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Sabine Neches Navigation Improvement Project Integrated Section 203 Feasibility Report and Environmental Assessment

Appendix H

Vegetation Habitat Assessment Survey

February 2026

An Assessment of The Vegetation Habitat That May Be Affected by The Sabine-Neches Federal Channel Widening Measures

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1 Overview

The Sabine Neches Navigation District's (SNND) has initiated a feasibility study of improvements to the federal channel at the Sabine Neches Waterway, Texas and Louisiana, under the authority of Section 203 of the Water Resources Development Act, 1986 (WRDA), as amended by Section 161 of WRDA 2020. For the feasibility study, the SNND will propose modifications to the federal channel at the SNWW to improve navigation by reducing congestion, increasing vessel traffic flow, and providing net positive local, state, and national economic benefit, while protecting and enhancing our nation's environment. Widening alternatives are being examined that would result in the physical alteration and re-stabilization of some portions of the left descending bank (eastern) adjacent to the federal navigation channel.

Designs for channel widening and engineering assumptions regarding the expected channel slopes after widening are not completed. As such, the area of potential effect from implementing channel widening (i.e., the extent to which widening could change adjacent shorelines or require conversion of adjacent dry land to wet areas) has not been clearly defined at this point in the study. To characterize the area that could be affected by the widening alternatives, vegetation habitat surveys were conducted landward of the existing shoreline in locations being evaluated for channel widening. Depending on the extent of the widening alternatives selected, existing terrestrial vegetation habitat would become either submerged or would be graded to tapering slopes connecting to existing uplands.

A field assessment and characterization of the existing vegetation was conducted June 5 through June 8, 2021 to establish the existing terrestrial vegetation habitat that could be affected by the different widening alternatives being evaluated.

As shown in Figures 1 and 2, the widening alternatives being evaluated in the feasibility study could result in changes to adjacent shorelines along the northern portion of Pleasure Island and along the shoreline of the left descending bank of the Neches River. The extent of the potential influence on adjacent habitat would be a function of the existing river bottom bathymetry, the proximity of dry land, and the assumed geometry of the post-construction slopes. All of these shoreline areas have been highly modified by more than a century of historical use as dredge material placement areas adjacent to the maintained deep draft navigation channel.

2 Channel Widening Assumptions and Potential Area of Effects

If channel widening measures are implemented resulting in channel widening of 100 feet from the current channel toe and side slopes of the widened channel are at a 3:1 slope, then there could be up to 32 areas where change to habitat could occur. Based on these assumptions, a spatial offset was developed in GIS to identify where the widening measure would be expected to “daylight” (i.e., where the slope of the modified channel would intersect the existing ground surface, even if that surface was under water). In

addition to the "daylight" line, and additional buffer of 100 feet was added in a landward direction to identify a potential additional area of disturbance for land-side activities during construction. The detailed methods of channel widening construction have not been established, so this approach conservatively identified an area of potential effects within which there was a need to characterize the existing vegetation and habitat.

These areas are listed in Table 1 including a localized naming convention (Land Mass Name), the areal extent of the area that could be disturbed (Area), and the linear length of potentially affected shoreline parallel to the proposed channel widening. "Area" in acres has been derived using a geographic information system (ArcGIS) spatial geometry tool on buffers created with a buffer tool starting from the designed channel widening measure edge depth. "Length" is the approximate shoreline distance in feet along which disturbance could be predicted under the analytical assumptions.

Sites in Table 1 are ordered from downstream to upstream. Given the existing ground surface elevation and bathymetry of the adjacent waterbody, areas designated as "wet" are assumed to be fully inundated because of the proposed channel widening and subsequent slope equilibration. Areas designated "dry" are assumed to remain uplands after adjacent channel widening and slope equilibration. Importantly, areas designated as "dry" are assumed to only be disturbed if land-side construction was necessary to implement channel widening measures. Within the elevation transition from inundated to dry, the lower one to three feet of elevation within the transition to the "dry" zone would likely be saturated due to tidal fluctuation (approximately 1 foot), wind-driven changes to the water surface elevation, and capillary rise in medium textured soils. Because of these wetting factors, areas would be routinely saturated and would be expected to revegetate to marsh vegetation fringe along the transition.

TABLE 1 Areas Potentially Disturbed by the Sabine-Neches Channel Improvement Project

SITE	ZONE	LAND MASS NAME	AREA (acres)	LENGTH (ft)
1	Wet	GC South	7.458	2,851
2	Wet	GC South	0.226	223
3	Dry	GC South	7.925	3,597
4	Wet	GC North	0.094	165
5	Dry	GC North	5.516	2,546
6	Wet	GC North	0.022	116
7	Wet	GC North	4.212	2,065
8	Dry	GC North	0.464	297
9	Wet	PA-11 South	0.055	200
10	Wet	PA-11 South	0.046	297
11	Dry	PA-11 South	5.470	3,087
12	Wet	PA-11 South	0.004	110
13	Wet	PA-11 South	0.022	100
14	Wet	PA-11 North	0.048	263
15	Wet	PA-11 North	0.356	356

TABLE 1 Areas Potentially Disturbed by the Sabine-Neches Channel Improvement Project

SITE	ZONE	LAND MASS NAME	AREA (acres)	LENGTH (ft)
16	Dry	PA-11 North	2.085	1,016
17	Wet	PA-11 North	0.002	32
18	Dry	Upper FINA	1.237	800
19	Dry	PA-18 Downstream	0.284	445
20	Dry	PA-18 Downstream	0.064	204
21	Wet	PA-18 Upstream	3.926	3,835
22	Dry	PA-18 Upstream	11.426	5,332
23	Wet	Bessie Heights Canal Downstream	0.039	170
24	Dry	Bessie Heights Canal Downstream	3.000	1,946
25	Wet	Bessie Heights Canal Upstream	0.023	241
26	Wet	Bessie Heights Canal Upstream	0.679	1,036
27	Dry	Bessie Heights Canal Upstream	3.414	1,626
28	Wet	PA-21	0.005	60
29	Wet	PA-21	0.581	635
30	Dry	PA-21	4.337	2,087
31	Wet	PA-21	1.084	820
32	Dry	Sun Upper-Lower Island	0.812	1,017
		TOTALS	**64.9**	**37,575**

The land mass name is a local site designation based on an island name or proximate geographic feature. Assuming a 100 foot channel widening in the areas to be widened and a 3:1 slope of the subsurface waterbody bottom, there would be approximately 64.9 acres within the total disturbance footprint. Of the 64.9 acres, there would be approximately 20.5 acres that are currently dry land that would become inundated and 44.4 acres that would remain uplands that could be temporarily disturbed during land-side construction actions or a small fringe that would transition from upland to marsh vegetation because of proximity to the new water line. The total length of potentially all affected shoreline areas would be approximately 37,575 feet. The approximate length of shoreline disturbance along the total length of the altered channel would be approximately 14,592 feet (2.76 miles). The total length of the upland areas that could be disturbed if land-based actions occurred would be approximately 22,983 feet (4.35 miles).

