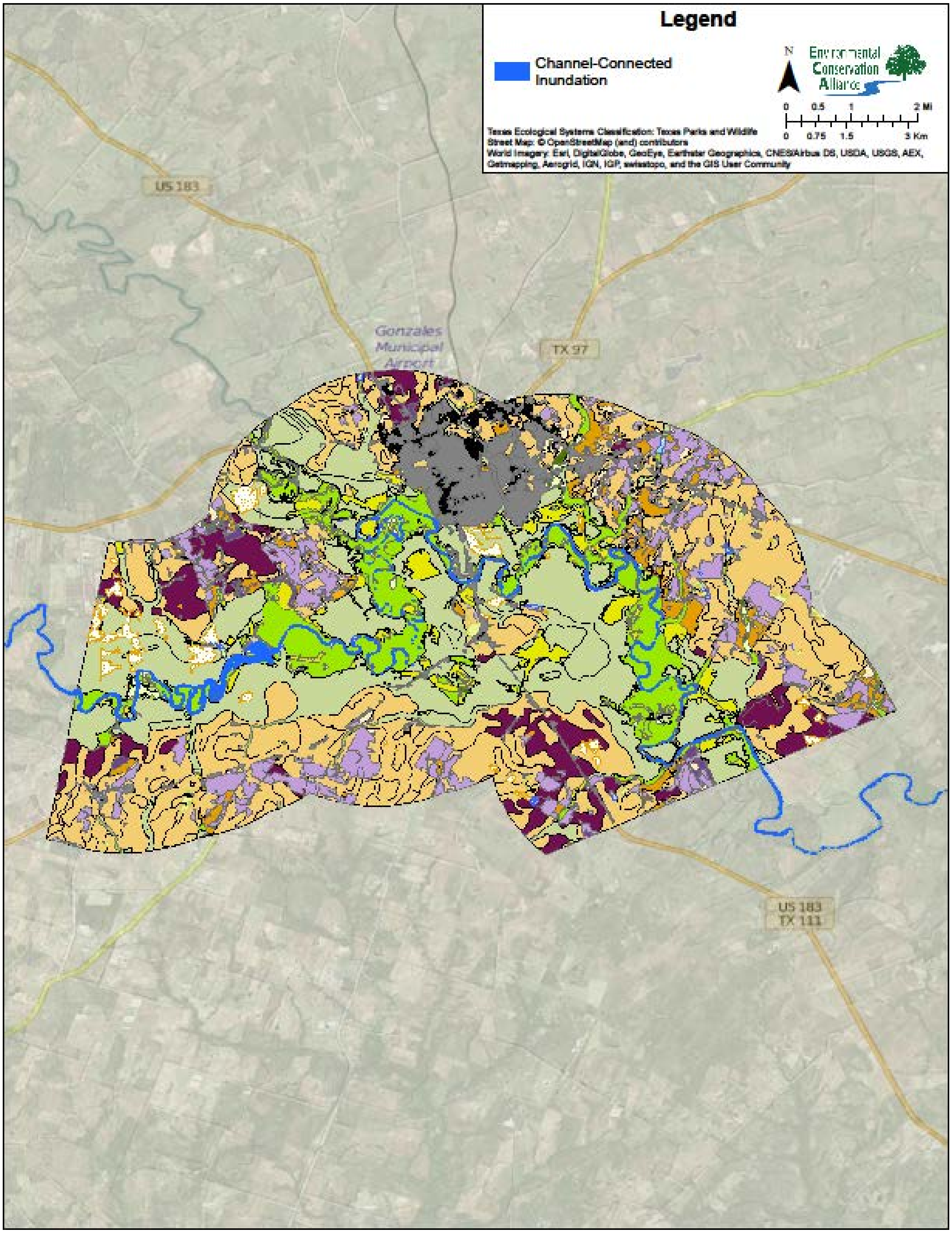


Figure 12.4 Channel-Connected Inundation Map: Gonzales Study Reach
03/03/14 Inundation Event: 446 cfs

