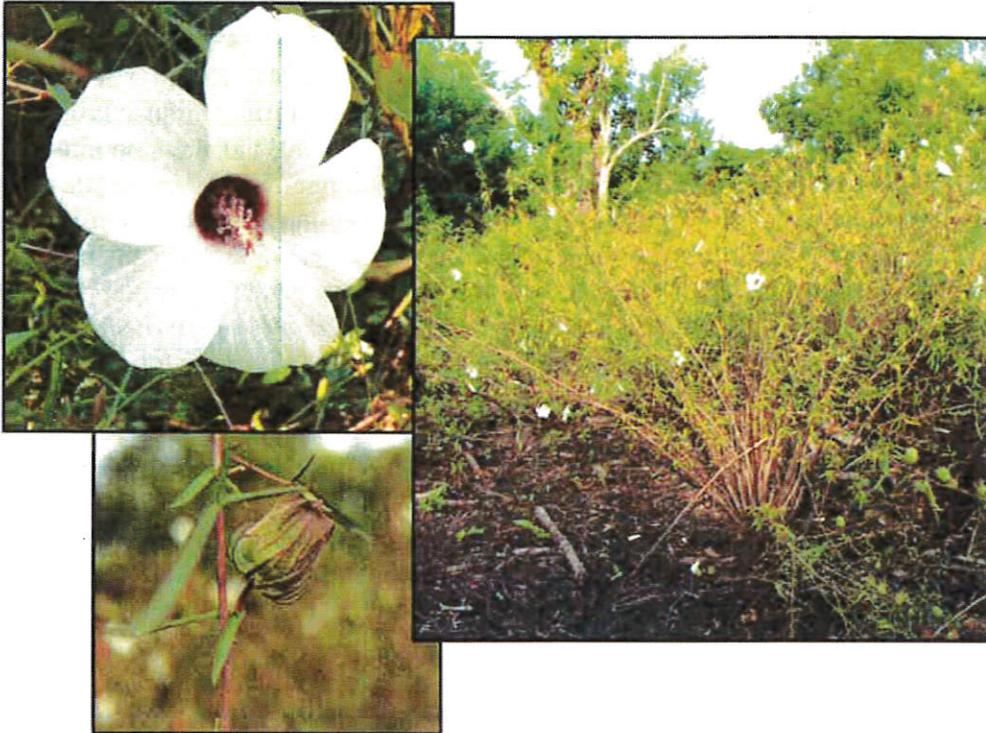


RECOVERY OUTLINE
Neches River rose-mallow
(*Hibiscus dasycalyx*)

U.S. Fish and Wildlife Service
Texas Coastal Ecological Services Field Office
Houston, Texas



March 2018

Approved:


Acting Assistant Regional Director - Ecological Services


Project Leader, Texas Coastal Ecological Service Field Office

INTRODUCTION

Species common and scientific name: Neches River rose-mallow (*Hibiscus dasycalyx*)

Listing status and date: The Neches River rose-mallow (hereafter referred to as “rose-mallow”) was listed by the U.S. Fish and Wildlife Service (Service) as threatened and designated with 11 units of critical habitat on September 11, 2013 (78 Federal Register (FR)). The species is listed as both a G1 and S1 species meaning it is critically imperiled both globally and subnationally, respectively (NatureServe 2017). The rose-mallow is not currently listed by Texas Parks and Wildlife Department (TPWD).

Species Description: The rose-mallow is a nonwoody perennial in the Malvaceae (mallow) family that grows 1.9-7.5 feet (ft.) (0.6-2.3 meters (m)) tall. Leaves are alternate, simple, generally t-shaped, and deeply three-lobed with petioles 1.1-1.8 inches (in) (3-5 centimeters (cm)) long. The species generally produces a single creamy white (rarely pink) flower at the base of the leaf stalk along the uppermost branches or stems. Plants are single to multi-stemmed. Each branch or stem can have numerous leaves, with the total number of flowers per plant numbering in the hundreds. Flowering is rain dependent, spanning a few weeks in June and July. Seeds are set in August (T. Philipps, pers. comm. 2016a). Large, numerous stamens are monadelphous, forming a tube that is united with the base of the petals. Potential pollinators may include, but are not limited to: the American bumble bee (*Bombus pensylvanicus*), Hibiscus bee (*Ptilothrix bombiformis*), moths, and the scentless plant bug (*Niesthrea louisianica*) (Klips 1995, Warnock 1995, Warriner 2011).

Recovery Priority Number: 8.

The recovery priorities for listed species range from 1 to 18, with 1 signifying the highest recovery potential (48 FR 43104). The rose-mallow’s final listing determination was the most comprehensive status review of the species to date. The principal threats affecting the rose-mallow include: habitat loss; habitat modification through the encroachment of nonnative and native plants species; hydrologic changes; and, construction/development projects. These significant threats coupled with a restricted species’ range (of which at least half of the properties are on private land) and potential hybridization with other hibiscus congeners (*H. leavis* and *H. moscheutos*), constitutes a high level of threat to the ecosystem throughout the East Texas Pineywoods ecoregion. Of the 11 populations known to exist, 3 populations exist along the state highway (SH) right-of-ways (ROWS) and operate under a revised 1988 Memorandum of Understanding (MOU) that governs management actions targeting conservation of listed species and key habitats on SH ROWs. These threats are moderated given that 7 sites are found on private or federal lands that are undergoing ongoing management and/or are bound by Endangered Species Act regulations. The rose-mallow, successfully propagated from cuttings, has benefited from planned transplants, thereby providing potential restoration opportunities. Based on this information, the Service has determined the current recovery priority number of 8 for the rose-mallow (48 FR 43104).