Nineteen of these areas could become permanent shallow water and thirteen would be graded to shallow slopes connecting to the adjacent remaining undisturbed mass. If such transitions were to occur, the upland areas would return rapidly to vegetated conditions due to the ubiquity of plant propagules and the humid subtropical climate. The recovery of vegetation through natural successional processes may be assumed as a virtual certainty. The present vegetation composition of these made-land islands has occurred and reoccurred without external assistance over the time period from original placement, through frequent re-disturbance for continued dredge material disposal or other land uses and subsequent abandonment.

The actual distance of site disturbance perpendicular to the shoreline would vary with the elevation and topographic form of the existing made-land. Higher elevations would result in a longer final slopes, assuming that the slope from the bottom of the channel widening is constant. Based on historic USGS topographic maps the elevation range is approximately 1 foot below sea level (as low marsh), to greater than 20 feet at the highest points along the potentially disturbed areas on Pleasure Island. As result of this topographic variation, the site assessment and sampling were conducted farther inland in some elevated locations than depicted by a uniform buffer line from the near edge of the proposed channel improvement depth.


FIGURE 1
Pleasure Island
Assessment Sites
PA-11 North
PA-11 South
PA-11 South
PORT ARTHUR
GC North
GC North
GC South
GC South
Legend
Zones
Dry
Wet
Channel Toe
Port Arthur
Yacht Club
3,600 1,800 0 3,600 Feet
N
W
E
S
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

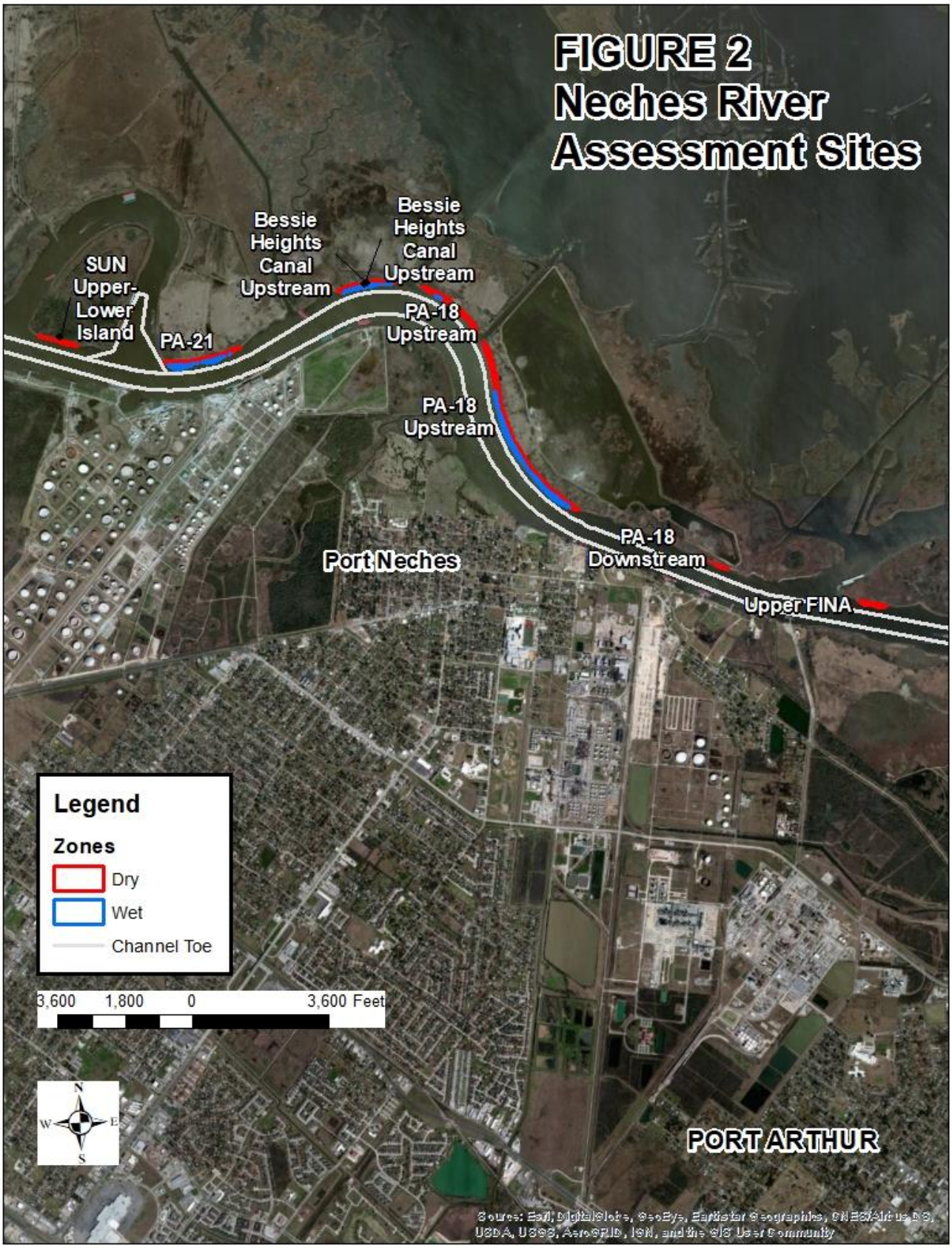


FIGURE 2
Neches River
Assessment Sites
Bessie
Heights
Canal
Upstream
Bessie
Heights
Canal
Upstream
SUN
Upper-
Lower
Island
PA-21
PA-18
Upstream
PA-18
Upstream
PA-18
Downstream
Port Neches
Upper FINA
Legend
Zones
Dry
Wet
Channel Toe
3,600 1,800 0 3,600 Feet
N
W
E
S
PORT ARTHUR
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

3 Field Assessment and Sampling

The potentially affected sites were accessed on foot and from air boats on June 5 through June 8, 2021. There were 30 sample locations for which plant species composition and relative magnitude of occupation were observed. Sample locations were initially pre-selected from aerial imagery. Maps created from aerial imagery were printed and carried in the field as guides. Other sample locations were chosen along the travel route between samples, as appropriate. Final sample locations were collected as points using a Trimble GeoXH hand-held data collector and post processed to an average position accuracy of less than three feet. The assessment travel route began at the southern end of the GC South sites, at the terminus of Rodeo Lane near the golf-ball water tower. Samples were numbered sequentially from 1 to 17 until reaching the northern end of Pleasure Island at PA-11 north, as shown on Figure 1. Sampling along the Neches River began at Upper FINA and proceeded upstream to SUN Upper-Lower Island and included samples 18 through 30, as shown on Figure 2.