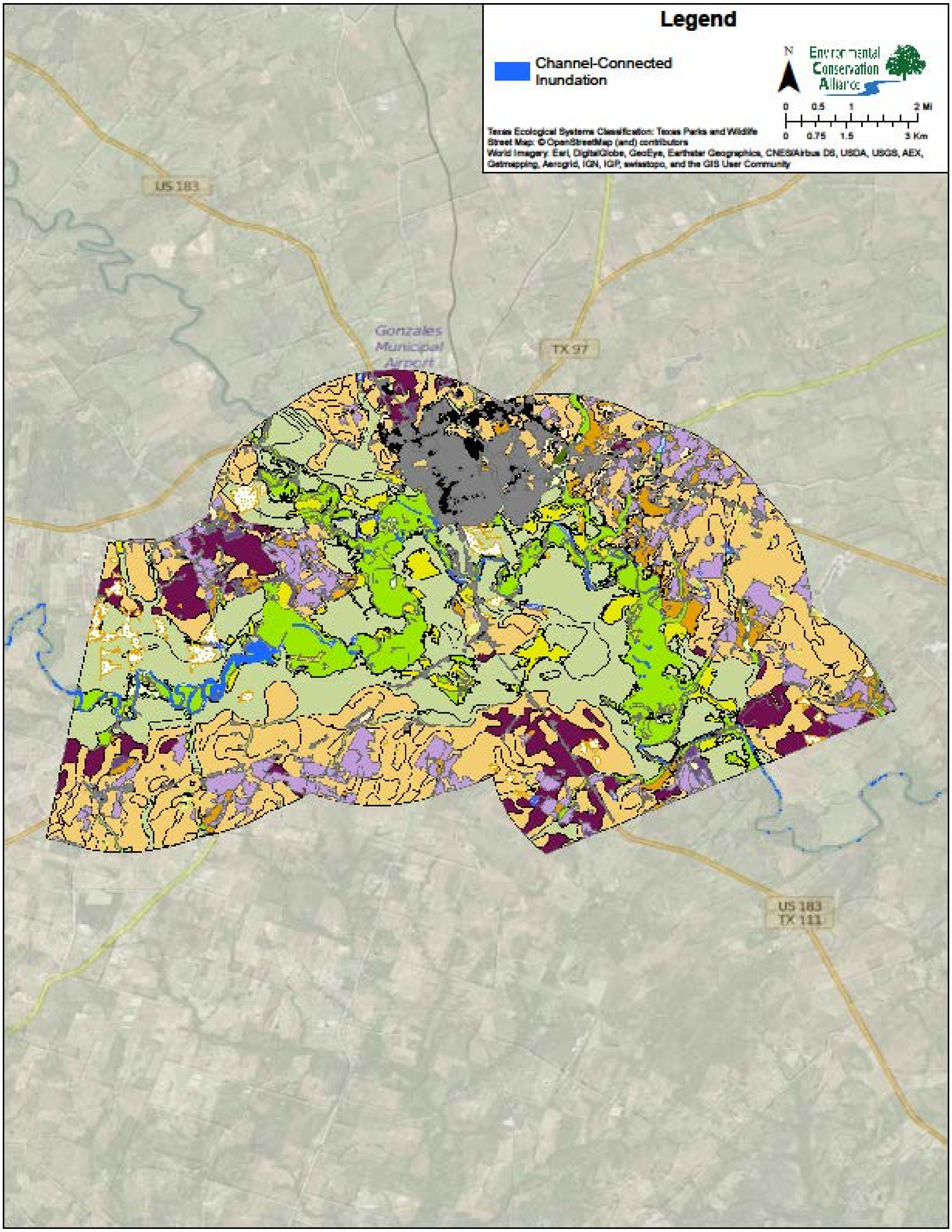


Figure 12.5 All Inundation Map: Gonzales Study Reach
12/04/04 Inundation Event: 7,650 cfs

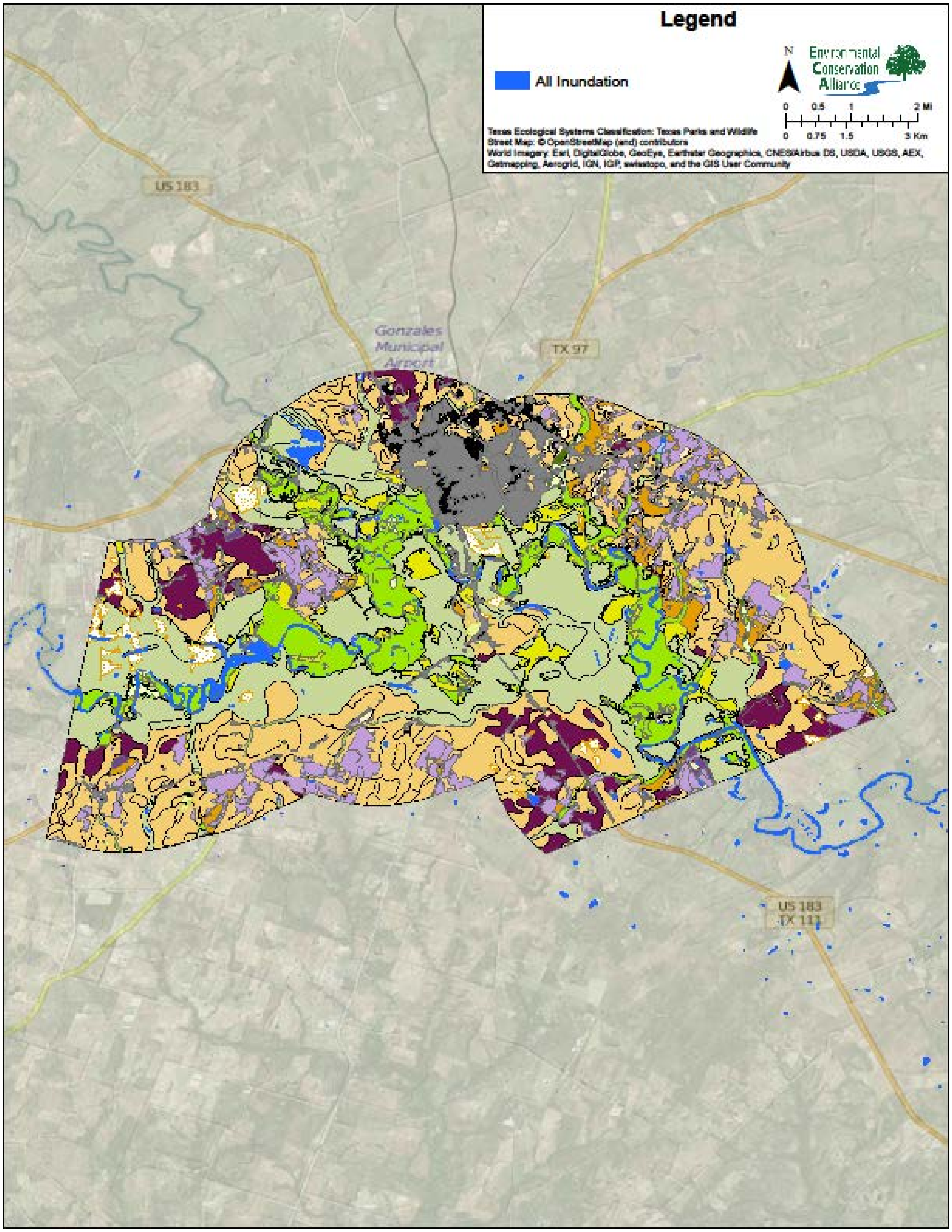


Figure 12.6 All Inundation Map: Gonzales Study Reach
01/14/05 Inundation Event: 3,450 cfs