Lead Region: Region 2

Lead Field Office/Cooperating Field Offices:

Texas Coastal Ecological Service Field Office (ESFO), Houston (Lead)
Arlington ESFO, Partners for Fish and Wildlife Program

Contact Biologist: Amber Miller: (281) 286-8282 extension 26501

Purpose and Use of the Recovery Outline: The purpose of this recovery outline is to provide an interim strategy to guide the conservation and recovery of the rose-mallow until a final recovery plan is completed. Recovery needs of the species will require cooperation among the Service, other Federal and State agencies, non-governmental agencies, private landowners, and the public. An outline of potential recovery actions for the rose-mallow may help interested stakeholders understand how we envision rose-mallow conservation proceeding until a recovery plan is finalized. The current outline and recovery strategy are based on the best available scientific information, including documentation cited in the Federal Register Proposed and Final Rules. Members of the East Texas Plant Working Group have expert knowledge and provided assistance in developing an assessment of threats, population trends, and the conservation strategy.

BRIEF METHODOLOGY

Information Sources and Quality, and Dealing with Uncertainty: To develop this recovery outline, the Service used the most current scientific literature published in the rose-mallow's final listing determination (78 FR). Information includes: biology and natural history, an assessment of demographic risks (such as small population sizes), threats, and viability. The final listing determination compiles data from the Service and species experts. It includes, but is not limited to: status reviews (Warnock 1995); field survey data collected by the Service between 2002-2005, 2007, and 2016; site observations from the TPWD's Natural Diversity Database (TXNDD); and biological information. The final listing determination also identifies final approved critical habitat for the rose-mallow, compiling the biological data with a description of past, present, and likely future threats facing the species. However, we recognize there are information gaps that are necessary to investigate. These gaps include pollinator studies, edaphic (soil) features, as well as seed biology (seed viability, seed survivorship, predation, and seed dispersal). Hybridization was listed in the Final Rule (78 FR 56065) to be a concern for the rose-mallow. To date, research has been funded to investigate the genetics within and among the *H. dasycalyx*, plus two more common *Hibiscus* species, *H. leavis* and *H. moscheutos*. This research is discussed below under the "Aspects of the species' biology and/or ecology affecting recovery potential" Section.

The species' status on several private lands remains unknown. There are three sites that have not been verified in over 20 years. Refer to the section "Distribution, Abundance, and Trends" for more specific information.

RECOVERY STATUS ASSESSMENT

The Service does not anticipate that a Species Status Assessment (SSA) will be completed prior to the publication of this recovery outline. However, the Service will initiate an SSA prior to the development of an approved recovery plan in Fiscal Year (FY) 2020.

The 2011 Final Listing determination considered the limiting factors for the rose-mallow recovery and viability within and among populations. The ability of a species to yield self-

sustaining populations over time defines the species' viability. The physical and biological needs of the rose-mallow were identified, including its habitat. Additionally, we examined the repercussions to the species when fulfillment of those needs is missing or diminished. Factors causing the species to lack what it needs, including historical, current, and future factors were considered. Finally, we evaluated the current status and future viability of the species in terms of resiliency, redundancy, and representation within/among each population.

Biological Assessment: This assessment considers individual, population, and species-scale needs based on the information known about the rose-mallow.

Requirements of Individuals

- Habitats: All life stages of the plant (Figure 1) are found along sloughs, oxbows, terraces, and sand bars of depressional or low-lying areas in the Neches River floodplains, Mud Creek, or Tatanbogue Creek. This plant is endemic to the open, wetland habitats of the East Texas Pineywoods ecoregion. The canopy is open with little cover, allowing direct sunlight for the plant. Soils associated with these wetlands sites are hydric alluvial or sandy loams in the Inceptisol or Entisol orders. Proximity to a floodplain provides seasonal inundation of water in the winter months and is thought to be the key mechanism for seed dispersal. At a minimum, the soil surface dries out during the summer months. Typical native woody associates include *Carya aquatic*, *Cephalanthus occidentalis*, *Celtis laevigata* var. *laevigata*, *Fraxinus* sp., *Quercus lyrata*, *Q. nigra*, *Liquidambar styraciflua*, and *Salix nigra* (Poole *et al.* 2007).

	Life Stage	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Life Stage	budding												
	leafing												
	flowering												
	fruiting - seed set												
	"dormant"												
Habitat	Dry - no standing water												
	Wet - standing water												

Figure 1: Habitat and Life Stages of the Neches River rose-mallow.

- Reproduction: The rose-mallow is a perennial plant and may be long-lived; however, life expectancy is unknown. Cross-pollination occurs (Blanchard 1976). The species may have high reproductive potential (fecundity) as it produces about 50 fruits per plant (Poole 2012, pers. comm., in 77 FR 55974). Fruits are capsules largely enclosed in the calyx prior to dehiscence, with pubescence composed of simple, stellate and glandular hairs. Seeds are locule, globose, and densely stellate-pubescent (Poole *et al.* 2007), but seed viability and survivorship are unknown. Potential pollinators may include bumble bees, Hibiscus bee, moths, and the scentless plant bug.
- Precipitation: Plants need consistent amounts of rain to sustain reproductive function and growth. Precipitation is evenly distributed throughout the year. Average annual rainfall in the Pineywoods ranges from 40 – 60 in (98 – 152 cm) (Diggs *et al.* 2006).