Sample locations were estimated 30 foot diameter circular plots wherein all observed species were listed and assigned a value corresponding to their estimated proportion of the presence of each. Each species was rated with a number from 1 to 100 to approximate its presence or dominance within a sample plot. For example, a single species occurrence or a small cluster in a stand dominated by other species was assigned a value of "1". A stand comprised of a single species would have that species assigned a value of "100" at that sample. Sample sites were inspected for 15 to 30 minutes to observe and record the data, depending on the diversity and vegetation density. Additional species not observed in sample plots, but along travel routes between samples, were also recorded to develop a master list.

Each species was assigned an "importance value" (IV) to express its overall presence within the sampled area. The IV for each species is a summary of dominance values assigned for all plots and the percentage of the total number of plots in which the species occurred; converting the decimal percentage to whole number (% x 100).

A total of 92 species representing 39 plant families were observed and recorded as presented in Table 2. Species are rated by nativity, their presence on lists of noxious weeds, invasive propagation, and whether they are a species introduced for various human purposes. Classifications by nativity and as noxious, invasive and introduced status is based on the USDA PLANTS database (https://plants.usda.gov/home).

The Table 2 list was compared to federal and state lists of rare, threatened or endangered plant species. No such listed species were observed. The full sampling summary data for all sample sites is attached as a master list appendix.

TABLE 2 Vascular Plant Species Observed in Areas Potentially Disturbed by the Sabine-Neches Federal Channel Improvement Project in Early June, 2021

Species	Common Name	FAMILY	Nativity	Noxious	Invasive	Introduced
Acer negundo	Boxelder	Aceraceae	Native	No	No	No
Albizia julibrissin	Silk tree	Fabaceae	Alien	Yes	Yes	Yes
Alternanthera philoxeroides	Alligator weed	Amaranthaceae	Alien	yes	Yes	Yes
Ambrosia artemisiifolia	Common ragweed	Asteraceae	Native	No	Yes	No
Ambrosia trifida	Giant ragweed	Asteraceae	Native	No	Yes	No

TABLE 2 Vascular Plant Species Observed in Areas Potentially Disturbed by the Sabine-Neches Federal Channel Improvement Project in Early June, 2021						
Species	**Common Name**	**FAMILY**	**Nativity**	**Noxious**	**Invasive**	**Introduced**
Anagallis arvensis	Pimpernel	Primulaceae	Alien	No	No	Yes
Andropogon glomeratus	Bushy bluestem	Poaceae	Native	No	No	No
Apios americana	Climbing wild bean	Fabaceae	Native	No	No	No
Avicennia germinans	Black mangraove	Verbanaceae	Native	No	No	No
Baccharis halimifolia	Groundsel tree	Asteraceae	Native	No	No	No
Bromus inermis	Smooth bromegrass	Poaceae	Alien	No	Yes	Yes
Broussonetia papyrifera	Paper mulberry	Moraceae	Alien	No	Yes	No
Calyptocarpus vialis	Straggler daisy	Asteraceae	Alien	No	No	Yes
Carex scoparia	Broom sedge	Cyperaceae	Native	No	No	No
Celtis laevigata	Sugarberry	Cannabaceae	Native	No	Yes	No
Convolvulus equitans	Texas bindweed	Convolvulaceae	Native	No	No	No
Cornus drummondii	Rough-leaf dogwood	Cornaceae	Native	No	No	No
Crataegus crus-galli	Cockspur hawthorn	Rosaceae	Native	No	Yes	No
Croton alabamensis	Croton	Euphorbiaceae	Native	No	No	No
Cynanchum angustifolium	Gulf coast swallow-wort	Apocyanaceae	Native	No	No	No
Cyperus entrerianus	Deep-rooted sedge	Cyperaceae	Alien	Yes	Yes	No
Desmanthus illinoensis	Illinois bundleflower	Fabaceae	Native	No	No	No
Eleocharis acicularis	Least spikerush	Cyperaceae	Native	No	No	No
Eleusine indica	Indian goosegrass	Poaceae	Alien	No	No	No
Elymus canadensis	Canada wildye	Poaceae	Native	No	No	No
Elymus canadensis	Canada wildrye	Poaceae	Native	No	No	No
Eremochloa ophiuroides	Centipedegrass	Poaceae	Alien	No	Yes	Yes
Eupatorium capillifolium	Dog fennel	Asteraceae	Native	No	No	No
Fraxinus caroliniana	Carolina ash	Oleaceae	Native	No	No	No
Gaillardia pulchella	Indian blanket	Asteraceae	Native	No	No	No
Hydrocotyle bonariensis	Large-leaf pennywort	Araliaceae	Native	No	No	No
Ilex vomitoria	Youpon holly	Aquifoliaceae	Native	No	No	No
Ipomoea purpurea	Tall morning glory	Convolvulaceae	Alien	No	No	Yes
Iva frutescens	Marsh elder	Asteraceae	Native	No	No	No
Juncus effusus	Soft rush	Cyperaceae	Native	No	No	No
Juncus roemerianus	Black needle rush	Cyperaceae	Native	No	No	No
Krigia caespitosa	Dwarf dandelion	Asteraceae	Native	No	No	No
Lactuca canadensis	Wild lettuce	Asteraceae	Native	No	No	No
Lantana camara	Lantana	Verbanaceae	Alien	Yes	Yes	Yes
Lepidium densiflorum	Common peppergrass	Brassicaceae	Alien	No	No	No
Ligustrum lucidum	Tree privet	Oleaceae	Alien	No	Yes	Yes
Ligustrum sinense	Chinese privet	Oleaceae	Alien	No	Yes	Yes
Lonicera japonica	Japanese honeysuckle	Caprifoliaceae	Alien	Yes	Yes	No
Ludwigia palustris	Marsh seedbox	Onagraceae	Alien	No	Yes	Yes
Malvastrum coromandelianum	Threelobe false mallow	Malvaceae	Alien	No	No	No
Mimosa strigillosa	Sunshine mimosa	Fabaceae	Native	No	No	Yes