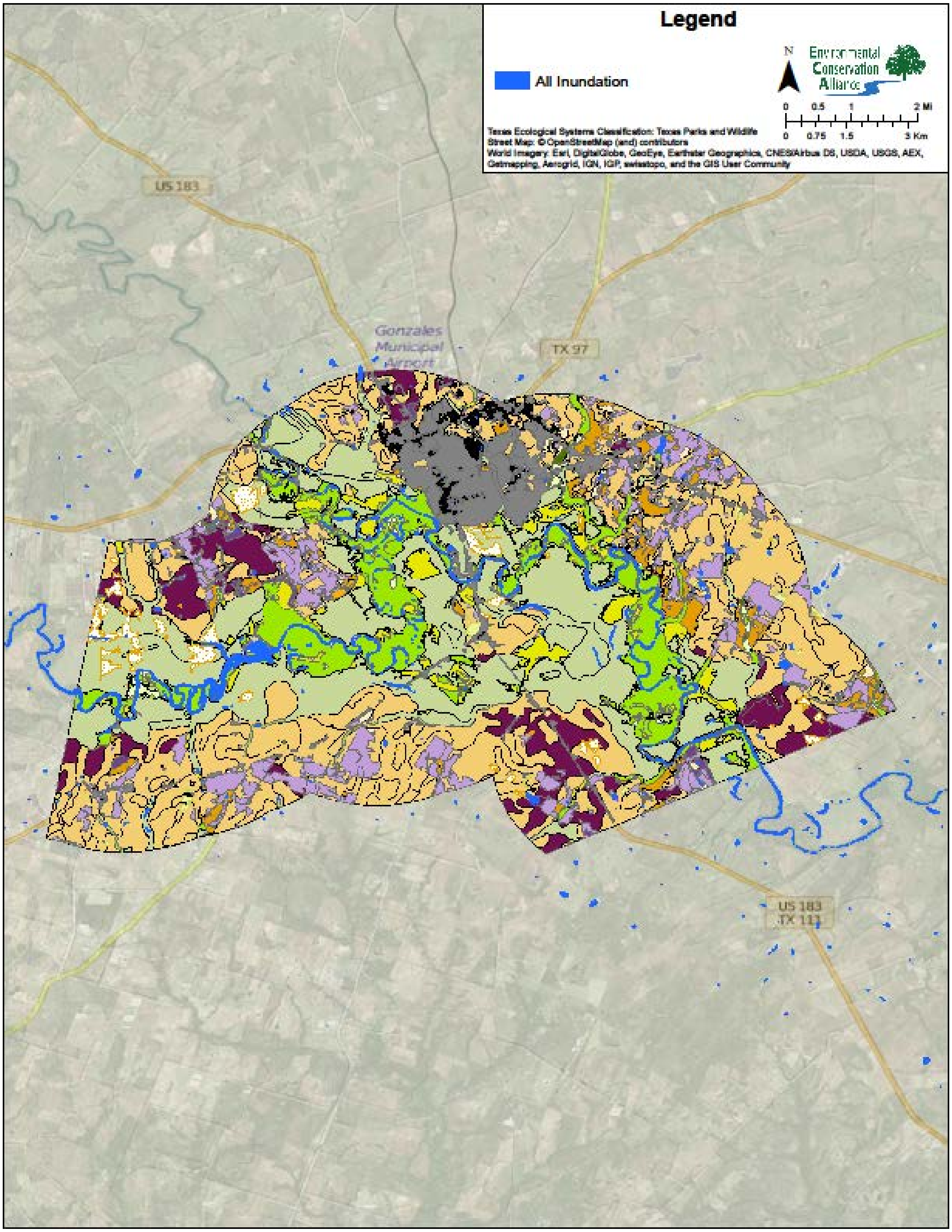


Figure 12.7 All Inundation Map: Gonzales Study Reach
03/03/14 Inundation Event: 446 cfs

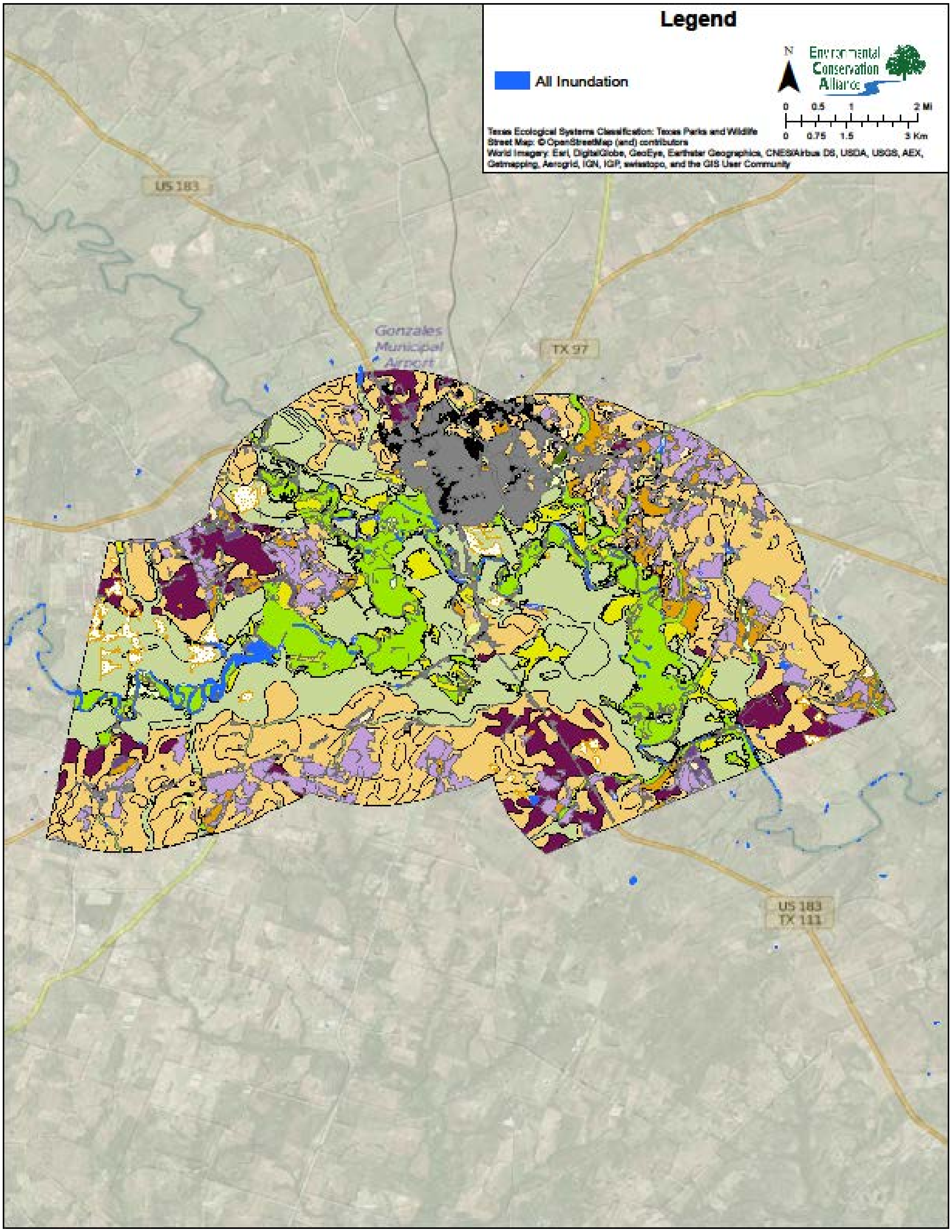


Figure 13.1 Inundation Maps: Hearne Study Reach
Legend for Columbia Bottomlands/Post Oak Savanna Habitat Types