Requirements of Populations

- Number of populations: When the species was listed in 2013, 11 populations were determined to be occupied by the rose-mallow (Table 1). Of those 11 populations, 3 sites have not been verified in over 20 years and 3 included introductions on the Davy Crockett National Forest. In addition to these natural populations, the Service is also aware of 8 reintroductions, introductions, or display gardens, some of which were coordinated through the Service.
- Minimum Viable Population: To guide what is needed for the conservation of the species, we relied upon Pavlik's 1996 Minimum Viable Population (MVP) analysis tool. Based on this analysis, best known scientific information on the species' life history, best known scientific information on the species' reproductive characteristics, and input from species experts, we concluded in 2012 that at least 10 viable populations of the rose-mallow, each containing an average of about 1,400 individuals, was the conservation goal of the species (77 FR 56002).
- Lack of Hybridization: Each population needs to be composed of a sufficient number of healthy, genetically "pure" *H. dasycalyx* individuals and devoid of other congeners. The purity status of the populations varies from the most "pure" being the population known as Lovelady found along Hwy 230 on The Land Conservancy site in Houston County, to the most hybridized being the SH ROW 204 along Mud Creek in Cherokee County.
- Pollinators: Rose-mallow needs pollinators to exchange its genetic material, limiting inbreeding depression. A sufficient number of healthy rose-mallow plants at each site will support native bees (Miller 2016a).
- Precipitation: The Pineywoods ecoregion is the wettest area of the state, with an average annual rainfall ranging from 32-60 in (81-152 cm) (Texas A&M Forest Service 2017, Diggs *et al.* 2006). Lufkin, Texas receives an average of 49 in (125 cm) of rain each year (U.S. Climate Data 2018). The populations need consistent rainfall to maintain current hydrologic characteristics at each site, thus allowing for seed dispersal between populations. However, we do not know how much rain is needed for growth or seed dispersal.

Requirements of the Species:

The viability of the species should be assessed in terms of its resiliency, redundancy, and representation.

Distribution, Abundance, and Trends: The natural geographic range is within Trinity, Houston, Harrison, and Cherokee counties, Texas, on SH ROWs, as well as private and Federal lands. To date, there are 8 natural, extant sites within the species' geographic range with planned introductions on Federal and private property (Table 1; see section regarding Introductions). Most of the sites were visited as recently as 2016 or 2017. The species has also been introduced on Federal, private, and county property, both within and outside of the species natural geographic range. Sites in Harrison County, Champion, and Camp Olympia have not been observed in the last 20-30 years. The Service considers these three sites extant as they still contain the physical and biological features essential to the rose-mallow. Details about the population status can be found in Table 1.

Table 1. The extant populations within the geographic range of the Neches River rose-mallow.

Site	County	Land Ownership	First Date Observed	Last Date Observed	Population status
Highway 94 ROW/Boggy Slough	Trinity	State	1955	August 2016	Plants were collected in 2014 by Banta and students as part of ongoing genetics work. In August 2015, 2 plants were observed in right-of-way (ROW); 6-7 additional plant sites found on the property. The Critical Habitat (CH) unit is being choked out by vegetation (B. Kartye, A. Miller, J. Reid). In 2016, large survey efforts on private land and ROW found numerous plants. Plants were identified in the CH unit, however, none were found along the tree line as in the past.
Harrison County***	Harrison	Private	1980?	(2016)	The Sabine Mining Company (SMC) using best location information describing CH unit 2 of Final Listing Rule to conduct 3 years of surveys for the site for presence/absence of plant. One of those sites, the South Hallsville No. 1 Mine, Permit 33H in Harrison and Rusk counties, was most recently visited by the Service, Railroad Commission of Texas, SMC in 2016. This site was originally designated as critical habitat in 2013 as CH unit 2 (77 FR 56004). The 2016 survey was conducted to facilitate the Permit 33H renewal process. The SMC committed to completing 3 survey events of the renewal areas, specifically in areas of suitable habitat. SMC identified 4 areas of suitable habitat, however rose-mallow plants have not been located during the 2014 or 2016 survey effort. An additional survey is underway to compile a total of 3 survey events (Blackland Environmental 2017).