TABLE 2 Vascular Plant Species Observed in Areas Potentially Disturbed by the Sabine-Neches Federal Channel Improvement Project in Early June, 2021						
Species	**Common Name**	**FAMILY**	**Nativity**	**Noxious**	**Invasive**	**Introduced**
Morella cerifera	Wax myrtle	Myricaceae	Native	No	No	No
Muhlenbergia capillaris	Hairawn muhly	Poaceae	Native	No	No	No
Nekemias arborea	Peppervine	Vitaceae	Native	No	Yes	No
Neptunia pubescens	Tropical puff	Fabaceae	Native	No	No	No
Oenothera speciosa	Evening primrose	Onagraceae	Native	No	No	Yes
Oxalis stricta	Yellow wood sorrel	Oxalidaceae	Native	No	Yes	No
Parkinsonia texana	Texas paloverde	Fabaceae	Planted	No	No	Yes
Paspalum monostachyum	Gulf paspallum	Poaceae	Native	No	No	No
Paspalum notatum var. notatum	Bahiagrass	Poaceae	Native	No	No	No
Passiflora foetida	Fetid passionflower	Passifloraceae	Native	No	Yes	No
Phragmites sp.	Common reedgrass	Poaceae	Alien	Yes	Yes	Yes
Phyla nodiflora	Frog fruit	Verbanaceae	Native	No	Yes	No
Quercu alba	White oak	Fagaceae	Native	No	No	No
Quercus nigra	Water oak	Fagaceae	Native	No	No	No
Querdus alba	White oak	Fagaceae	Native	No	No	No
Quescus virginiana	Live oak	Fagaceae	Native	No	No	No
Rhynchosia minima	Least snout bean	Fabaceae	Native	No	No	No
Rhynchospors corniculata	Bristly sedge	Cyperaceae	Native	No	No	No
Rubus argutus	Sawtooth blackberry	Rosaceae	Native	No	No	No
Rubus trivialis	Southern dewberry	Rosaceae	Native	No	Yes	No
Rumex maritimus	Golden dock	Polygonaceae	Native	No	No	No
Sabal palmetto	Cabbage palmetto	Palmae	Planted	No	No	No
Sagittaria lancifolia	Bulltounge arrowhead	Alistimataceae	Native	No	No	No
Salix nigra	Black willow	Saliaceae	Native	No	No	No
Schoenoplectus acutus	Hardstem bulrush	Cyperaceae	Native	No	No	No
Schoenoplectus americanus	Chairmakers rush	Cyperaceae	Native	No	No	No
Sesbania punicea	Rattlebox	Fabaceae	Native	No	No	No
Setaria pumila	Yellow bristlegrass	Poaceae	Native	No	No	No
Sisyrinchium angustifolium	Blue-eyed grass	Iridaceae	Native	No	No	No
Smilax bona-nox	Saw greenbrier	Liliaceae	Native	No	No	No
Solidago rugosa	Wrinkleleaf goldenrod	Poaceae	Native	No	Yes	No
Sorghastrum nutans	Indiangrass	Poaceae	Native	No	No	No
Spartina patens	Salt hay	Poaceae	Native	No	No	No
Tamarix gallica	French tamarix	Tamaricaceae	Alien	Yes	Yes	No
Taxodium distichum	Bald cypress	Cupressaceae	Native	No	No	No
Teucrium chamaedrys	Germander	Lamiaceae	Alien	No	Yes	No
Tortilis arvensis	Spreading hedge parsley	Apiaceae	Alien	No	Yes	No
Toxicodendron rydbergii	Western poison ivy	Anacardiaceae	Native	No	No	No
Tradescantia ohiensis	Bluejacket	Commelianaceae	Native	No	No	No
Triadica sebifera	Tallow tree	Euphorbiaceae	Alien	yes	Yes	No
Typha domingensis	Southern cattail	Typhaceae	Native	No	No	No

TABLE 2 Vascular Plant Species Observed in Areas Potentially Disturbed by the Sabine-Neches Federal Channel Improvement Project in Early June, 2021						
Species	**Common Name**	**FAMILY**	**Nativity**	**Noxious**	**Invasive**	**Introduced**
Ulmus parvifolia	Chinese elm	Ulmaceae	Alien	No	No	No
Vachellia farnesiana	Sweet acacia	Fabaceae	Native	No	No	No
Verbena halei	Texas vervain	Verbanaceae	Native	No	No	No
Vitis mustangensis	Mustang grape	Vitaceae	Native	No	No	No
Zanthoxylum clava-herculis	Toothache tree	Rutaceae	Native	No	No	No

Nativity is ranked as either "native" or "alien". Native species are those presumed by historical records and early botanical manuals to have evolved in and occupied a region since ancient times. Alien species have "invaded" and occupied the land, either intentionally or inadvertently, through the actions of humanity.

Noxious species, generally rated as such by public health and agricultural organizations, are those that aggressively invade natural biotic communities and crop lands because they are considered to be injurious to people and livestock, are disease vectors, are parasites or otherwise negatively impact desired crops and ecosystems. Both the federal government and state governments promulgate lists of such species and also provide some programmatic funding for their control and eradication. Noxious species are often also considered as "invasive".

Invasive species are those not listed as noxious that are often also alien to a region and can quickly occupy an area (particularly a disturbed area) to the detriment of native species and natural communities. Native species can be considered as invasive if they form monocultures and out compete desired species compositions. Early successional species occupying recently disturbed land such as plowed fields and fill material disposal areas due to their reproductive methods and their ability to endure harsh conditions for growth, may also be considered temporarily as invasives. Native invasives can occupy and area to the exclusion of other more desired species for either brief or long periods. Natives species occurring in near monocultural occupations such as goldenrod and ragweed for short periods, and common reed for long periods are ranked in this description as invasives. Early successional plant species often yield in time to native species, which because of their ancient occupation of a region, have evolved to better endure the extremes of the local environment and to take best advantage native propagators and propagation opportunities predominant in the area. A greater presence of early successional and invasive species suggests a shorter time period since the most recent perturbation.