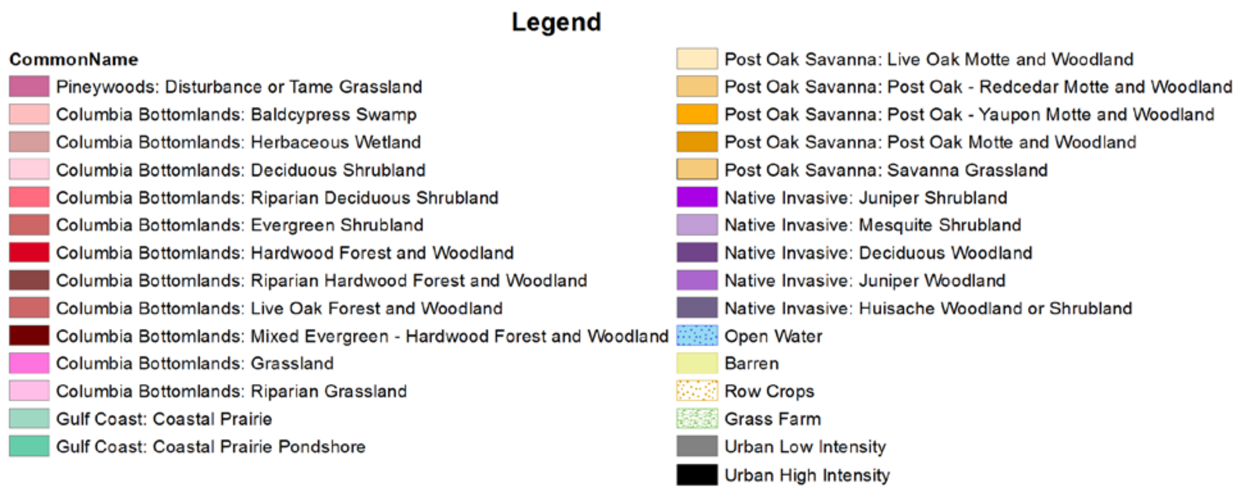


Figure 13.2 Channel-Connected Inundation Map: Hearne Study Reach
01/19/92 Inundation Event: 36,300 cfs

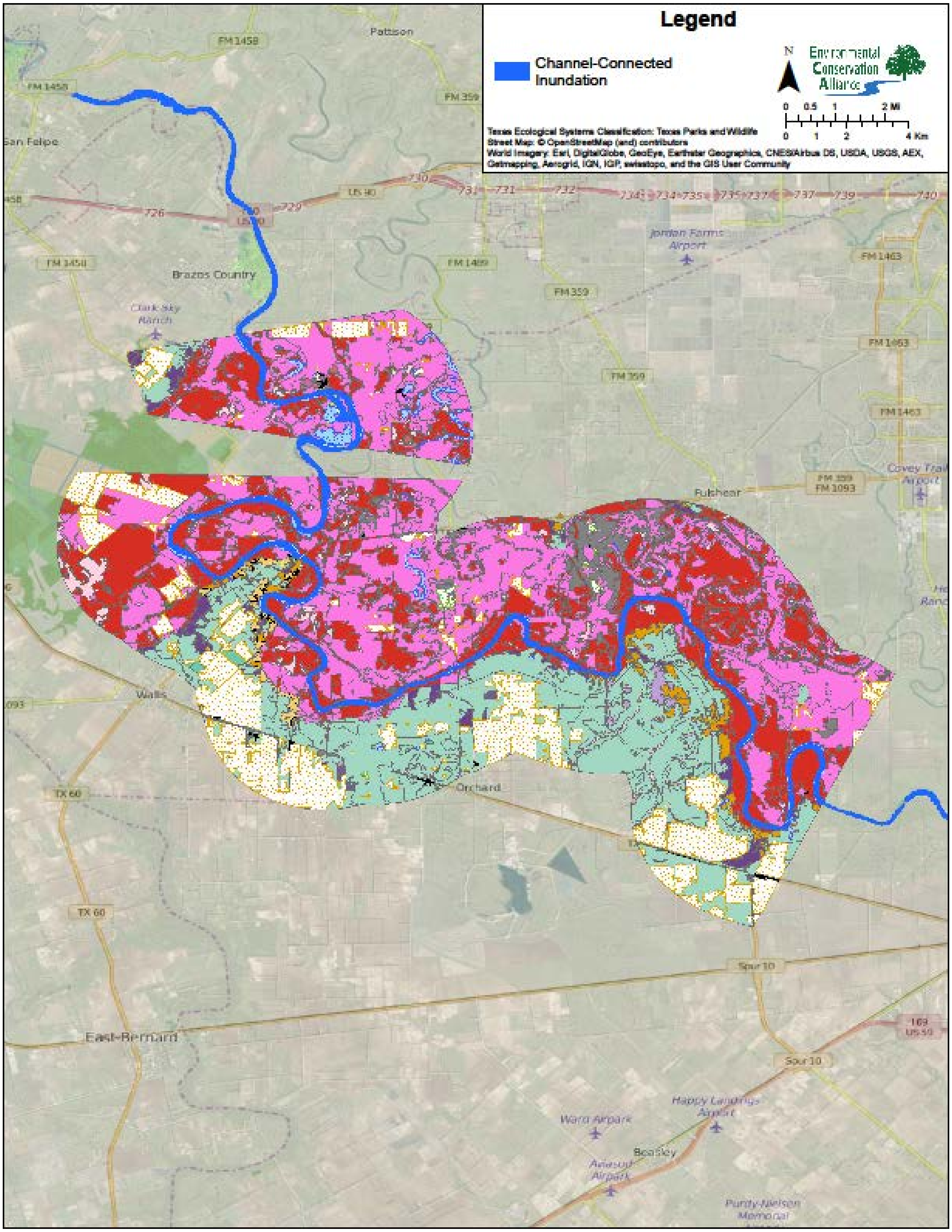


Figure 13.3 Channel-Connected Inundation Map: Hearne Study Reach
01/14/05 Inundation Event: 4,430 cfs