Lovelady	Houston	Private	1991	June 22, 2017	As of April 2016, site was inundated with water. A survey was conducted in July 2016 where there were 6 large polygons mapped and plants counted; all part of one large population. Herbivory was noted on some plants. Samples were also collected by University of Texas (UT) - Tyler as part of ongoing genetics research. Site was visited in June 2017 by Service, Texas Parks and Wildlife Department (TPWD), The Land Conservancy (TLC), and Mercer Arboretum and Botanic Gardens (Mercer) to survey population and discuss site as potential reintroduction efforts (see reintroduction section for more detail).
Highway 204 ROW/Mud Creek	Cherokee	State	1992	July 2016	Aerial spraying by contractors along ROW damaged 3-4 plants in 2013. Site visited by TxDOT and Service biologists in July 2016. Evidence of hybridization present. Samples were also collected from this site in April 2016 by UT-Tyler as part of ongoing genetics research.
Davy Crockett NF, Compartment 55	Houston	Federal	2000	2016	Found by USFS biologists in 2000. Sites relocated in 2002 and 2005. Monitored since. Large survey effort in 2011 by Service, TPWD, U. S. Forest Service (USFS) – found plants. Drought occurred in 2011, but plants still seemed healthy despite climate conditions and herbivory. Heavy rains in 2015 made site inaccessible for survey counts. Site inundated with water. Concerns with herbicide by an adjacent landowner (P. Loos). Site visited in June/July 2017; plants in flower but stunted. In July 2017, USFS treated Chinese tallow; post-treatment monitoring has not been conducted (T. Philipps, pers. comm. 2017).
Davy Crockett NF, Compartment 11 (introduced	Houston	Federal	2004	2016	Introduced in 2004. Surveyed in 2006, 2010, and 2011. Surveyed most

site)					recently by Peter Loos, USFS, and Service in 2016. Plants were not observed; site may be extirpated due to failure of dam, resulting in alteration of the hydrology and increased sedimentation at site. Other species, including loblolly pine, have invaded the rose-mallow habitat, resulting in out-shading.
Davy Crockett NF, Compartment 20 (introduced site)	Houston	Federal	2000	2016	Introduced in 2000. Surveyed in 2002, 2006, 2010, and 2011. Surveyed most recently by Peter Loos, USFS, and Service in 2016. Plants seemed healthy, with obvious signs of reproduction.
Davy Crockett NF, Compartment 16 (introduced site)	Houston	Federal	2000	2016	Introduced in 2000. Surveyed in 2002, 2003, 2006, 2010, and 2011. Surveyed most recently by Peter Loos, USFS, and Service in 2016. Plants were present, but some impacted by herbivory.
Champion***	Trinity	Private	1996	2001	Hundreds of plants in 1997; about 300-400 plants in 2001. The site has not been located or re-verified since 2001.
Mill Creek Gardens (introduced site)	Nacogdoches	Private	1995	July 6, 2017	In coordination with the landowner, we accessed the site in July 2016 and July 2017. In 2016, the site had hundreds of plants within the spillway or wet, depressional area. Vegetation in the spillway was thick and full of water due to heavy rains. Observed 1-2 plants that didn't look like pure rose-mallow (Miller 2016b). In 2017, the site was also very wet, but there were many flowering plants. Some plants had herbivory damage, but most were in good condition. We only noticed a few plants that looked like potential hybrids. Site might need maintenance work in future.
Camp Olympia***	Trinity	Private	1977	1992	This site was designated as CH unit 9 in 2011 since it had the physical and biological features essential to rose-mallow. However, site has not been observed since 1992. TPWD is undertaking work near the Camp

					<p>Olympia site on Lake Livingston, as part of a Reservoir Fish Habitat Partnership grant. These plantings are part of a fisheries enhancement project. Through the Section 7 consultation process, the Service requested that TPWD survey all shoreline within and adjacent to the planting area, as records indicate an occurrence for rose-mallow from 1992. TPWD surveyed areas along the bank in 2015 and 2016. All surveys were completed jointly by TPWD and Trinity River Authority biologists during the June to August blooming period. Several <i>Hibiscus</i> species were observed, but they were not identified as rose-mallow nor to the species level.</p>
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***Sites that have not been observed in 20-30 years but are considered extant.

Information regarding INTRODUCED populations:

The Collins Academy, in Jefferson, Marion County, Texas (private)

The Service learned of this introduction in September 2014 (L. Gray, pers. comm., 2014). Rose-mallow was planted at the Port Jefferson History and Nature Center in 2013. The plant source for this introduction was from Black Mountains Garden Nursery (G. Endsley, pers. comm. 2014). The status of this reintroduction is unknown.

Winston 8 Ranch, Nacogdoches County, Texas (private)

This site is located in Nacogdoches County on private land. The Service's Partners for Fish and Wildlife (PFW) program initiated this introduction in 2014 with about 200 plants. PFW biologists visited the site in 2016 and 2017 (J. Reid, pers. comm. 2017). Individual plants were not counted. In 2016, plants were flowering. In 2017, several plants were 5-6 feet tall and flowering.

Frank Morris Park in Lufkin, Angelina County (City of Lufkin)

This site was originally found in 2014 along one section of the pond's perimeter by the Service's PFW biologist. An observation by U.S. Forest Service (USFS) biologist in June 2016 found that plants had migrated from their original location along the edge of the pond, to large clumps of individual plants in front of the ponds covered observation deck. The total area covers between 2-3 acres (T. Philipps, pers. comm. 2016b). In 2016, water levels in the pond were high, decreasing accessibility to survey plants. In 2016, between 100 and 250 plants were estimated at the site (A. Miller, pers. comm. 2016c). Plants were in flower and appeared healthy. No herbivore or insect predation was noted. Areas where plants are located are in full sun. Most mature plants were about 4 feet tall. The site is undergoing successful reproduction as other plants were of varying age classes (heights) (T. Philipps, pers. comm. 2016b). Chinese tallow trees were observed on the west side of the pond. The Service and partners should coordinate with the City of Lufkin to manage the site. The site was visited on July 7, 2016, by the Service, U.S. Forest Service (USFS), and Peter Loos. A total of 270 plants were observed (Miller 2016).