Introduced species are those non-native species that have been intentionally established and planted for their presumed human benefit. They often escape cultivation and may become noxious or invasive, such as Kudzu, Chinese privet, wisteria, and many others. The presence of centipede grass on Pleasure Island from golf course plantings is an example of a resilient introduced species. Introduced plant species often are less valuable for support of native animal populations.

The relative dominance of plants within the assessment area listed within each of these ranking categories provides a method of valuation for the plant communities that will be disturbed by the navigation improvement project. The categories of "alien", "noxious" and "invasive" cast a negative or undesired

connotation to the structure and composition of the present plant community. Introduced species need not be replaced or accounted as a loss of valuable habitat. Table 3 is a summary of the relative importance as a percentage of the present composition of each ranking category within all of the sample sites.

All sample data are included as an attached pdf document.

Table 3 Weighted Species Categories for Sampled Stands

Category	Species Count	Relative Importance Value for All Samples	Average Percent of Dominance in All Samples
Alien Species	23	1068	22%
Native Species	67	3845	78%
Noxious Species	8	693	14%
Invasive Species	26	2352	48%
Introduced species	15	528	11%

Ranking the species by importance value (Table 4) reveals that only 9 species comprise more than 50 percent of the plant community at all sites. Three of these are alien species. Two species are considered noxious. Six of these are invasive species, in terms of their ability to rapidly occupy newly disturbed ground. The single most dominant herbaceous species on well-drained sites is wrinkleleaf goldenrod. The invasive alien Tallow tree is the most common woody species on dry sites; closely followed by the native sugarberry. On wet to moist sites common reed and deep-rooted sedge, are the most common. Both of these are invasive aliens. Common reed is listed as noxious.

Table 4 Dominant Species in all Sample Plots

Species	Common Name	Nativity	Noxious	Invasive	Introduced	% Tot IV	Running
Solidago rugosa	Wrinkleleaf goldenrod	Native	No	Yes	No	14%	14%
Triadica sebifera	Tallow tree	Alien	yes	Yes	No	8%	22%
Celtis laevigata	Sugarberry	Native	No	No	No	6%	29%
Baccharis halimifolia	Groundsel tree	Native	No	No	No	5%	34%
Nekemias arborea	Peppervine	Native	No	Yes	No	5%	39%
Ambrosia trifida	Giant ragweed	Native	No	Yes	No	4%	43%
Phragmites sp.	Common reedgrass	Alien	Yes	Yes	Yes	3%	46%
Verbena halei	Texas vervain	Native	No	No	No	3%	49%
Cyperus entrerianus	Deep-rooted sedge	Alien	No	Yes	No	3%	51%

4 Site Descriptions

4.1 Pleasure Island Sites

The Pleasure Island shoreline along the federal navigation channel is the area that could have the most extensive alterations (GC 1, GC 2, and PA-11 in Table 1). However, all of Pleasure Island is made land created by the placement of dredged material from constructing and maintaining the Sabine-Neches Waterway. This pattern of material placement, begun in the 1840's, has continued to the present day. The creation and maintenance of confinement levees to receive this dredged material had material placement areas presently extending nearly a mile into Sabine Lake.

The central portion of Pleasure Island includes municipal greenspace/parks, recreational vehicle parks, a yacht club/marina, permanent residences, and an abandoned 18-hole golf course. Review of historical aerial imagery on Google Earth reveals that the golf course was operating in 2005 but suffered extensive flooding damage from flooding associated with Hurricane Ike (visible in Google Earth's September 2008 imagery). The last evidence of mowing visible in Google Earth images is March 2010. The golf course has been undergoing natural succession for at least 11 years.

Portions of the GC and PA-11 sites are the highest elevation of the areas investigated, ranging to more than 20 feet above sea level. This reach of the channel is mesohaline, with salinity ranging from 5 to 12 parts per thousand depending on the volume of flow in the Neches River (Winemiller et al, 2013). There is also significant evidence that a large wild hog population occupies this area.

4.1.1 GC Sites

Labeled GC north and GC south, these areas are the channel-side fringe of the abandoned golf course, now separated by several hundred foot gaps of eroded shoreline as shown on Figure 3. They are nearly identical in terms of elevation above water, nature of recent perturbation and the time since human disturbance ended. The Wet zone units often have a waterside rip-rap toe below a steep, eroded former confinement levee slope. The slope and rip-rap areas, if vegetated, are dominated by common reed due to that species' ability to tolerate moderate salinity in the adjacent Sabine Neches Channel. Areas above the channel slope were previously modified into golf course features. Parallel to the water course, there is a paved asphalt cart path meandering through both the Wet and Dry zones. The majority of the more elevated GC area is dominated by tall herbaceous vegetation; primarily goldenrod and giant ragweed. A few larger trees remain that were maintained as part of the golf course landscaping. Tallow tree and sugarberry are the most common successional trees. Groundsel-tree is the most common successional shrub. There are a few small ponds, also formerly part of the golf course landscaping. These ponds are generally dominated by two alien wetland species along the shoreline; alligator weed and deep-rooted sedge. Figure 4 presents four figures (4A, 4B, 4C, 4D) that depict the typical vegetation observed within the GC sites.


FIGURE 3
Pleasure Island Sites
GC South and GC North
PORT ARTHUR
GC North
GC North
GC South
1
2
3
4
5
6
7
8
9
10
11
12
Legend
Zones
Dry
Wet
Channel Toe
Sabine Samples
800 400 0 800 Feet
N
W
E
S
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

FIGURE 4. Images of GC Dry zone

4A. Former cart path in GC Dry zone south. Common reed along shoreline. Tallow tree flanks path.

4B. Successional goldenrod and ragweed near shoreline fringe of groundsel tree and sugarberry.

4C. Dominant groundcover in GC Dry zone: goldenrod and Texas vervain.

4D. Former golf course water hazard pond covered by duckweed and surrounded by cattail, alligator weed and deep-rooted sedge. Tallow tree, black willow and groundsel tree in background.