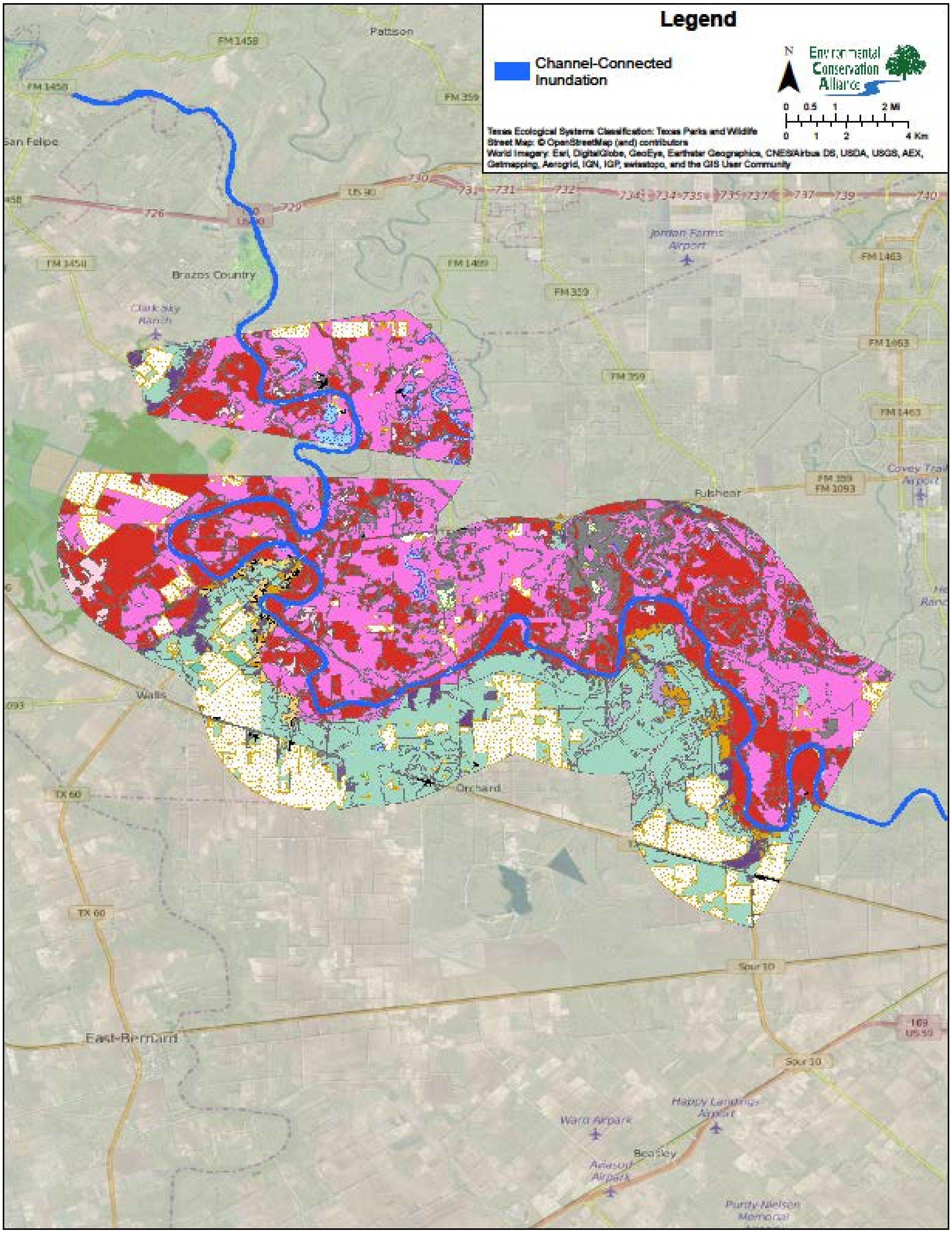


Figure 13.4 Channel-Connected Inundation Map: Hearne Study Reach
12/12/89 Inundation Event: 463 cfs