East Texas Plant Materials Center (U.S. Department of Agriculture (USDA), Natural Resource Conservation Service (NRCS) – federal)

Plants were propagated from seeds collected from the SH 204/Mud Creek population in Cherokee County in 2015. Seeds were grown out and plants were placed in a wetland pond at the PMC. Shadow (2018) reported that plants were stable and the population did not appear to have any hybrids (A. Shadow, pers. comm. 2018).

Keith-Weiss Park, Harris County, Texas (City of Houston)

The Service became aware of this site in July 20, 2017 from a botanist at Mercer Arboretum and Nature Center (Mercer). The original plant material was propagated from root cuttings provided by a private citizen. The SFA Gardens in Nacogdoches, Texas, housed the plants. According to the Harris County Flood Control District contact who first notified Mercer about this planting, there were no other Hibiscus species present at this site (A. Tiller, pers. comm. 2017). The Service was unaware of this planting and was not asked to participate in the planning process.

Demonstration Garden, in Center, Texas, Shelby County (state ROW)

Rose-mallow was planted along the edge of a small cypress swamp on Farm-to-Market Road (FM) 1545 in Shelby County. Most seeds were ripe by the end of July. Plants were staked out as an avoidance measure. Mowing during the fall after seeds are ripe and have dispersed is preferred (G. Grant, pers. comm. 2016). The source for this population is unknown. The current status of plants at this site is also unknown.

Douglass, Texas – along Highway 21, Nacogdoches County (private)

The U. S. Army Corps of Engineers' (USACE) records indicate that more than 1/3 acres of wetlands were impacted without a permit to construct a parking lot and recreation area at the Old Spanish Trail Restaurant on Highway 21 in Douglass, Texas. To mitigate the impacts, the applicant offered to restore 2.21 acres on-site and additional acres off-site. The site was planted in 2001 with several tree species however, only two survived. As part of this planting effort, Dr. David Creech of SFA planted about 100 rose-mallow plants along the riparian edge. Prior to planting, Dr. Creech assured the USACE the site was clear of other *Hibiscus* species, thus it would not threaten any pure *H. dasycalyx* plants introduced to the site (USACE 1999, pp. 78-80). The landowners have not been contacted since 2011. However in June 2016, the site was healthy, with many flowers in bloom (D. Creech, pers. comm. 2016).

Gayle Mize Garden, Stephen F. Austin State University, Nacogdoches County (public)

This demonstration garden was planted in 2012, with stock plants from the Hibiscus Preserve (Lovely) in Houston County. These plants are isolated, with no other *Hibiscus* present. Several plants were lost from incidental spray of glyphosate, but SFA has resolved the issue. A second colony of rose-mallow is growing at the north end of the Pineywoods Native Plant Center, in a rainwater catchment basin. A third population was planted at the Pineywoods Native Plant Center marsh by the horticultural facility; this area is burned annually (D. Creech, pers. comm. 2018).

Aspects of the species' biology and/or ecology affecting recovery potential:

Hybridization: The genus *Hibiscus* naturally hybridizes in the nursery trade. The *Hibiscus* species at several rose-mallow sites contain individuals that may be products of crosses between the rose-mallow and two congeners, the *H. laevis* or *H. moscheutos*. Hybridization has been noted at the Cherokee County site (Banta 2017, Miller 2016). Previous genetic studies conducted by Mendoza (2004) and Warnock (1995) did not specifically investigate hybridization. The University of Texas – Tyler (UT-Tyler) published research identifying the relatedness between rose-mallow and its congeners (Banta 2017, Norrell 2017). Their research suggests that *H. dasycalyx* and *H. laevis* are more closely related than *H. dasycalyx* and *H. moscheutos*. Banta (2017) found that *H. dasycalyx* is a separate taxon, but that hybridization with *H. laevis* is occurring, presenting a pervasive threat. Ecological niche modeling found that rose-mallow is predicted to generally be closer to the banks of waterways than its congeners. It is found in very flat, broad, frequently-flooded areas with highly erodible alluvial deposits (Banta 2017). Given this data, the Service does not question the validity of the species, and accepts that the rose-mallow is a genetically and ecologically distinct species.

Propagation Potential: Both the scientific and horticultural communities have collected plants, as well as seeds of rose-mallow from wild populations. We have no evidence that suggests these

collections have depleted the seed bank or adversely affected plants. Hibiscuses, including the rose-mallow, are plants that are easily cultivated and are well established in the nursery trade, thereby reducing collection pressure. This ease of propagation can assist with future recovery efforts, where augmentation of existing populations might be needed. However, augmentations should be planned in discussion with the Service to meet the species' specific Propagation and Reintroduction Plan (as guided by the Service's 2000 Controlled Propagation and Reintroduction rule).

THREATS ASSESSMENT

Habitat Encroachment and Modification: The principle threats affecting the rose-mallow throughout its geographic range include habitat loss/modification through the encroachment of nonnative and native plants species. Chinese tallow (*Triadica sebifera*) is the prominent invasive nonnative that is encroaching on all natural rose-mallow populations, as seen during surveys conducted in July 2016. Some natural sites were more invaded than others, but all contained some level of Chinese tallow. Additionally, some natural sites have coastal Bermuda grass (*Cynodon dactylon*) (Hwy 94/Boggy Slough), trifoliolate orange (*Citrus trifoliata*), *Brunichia ovata*, Green ash (*Fraxinus pennsylvanica*), and sweetgum (*Liquidambar styraciflua*). Biological information about these invasive species can be found in the Final Rule (78 FR 56058-56059). These invasives can be controlled through mechanical or chemical treatment.