FIGURE 5
Pleasure Island Sites
PA-11 South and PA-11 North
PORT ARTHUR
13
14
15
16
PA-11 North
17
PA-11 South
PA-11 South
Legend
Zones
Dry
Wet
Channel Toe
Sabine Samples
800 400 0 800 Feet
1 inch = 667 feet
N
W
E
S
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

4.1.2 PA-11 Sites

Further upstream, the PA-11 sites are similarly separated by bank erosion gaps as depicted in Figure 5. They are virtually identical in configuration; water side levee faces, vegetated with successional trees and shrubs. The majority of each of these sites is in the Dry zone. These are confinement-levee top access roads and the waterward steep slopes to the river channel. There is a 20-30 foot wide band of rip-rap at the toe of each, separated from herbaceous and shrubby vegetation on the slope, by a fringe of salt-tolerant common reed. Dominant vegetation is the tall early successional herbs giant ragweed and goldenrod mixed with tallow tree and French tamarisk. Figure 6 shows the typical vegetation observed in the PA-11 sites.

FIGURE 6. Images of PA-11 Dry zone

Figure 6A: Goldenrod, ragweed, groundsel tree and tallow tree on waterside levee slope near sample 17.

Figure 6B: French tamarisk, tallow tree surrounded by goldenrod and ragweed along the levee top road near sample 16.

The widening and reconstruction of the levee-top access road was underway at the time of the field survey. The new access road has impinged upon the already narrow strip of vegetated levee waterside slope face, reducing its width to 20 to 30 feet.

4.2 Neches River Sites

As shown in Figure 2, the potential footprint of disturbance from widening measures within the Neches River portion of the navigation channel involves the southern tips of a series of island shorelines. These shorelines appear to have been created by excavation of a straight channel through the western side of the flood plain to cut off former river bends, or were formed by the placement of dredged materials during navigation channel maintenance or improvement actions.

These sites tend to range in elevation from mean sea level to approximately +4 feet elevation. The more northern sites may range to +5 or +6 feet elevation on the landward side, as dredge material has been historically placed adjacent to the river bank. These more elevated sites have not been recently disturbed and support small trees and large shrubs. Many are freshwater wetlands that range from low marsh to high marsh. At some locations, the adjacent uplands are dredge material placement area containment dike faces and there is evidence that many of these sites are used for grazing by cattle.

In total, the areas defined within the wet zone (i.e., blue polygons) sum to approximately 6.34 acres and the areas within the dry zone (i.e., red polygons) sum to approximately 24.6 acres.

4.2.1 Upper FINA Site

The Upper FINA site, as shown in Figure 7, is a 1.237 acre area that is entirely within the estimated dry zone (i.e., there would be no predicted change to the area of dry land currently depicted and the red-polygon of Figure 7 depicts an area that would only be disturbed by upland activities during widening). It is also entirely within a tidal low marsh. A field sample was not collected in this site; however, it was observed from the boat and it clearly presents a low marsh textural signature in all available imagery.

It is dominated by common reed on the water side and cattail toward the landward side. This site appears to experience low salinity, as salinity intolerant species, such as southern cattail and bulltounge, have become dominant. .

4.2.2 PA-18 Sites

The PA-18 sites, as shown by Figure 8, have been characterized by samples 26 through 30. The downstream PA-18 sites total 0.348 acres (0.284 + 0.064) and are within the dry zone, but like Upper FINA, are entirely low tidal marsh dominated by southern cattail. The 3.962 acre wet zone of Upstream PA-18 site is split between low marsh and high marsh. The low marsh is dominated by southern cattail, cane-maker's rush, and bulltounge arrowhead. Upper marsh vegetation, approximately one-foot higher in elevation, is composed of deep-rooted sedge, frogfruit and groundsel tree saplings. One to two feet higher in elevation, the plant community becomes a dense tangle of southern dewberry, peppervine, and shrub-

sized tallow tree and sugarberry. The dry zone of the PA-18 site is approximately 11.426 acres with the upstream-most 300 feet of this unit nearly +5 feet in elevation. This higher elevation area supports older trees; however, the dominant species are also tallow tree and sugarberry. Figure 9 (9A, 9B) show the typical vegetation found at these sites.