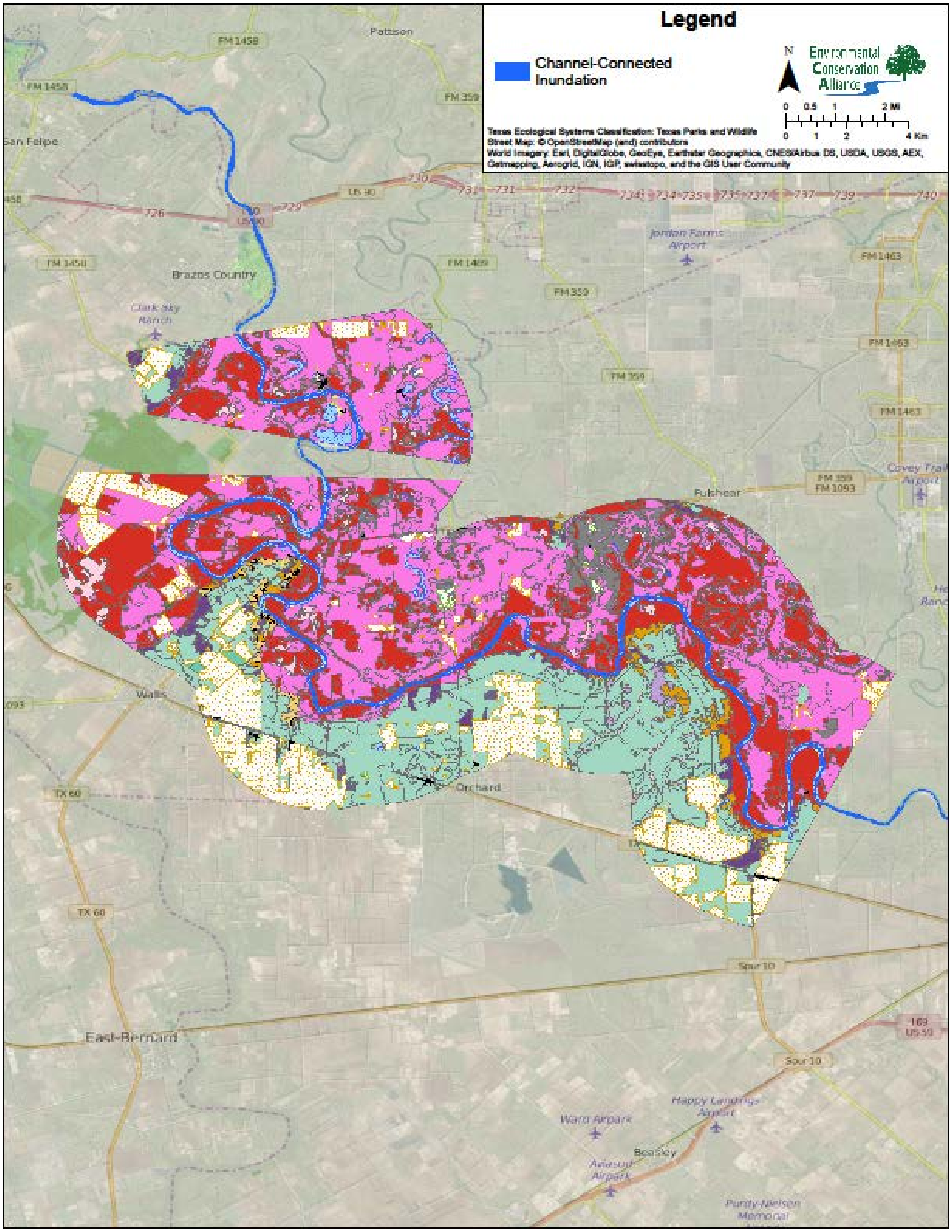


Figure 13.5 All Inundation Map: Hearne Study Reach
01/19/92 Inundation Event: 36,300 cfs

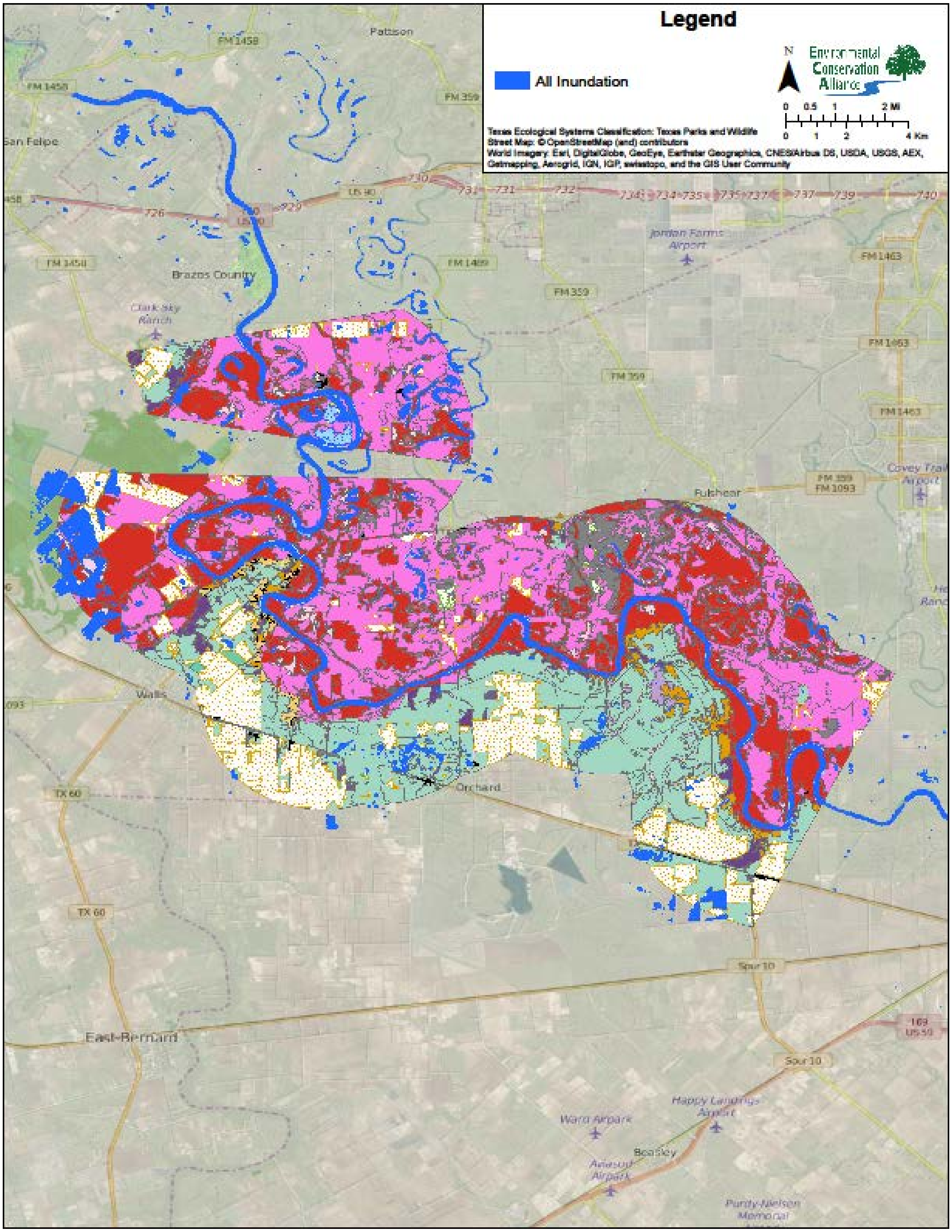


Figure 13.6 All Inundation Map: Hearne Study Reach
01/14/05 Inundation Event: 4,430 cfs