Hydrologic Changes: Rose-mallow habitat includes both intermittent and perennial wetlands occurring along oxbows, sloughs, terraces, sand bars, and other low-lying areas with minimal standing water. Despite its name, the rose-mallow is not found in deeper waters, but is adapted to variable flow rates. The species likely needs high precipitation and flowing water to disperse seed (Warnock 1995, Scott 1997, Reeves 2008). As rose-mallow is innately tied to the hydrology of a site, both dewatering and water inundation could impact the species. More detail on this threat can be found in the Final Rule (78 FR 56059-56060).

Development and/or construction projects: Currently, a permit was filed with the U.S. Army Corps of Engineers in the fall 2000 to construct the Lake Columbia Reservoir project, located in Cherokee County. The permit process is still ongoing, and construction has not begun. Since rose-mallow is a wetland species, thriving in certain habitats and water levels, construction of this reservoir could impact sites downstream.

Between 2017 and the year 2070, the population of the East Texas region is projected to increase by 35% (Texas Water Development Board 2017). This includes a 45% change in water demand, and 114% change in annual water needs. To meet this rising demand, it is anticipated that an additional 86 water management projects will be developed by 2070. These projects could include, but are not limited to: reservoirs, dams, water capturing projects, and desalination facilities.

Road Construction Projects: The following road construction work is occurring in ROW areas where rose-mallow is known to occur (J. Adams, pers. comm., 2018):

- **Farm to Market (FM) 230** – The work currently on FM 230 is a resurfacing roadway project. No widening, culvert work, etc. The existing pavement width will receive a new

surface. Texas Department of Transportation (TxDOT) finished the construction of the Tantabogue Creek bridge near the rose-mallow site in Houston County in 2007. TxDOT is not aware of any additional projects in this area.

- **SH 204** – Work would include a road widening project, spanning from Jacksonville to SH 110 in Cherokee County. The project is known as a “super 2”, as it would add passing lanes at various locations within the limits of the project. TxDOT will not be doing any widening within the limits of the rose-mallow critical habitat on SH 204. The critical habitat shapefile has been given to the designers and they know to stay out of that area. The project is currently unfunded and will likely be developed as a “shelf project” (J. Tullos, pers. comm. 2018). At a later date, a “shelf project” could be revisited and implemented with existing funds.
- **SH 94** – TxDOT is currently texturizing the existing shoulders of SH 94 and is planning on updating the existing guardrails to meet current design standards. The project is slated to begin in 2021.

Herbicide Application: Rose-mallow is susceptible to both direct and indirect effects from herbicide application. Refer to the Final Rule for more information (78 FR 56061).

Climate Change: Refer to the Final Rule for more information (78 FR 56062).

CONSERVATION ASSESSMENT

Conservation Mechanisms (Habitat Conservation Plans, Candidate Conservation Agreements (CCA), Candidate Conservation Agreements with Assurances (CCAA), Biological Opinions, Permits, and Management Plans)

Historically, the Service entered 2 Candidate Conservation Agreements: Champion International in 1998 and Temple-Inland Forest Products in 2002. These have expired, the species are no longer candidates thus, a CCA or CCAA is not appropriate.

Populations found along Highway ROWs currently operate under a revised 1988 MOU that governs management actions targeting conservation of listed species on key habitats on SH ROWs that may potentially affect natural resources within facilities owned or managed by TPWD. No current roadway development projects are currently being reviewed under the MOU.

Four populations (3 of which are introduced) are found on federal land owned and managed by the Forest Service on Davy Crockett National Forest. Section 7 of the Act states that Federal agencies ensure that activities they fund, authorize, or carry out are not likely to jeopardize the continued existence of the species or destroy or adversely modify its critical habitat. The Service is not engaged with the USFS on any consultations.

There are no management plans or BOs in place for the rose-mallow.

There have been several requests for Section 10(a)(1)(A) permits to survey and collect plant material.

In accordance with policy (65 FR 56916-56922), the Service is drafting a Controlled Propagation and Reintroduction Plan for the rose-mallow. This will guide both introduction and reintroduction efforts that can assist in recovering the species. The Service anticipates a Final Plan will be completed this spring 2018.

Recovery-related Research:

Genetics

The University of Texas (UT) – Tyler published research identifying the relatedness between rose-mallow and its congeners (Banta 2017, Norrell 2017). Their research suggests that *H. dasycalyx* and *H. laevis* are more closely related than *H. dasycalyx* and *H. moscheutos*. Banta (2017) found that *H. dasycalyx* is a separate taxon but that hybridization with *H. laevis* is occurring and is a pervasive threat. Ecological niche modeling found that rose-mallow is predicted to generally be closer to the banks of waterways than its congeners, and is found in very flat, broad, and frequently-flooded areas with highly erodible alluvial deposits (Banta 2017). Given this data, the Service does not question the validity of the species and resigns that the rose-mallow is a genetically and ecologically distinct species.