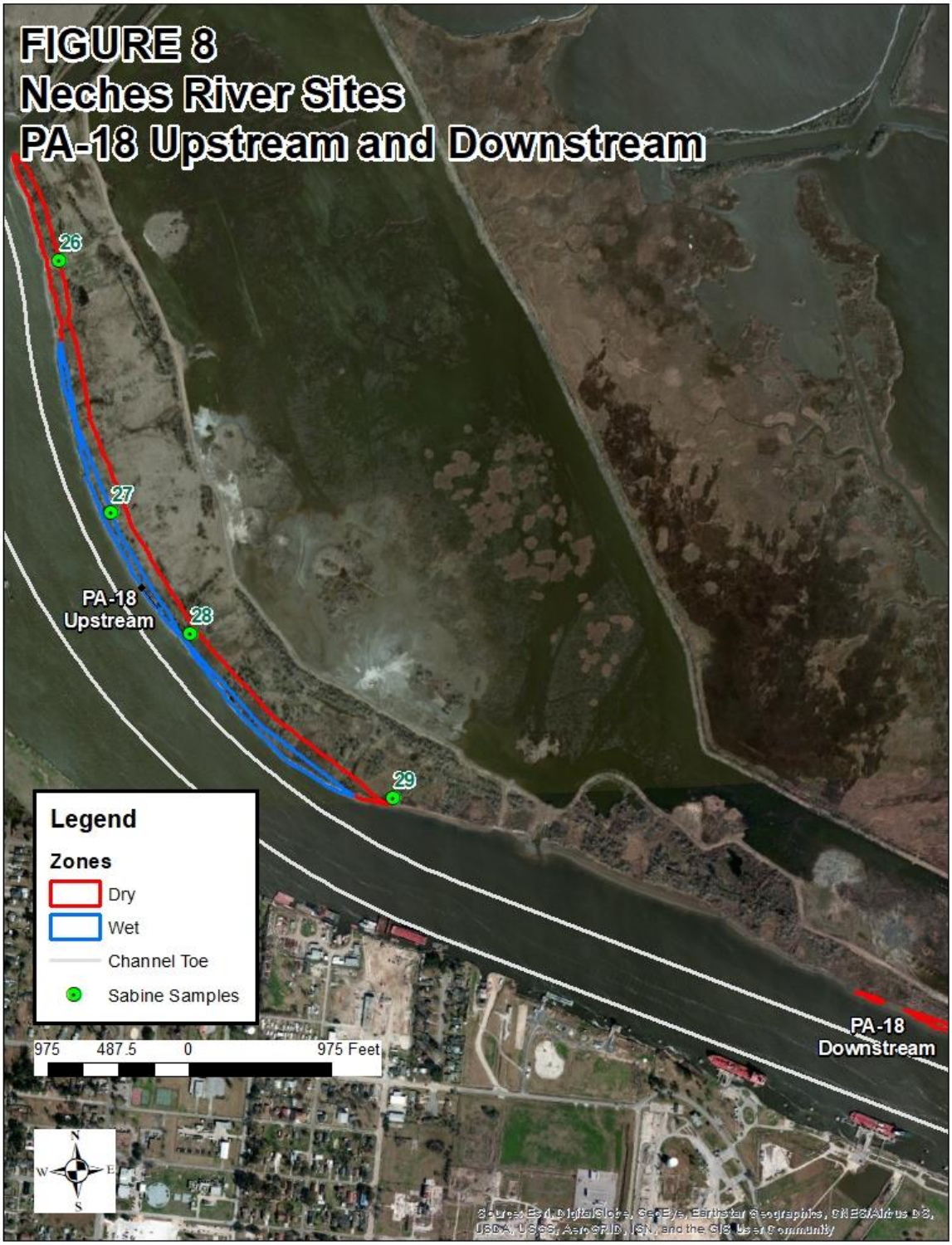
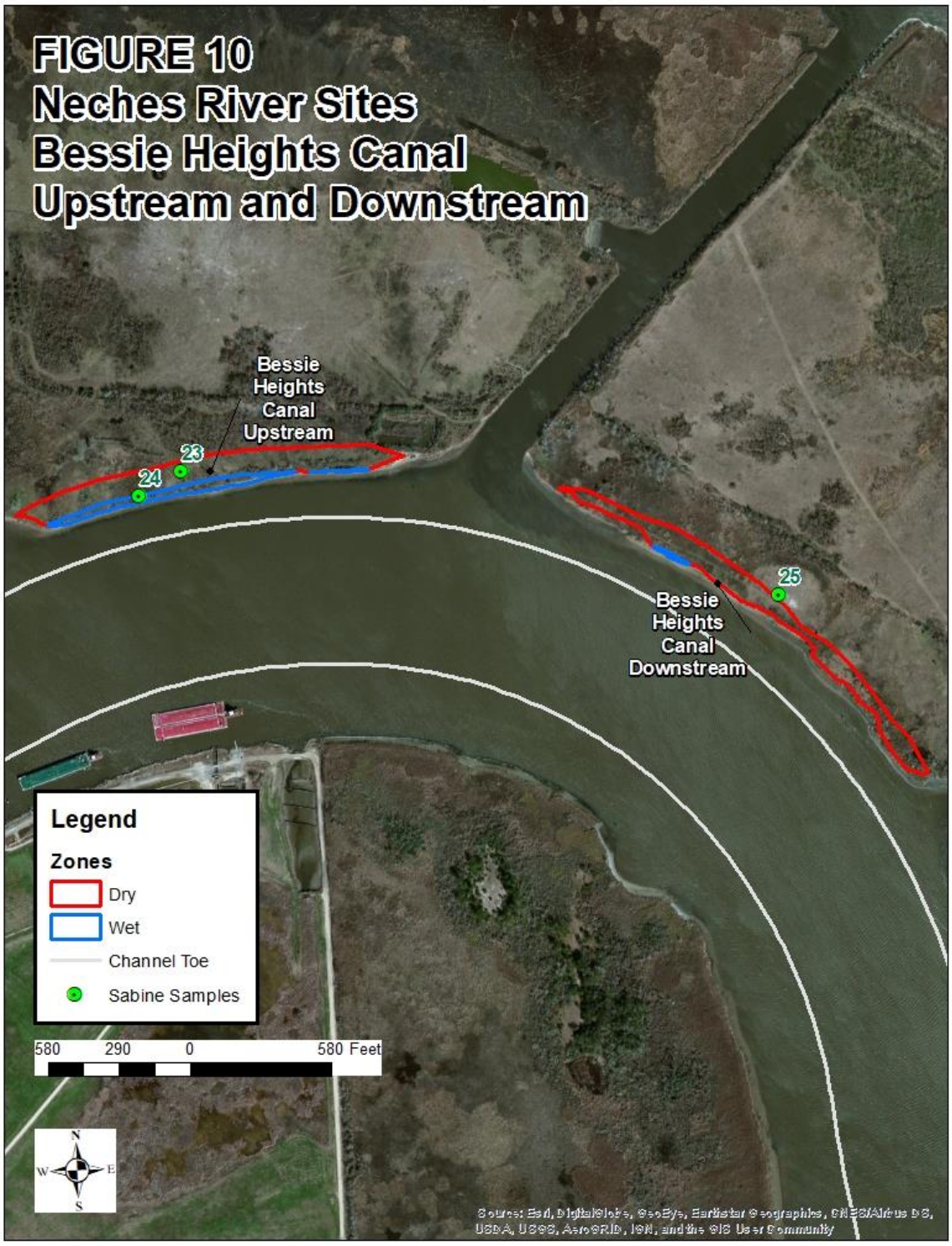


FIGURE 9. Images of PA-18

Figure 9A: PA18 Downstream low marsh dominated by southern cattail. Tallow trees and sugar berry trees are growing on a low levee face in the background.

Figure 9B: PA-18 low marsh, high marsh and shrub-sapling covered levee face in background.

4.2.3 Bessie Heights Canal Sites



The Bessie Heights Canal sites, as shown on Figure 10 are a series of dredge material mounds and swales reflecting incident decisions on the placement of dredge material. In the Bessie Heights Canal Downstream area, approximately 0.039 acres are within the wet zone and 3.0 acres are within the dry (red polygon) zone that could be affected by the widening. Within the Bessie Heights Canal Upstream area,

approximately 0.702 acres (0.023+0.679) are within the wet zone and 3.414 acres are within the dry (red polygon) zone that could be affected by the widening.