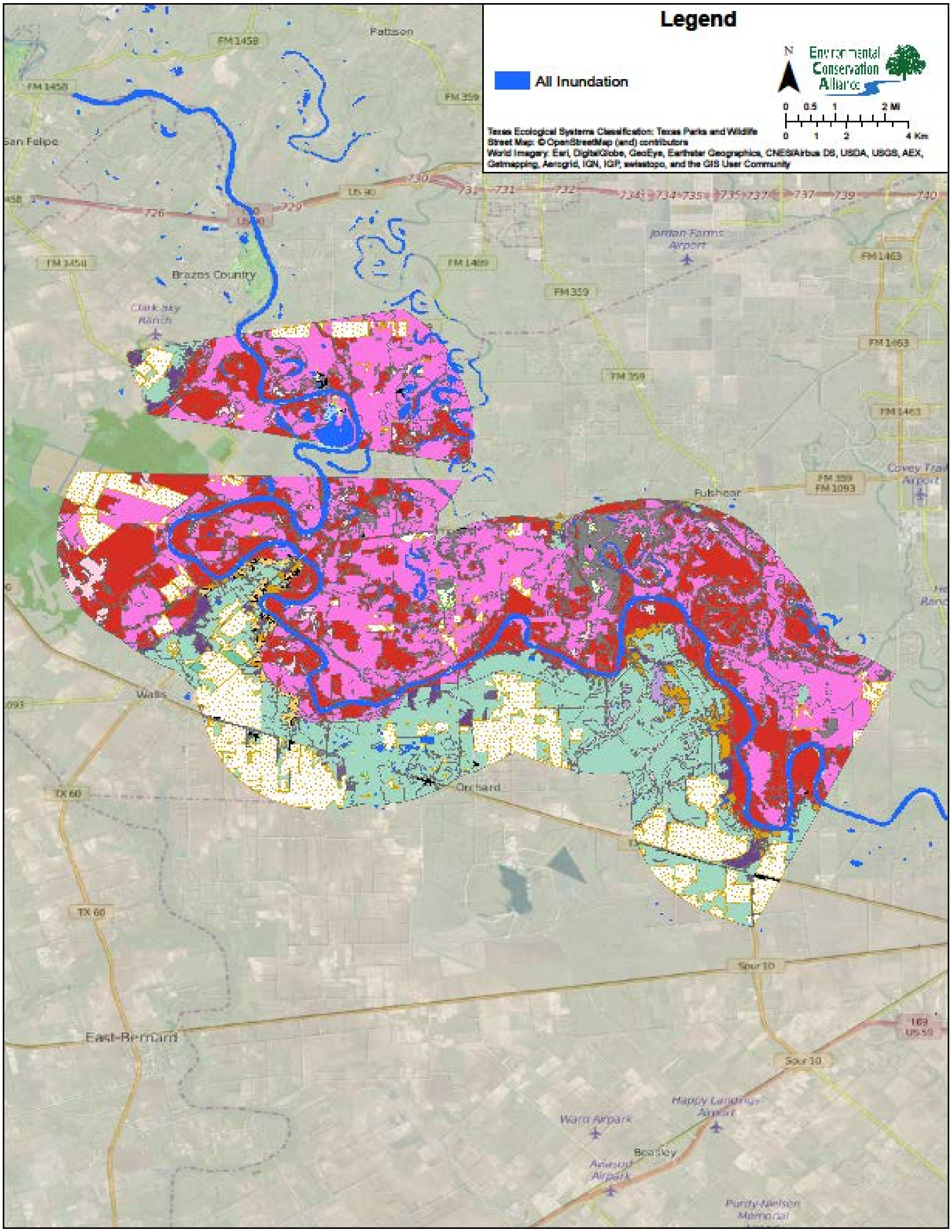
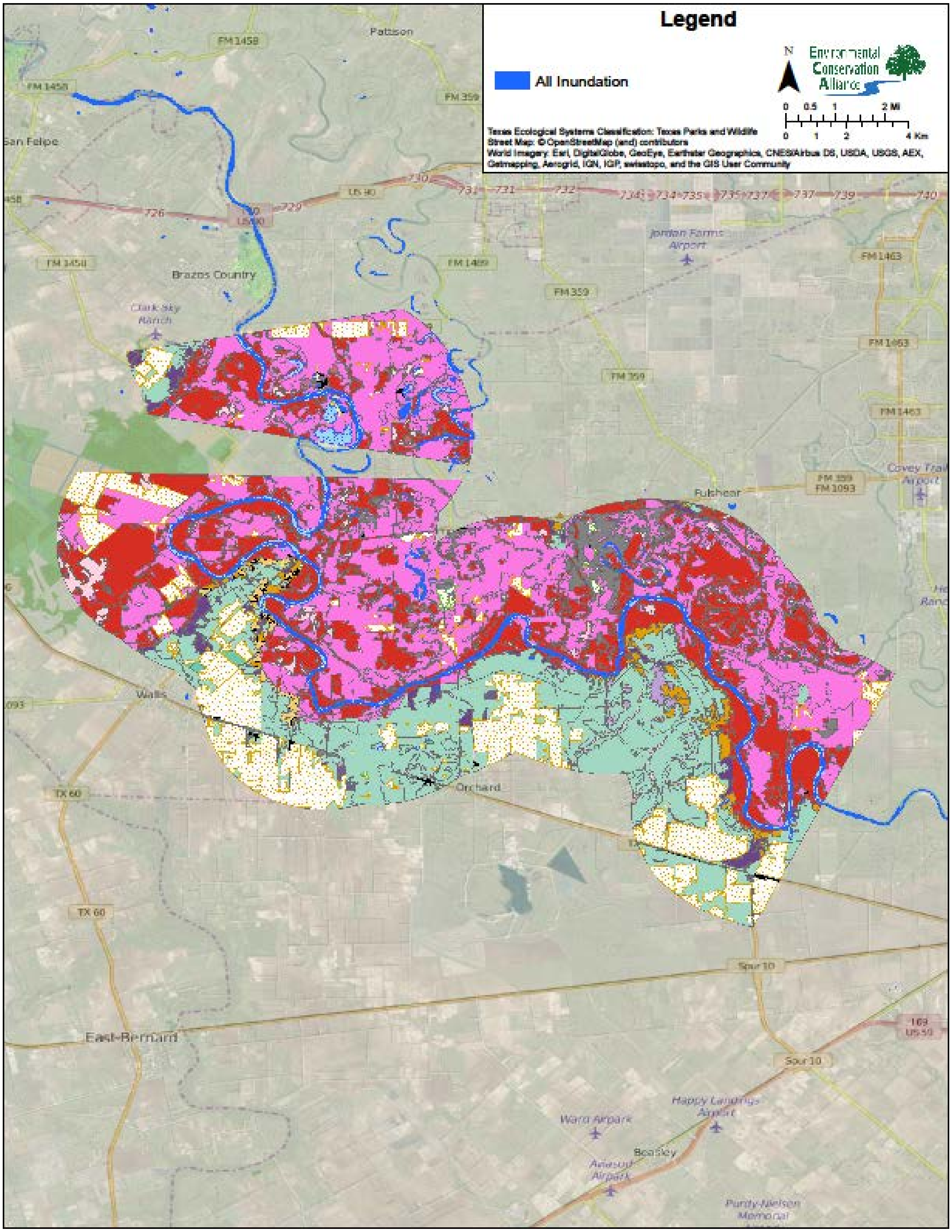