Germination

Germination studies have been investigated on rose-mallow. Dan Jones with TPWD collected seeds from 10 pods from 10 mother plants at the Lovelady site on November 15, 2013. Five of the pods produced seeds that germinated, producing 33 plants. These results showed a 49% germination rate (A. Tiller, pers. comm. 2018). Additionally, Edwin Umanzor, a student from UT, tested seeds collected from the Lovelady site on August 8 and 29, 2014. Seeds produced plants which are housed at Mercer. Both plants produced during Jones' and Umanzors' collections will be used for augmentation, as needed.

Status of a population viability assessment (PVA), Population and Habitat Viability Assessment (PHVA), and/or minimum viable population (MVP) to inform recovery: At a minimum, a MVP should be developed to inform future recovery needs and necessary actions, but no PVA, PHVA, or MVP has been developed for the rose-mallow.

Current Protective Measures for Key Populations and their Habitat: The Lovelady site (Houston County) is owned and managed by the Texas Land Conservancy (TLC). The site includes 30 acres purchased specifically for the conservation of rose-mallow in 2004. Although plants are found entirely on private lands and not afforded protection under the ESA, the TLC has initiated several conservation efforts to improve the habitat. TLC allows access to groups, including the Service, to conduct surveys. Collectively, TLC, Mercer, TPWD, and the Service are working to manage the habitat, both mechanically and chemically, to control invasive species and reduce competition from native woodies. Working collectively to improve site conditions, this group will be introducing 2-year old plants (from the original Lovelady stock) back onto the site in spring 2018. Placement of cattle-exclusion fencing is a lower priority action on this site, as funds are not available at this time to purchase and construct it.

The 4 populations on the Davy Crockett National Forest are protected by Federal regulations under the ESA.

The T.L.L. Temple Foundation purchased more than 19,000 acres of hardwood forest and wetlands in East Texas (Boggy Slough) from International Paper and agreed to donate a conservation easement over the entire property to the Conservation Fund.

There is an existing MOU between TPWD and the Service regarding management actions along ROWs for rose-mallow populations.

Management Measures for the Species, and their effectiveness:

Seedbanking Efforts

Plant cultivation (seed and plant material) and protection are vitally important to successful restoration efforts. Mercer cultivates endangered native species, including rose-mallow, for restoration purposes only, with yields used strictly for seed-banking or restoration-related research for the species. Seed and/or plants are not released for private/commercial sale, trade, or swap, and can be used in augmentations. Additionally, seed collections follow strict guidelines, as per the above references, such that no more than 10% of seed is collected at sustainable intervals from a given population. To serve as a backup seed source, banked seeds are shared with the Lady Bird Johnson Wildflower Center (LBJWC), USDA National Center for Genetic Resource Preservation (NCGRP), and/or the USDA bank.

Stephen F. Austin State University (SFASU) has also propagated plants for reintroduction and introduction efforts. Three sites are found on SFASU ground, while others are located off site. SFASU collaborates with landowners and works with the Service to continue monitoring sites, as needed.

Surveys for wild seed collection

To genetically diversify the seedbank, Mercer also periodically conducts seed collection through surveys for species, including rose-mallow, occurring within and outside the Houston metro area. These surveys are conducted with Service, TPWD, U.S. Army Corps of Engineers personnel and/or sometimes autonomously with permission from private landowners. Collected seeds are invaluable resources by: providing seed banking or seed stocks of sites potentially affected by stochastic events; safeguarding the genetic diversity of a site; and, providing seeds for future reintroduction efforts or management needs. To protect these scarce vital resources, Mercer uses backup generators to protect frozen and refrigerated seed banks.

Data Collection and Decimation

As a Harris County facility in Texas, Mercer provides information about native plant conservation and is a participating institution of the Center for Plant Conservation (CPC), a national program headquartered at the Missouri Botanical Garden. CPC profiles are updated periodically, thus profile information may not reflect current ranges or research. Images of all the species discussed by this working group, as well as links to the CPC website profiles, are provided within Mercer's website (www.hcp4.net/Community/Parks/Mercer/Conservation). Anita Tiller, Mercer's botanist, has provided much of the information on rose-mallow within this section.

Table 2: Current and Future Management Needs per site.