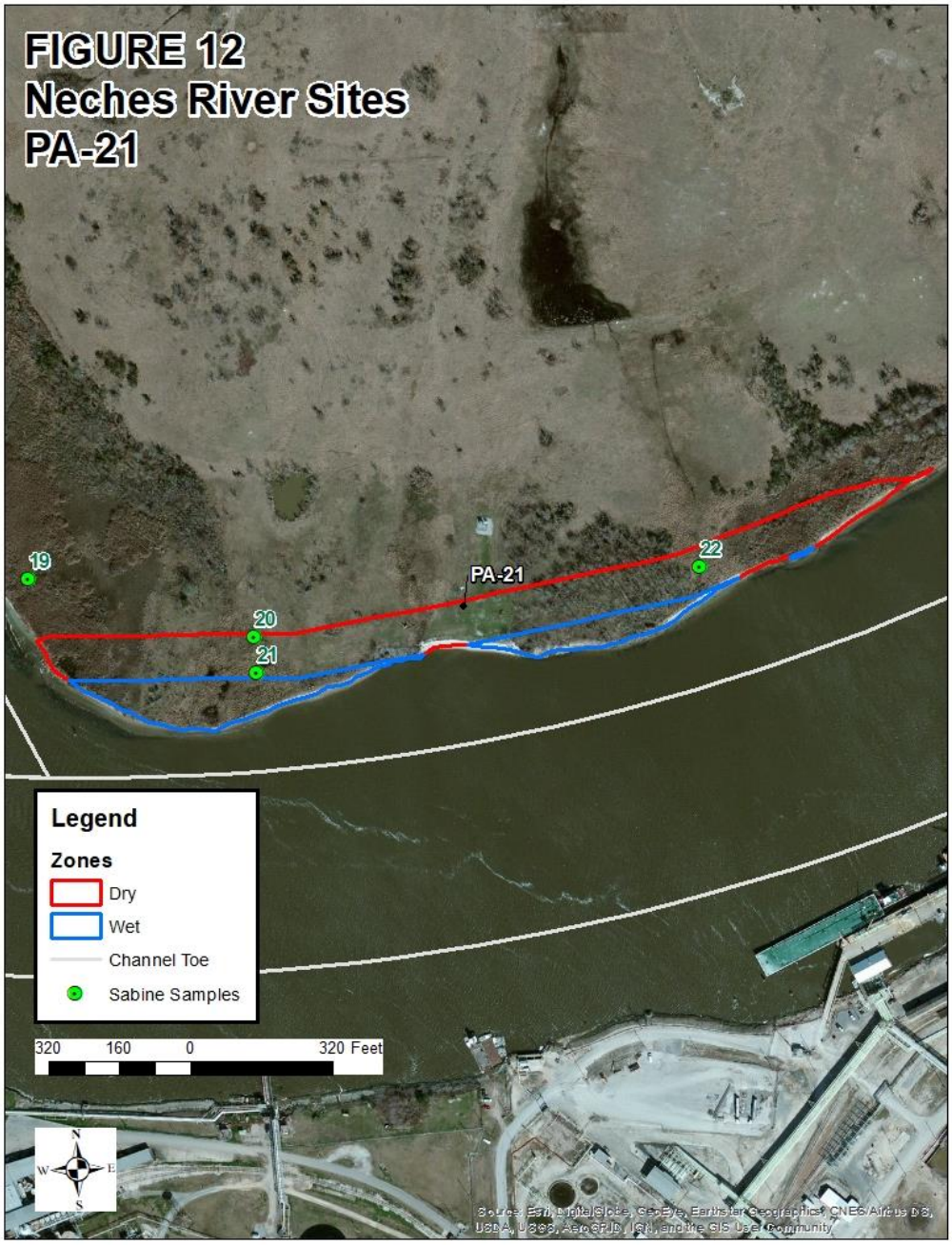
Samples 23, 24 and 25 were logged in these sites. Within the area of potential influence from widening measures, the mounds are elevated to +5-feet or more above the water. The more elevated locations support stands of tall shrubs of tallow tree, sugar berry, wax myrtle. A few small, scattered bald cypress are noteworthy near the shoreline. Lower areas support low diversity high marsh occupied by deep-rooted sedge, southern dewberry and Texas vervain. Low marsh vegetation is composed of cattail, frog fruit and bulltounge.

FIGURE 11. Images of Bessie Heights Canal Upstream and Downstream

Figure 11A. Low marsh in swale followed by a dredge material mound at the Bessie Heights Canal site

Figure 11B. Old levee end surrounded by high marsh near sample 22 within the Bessie Heights Canal site

Figure 11C. Successional goldenrod, peppervine and southern dewberry within Bessie Heights Canal Dry



PA-21 Site

PA-21, as shown by Figure 12, is similar to the Bessie Heights Canal upstream and downstream sites, with approximately one-quarter of the area in shrub-dominated, elevated mounds. In the PA-21 site, approximately 1.67 acres (0.01+0.58+1.08) are within the wet zone (blue polygon) and 4.34 acres are within the dry (red polygon) zone that could be affected by the widening. Samples 19 through 22 characterize the vegetation found in these sites. Major vegetation continues to be sugarberry, tallow tree and groundsel tree. The remainder is low marsh strongly dominated by southern cattail.

4.2.4 Sun Upper-Lower Island Site

The Sun Upper-Lower Island site, as shown in Figure 12, is a 0.81 acre area that is entirely within the estimated dry zone (i.e., there would be no predicted change to the area of dry land currently depicted and the red-polygon of Figure 13 depicts an area that would only be disturbed by upland activities during widening). The Sun Upper-Lower Island Site appears to be mostly a recently disturbed older levee face. It is dominated by early successional colonizers such as giant ragweed, common reedgrass, and Peppervine. Some areas near the eastern end support low marsh (Figure 14).

FIGURE 14. Sun Upper Lower Island Sites

Figure 11D. Low cattail marsh that comprised the Wet zone of Sun Lower Island.

SUMMARY

If channel widening measures are implemented in the areas identified and surveyed, terrestrial vegetation and its use as habitat would be eliminated in the newly submerged areas. Depending on final depth and water clarity, some portion of the disturbed areas would be expected to revegetate as submergent to emergent wetlands. The new graded slope above the new wet zone would likely revegetate through natural successional processes to the habitat character and composition found there now.

All sites are low in species diversity. There were no listed rare, threatened or endangered species observed. A significant portion of most non wetland stands are presently composed of alien species, some of which are listed as noxious weeds. Most low marsh areas in the southern navigation channel project area are almost entirely composed of common Reedgrass; a noxious alien weed. The foregoing characteristics define ecological compositions classifiable as early successional colonizers. This type of community occurs in instances of recent and frequent disturbance. The presence of these types of plant communities suggests that there is a nearby propagule pool to facilitate rapid natural revegetation of the potentially affected sites.

It is uncertain as to whether the marshes along the Neches River portion of the area investigated would be directly affected by the channel improvement project, since the slope from the wet zone excavation would daylight at the existing elevation, which is at or below ordinary water elevation in many low marsh areas. This is an assumption that should be further evaluated by the channel design engineers.

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