Figure 13.7 All Inundation Map: Hearne Study Reach
12/12/89 Inundation Event: 463 cfs



# Appendix 3: Response to 6/14/16 Comments by the Texas Water Development Board

**NOTE: All required and suggested changes were made, in addition to expanding the data analyses and re-writing much of the report. Tom Hayes**

**Riparian Assessment on the Guadalupe and Brazos Rivers**
**Draft-final report to the Texas Water Development Board**

Contract number 1248311359

**REQUIRED CHANGES**

**General Draft Final Report Comments:**

1. Please title the report "Riparian assessments on the Guadalupe and Brazos Rivers."
2. Please reference "TWDB Contract No. 1248311359" on the cover of the report.
3. Please correct the following typos:
    a. Page 13, 1st paragraph, last sentence, "as described Section 3.1.2" should be "as described in Section 3.1.2."
    b. Page 17, 1st paragraph, 3rd sentence, "limited to a rising or stable flows" should be "limited to rising or stable flows."
    c. Page 19, 3rd paragraph, 4th sentence, "set to .5" should be "set to 0.5."
    d. Page 20, 3rd paragraph, 1st sentence, "was used apply" should be "was used to apply."
    e. Page 22, 3rd paragraph, 4th sentence, "may farthest" should be "may be farther."
    f. Page 24, 1st paragraph, 3rd sentence, "meandered most than" should be "meandered more than."
    g. Page 25, 4th paragraph, 1st sentence, "higher the river stages" should be "higher river stages."
    h. Page 25, 4th paragraph, last sentence, "IN this manner" should be "In this manner."
    i. Page 26, 4th paragraph, 2nd sentence, "have been are" should be "have been."
    j. Page 31, "Van Dyke. 2012. Hydrological shifts" should be "Van Dyke. 2013. Hydrological shifts."
4. On page 4, in the 1st paragraph, 1st sentence, introduces the abbreviation CLI which is not used anywhere else in the document. Please remove this abbreviation from the document.
5. On page 4, in the 1st paragraph, reference is made to a larger "Texas Parks and Wildlife Department -Texas Water Development Board (TPWD-TWDB) project." More specifically, this is a Texas Instream Flow Program (TIFP) project. The TIFP is a cooperative effort of TPWD, TWDB, and the Texas Commission on Environmental Quality. Please refer to the larger project as the TIFP throughout the document.
6. The abbreviation "DBH" is used on page 11, last paragraph, 1st sentence before it is defined on page 12. Please insure all abbreviations are defined in the text before they are used.
7. The abbreviation "MHWM" is defined on page 11, 2nd paragraph, 2nd sentence and again on page 12, 2nd paragraph, 1st sentence. Please remove the second definition of this abbreviation on page 12.
8. Please provide definitions for the following abbreviates used in the document: ENVI, ESRI, TM, NAHP, NAPP, TOP, NAIP, OBL, FACW, and FAC.
9. For Figures 4.1-4.4 on pages 41-44, please provide an explanation in the legend regarding the significance of the yellow lines.

10. In Table 1 on page 45, it is unclear if the column heading "Life Form" is equivalent to "Growth Form" in the footnotes. Please adopt one or the other designation to avoid confusion. Please add a footnote to confirm that the G, N, V, and H labels on the four, far right columns designate the Gonzales, Nursery, Victoria, and Hearne study sites, respectively. Also, please designate the contents of the four far right columns as being abundance codes.

**SUGGESTED CHANGES**

11. Page 8, 2$^{nd}$ paragraph, last sentence. Reference is made to "the average rate of seedling root growth, which is less than one inch or 2.5 cm per day." The value of 2.5 cm per day was developed specifically for cottonwood seedlings in western North America. As acknowledged by Hughes and Rood (2003), "decline rate is influenced by floodplain substrate texture, plant species, and the ambient weather conditions related to water demand, particularly temperature, rainfall events, wind and sunshine." For other riparian tree species in different physical settings, it's reasonable to expect a different decline rate (either more or less than 2.5 cm per day) may be appropriate. Therefore, please consider amending your statement to read something like: "the average rate of seedling root growth, which they found to be less than one inch or 2.5 cm per day for cottonwood in Western North America."
12. Page 8, 3$^{rd}$ paragraph, 2$^{nd}$ to last sentence states "early spring floods following leaf emergence probably should last a total of two to four weeks." This statement seems to be related specifically to bottomland hardwood forests, which were apparently the subject of research by Gosselink et al. (1981) and Townsend (2001). For other situations, different flood durations may be more appropriate. Please consider amending the statement to read something like the following "for bottomland hardwood forests, early spring floods following leaf emergence should last a total of two to four weeks."
13. On page 23, 3$^{rd}$ paragraph, last sentence mentions that the three most important tree species at the Victoria site include Chinese tallow. Chinese tallow is an invasive species in Texas. Please mention this in the report and consider including some discussion of the implications of this species becoming important at this study site in the Discussion section of the report.