Site	County	Management Actions Completed or Ongoing	Management Actions Still needed
Highway 94 ROW/Boggy Slough	Trinity	<ol style="list-style-type: none"> 1) Surveys were conducted in August 2016 on Temple Foundation and Temple family land. Prior to surveys, Brent Karyte and crew cleaned, marked, and identified new rose-mallows prior to the surveys (M. Hafernik, pers. comm. 2016). 2) The Service’s Partners for Fish and Wildlife (PFW) Program proposes to use FY 2016 funds provided to Caddo Lake Institute under Cooperative Agreement F16AC00492 to provide cost-assistance to a private landowner for approximately 583 acres of Chinese tallow control on private land. The site is on the Boggy Slough Conservation Area (BSCA). Work included both chemical and mechanical treatments. No rose-mallow was known to occur within the 583-acre project area. Surveys were conducted in June-October 2017 to determine their presence; rose-mallow plants were not observed during the survey. The surveys were conducted when individual Chinese tallow trees are being sprayed throughout the project area. All individuals spraying were trained on how to identify the rose-mallow. Spraying of rose-mallow should not occur. Therefore, this project is not likely to adversely affect the rose-mallow (see Consultation No 02ETTX00-2017-I-0496). 3) The Service’s PFW project (Consultation no. 02ETTX00-2016-I-1134) aimed at controlling Chinese tallow on the BSCA. The goal of the project was to restore red-cockaded woodpecker habitat in uplands. 4) Texas Department of Transportation (TxDOT) conducts chemical treatments as needed, when woody vegetation is too dense along any part of the right-of-way. This could include areas where rose-mallow exists. Most spraying is accomplished by using trucks. 	Hwy 94 is being choked out, therefore the site needs to be cleared (T. Philipps pers. comm.).
Harrison County	Harrison	Unknown	
Lovelady	Houston	The site was cleared by hand and by brush cutter to remove a few large trees. About ¼ of the area where rose-mallow is located was cleared (site was wet and very thick) (S. Ramirez, pers. comm.2018).	If the site dries out enough this winter, it would be good to mow the portion where the hibiscus stands are located. Competing woody species that resprout can then be treated during the coming growing season. A tractor or skid steer with an auger will be useful for planting holes. Also, maybe creating additional microtopography with a backhoe or skid steer to match the elevation of current clumps (D. Jones, pers. comm. 2018)

Hwy 204/Mud Creek	Cherokee	TxDOT undergoes chemical treatments as needed, when woody vegetation is too dense along any part of ROW. This could include areas where rose-mallows exist. Most spraying is accomplished by trucks. The site is not mowed, as it is designated as “No Mow” zone within the limits of the rose-mallow critical habitat (J. Tullos, pers. comm. 2018).	Site is getting swamped out by the 2 closely related Hibiscus species and needs hand clearing to remove obvious hybrids. Plans for Service to coordinate with TxDOT to conduct this work along ROW this summer during flowering.
Davy Crockett NF, Compartment 55	Houston		Chinese tallow was observed in all locations in 2011. Due to heavy rains, flooding, and road damage on the Davy Crockett NF in 2015, none of the sites were accessible despite Loos’ efforts to monitor the known locations (T. Philipps, pers. comm. 2016c). As it stands, Chinese tallow, feral hogs, and vegetative competition are the biggest threats. Rose-mallow sites are not typically managed, as they are all in riparian areas. USFS might treat the Chinese tallow in those sites next year (T. Philipps, pers. comm. 2015). These are wet flatwood “ponds” that tend to serve as a magnet for wildlife species looking for water, thus exposing the plants to intense browsing pressure. Most of these areas have been impacted by numerous invasive species, especially feral hogs and Chinese tallow. In some areas, obvious hybrids have been observed, indicating genetic swamping. Parasitic plants, like American dodder vine, have also been observed in relation to this species. Chinese tallow and woody species (<i>Brunnchia ovata</i>) need to be eradicated if on-site (T. Philipps, pers. comm. 2016c).

<p>Davy Crockett NF, Compartment 11**</p>	<p>Houston</p>		<p>The experimental population in Compartment 11 appears to be extirpated due to the failure of a dam, and the subsequent results of altered hydrology, as well as an increase in sedimentation. This has resulted in the encroachment of loblolly pine and other species which have apparently shaded out rose-mallow from the site. Thus, no individuals were documented (T. Philipps, pers. comm. 2016c). These are wet flatwood “ponds” that tend to serve as a magnet for wildlife species looking for water, thus exposing the plants to intense browsing pressure. Most of these areas have been impacted by numerous invasive species, especially feral hogs and Chinese tallow. In some areas, obvious hybrids have been observed, indicating genetic swamping. Parasitic plants, like American dodder vine, have also been observed in relation to this species. Chinese tallow and woody species (<i>Brunnchia ovata</i>), need to be eradicated if on-site (T. Philipps, pers. comm. 2016c).</p>
<p>Davy Crockett NF, Compartment 20**</p>	<p>Houston</p>		<p>Plants at the Compartment 20 site seemed healthy and thriving with obvious signs of reproduction (T. Philipps, pers. comm. 2016c). These are wet flatwood “ponds” that tend to serve as a magnet for wildlife species looking for water, thus exposing the plants to intense browsing pressure. Most of these areas have been impacted by numerous invasive species, especially feral hogs and Chinese tallow. In some areas, obvious hybrids have been observed, indicating genetic swamping. Parasitic plants, like American dodder vine, have also been observed in relation to this species. Chinese tallow and woody species (<i>Brunnchia ovata</i>), need to be eradicated if on-site (T. Philipps, pers. comm. 2016c).</p>

Davy Crockett NF, Compartment 16**	Houston		Plants at the Compartment 16 site were present, but most were impacted by herbivory. These are wet flatwood “ponds” that tend to serve as a magnet for wildlife species looking for water, thus exposing the plants to intense browsing pressure. Most of these areas have been impacted by numerous invasive species, especially feral hogs and Chinese tallow. In some areas, obvious hybrids have been observed, indicating genetic swamping. Parasitic plants, like American dodder vine, have also been observed in relation to this species. Chinese tallow and woody species (<i>Brunnchia ovata</i>), need to be eradicated if on-site (T. Philipps, pers. comm. 2016c).
Champion	Trinity	Unknown	
Mill Creek Gardens**	Nacogdoches	None.	When site was visited in August 2017, noted that the planting site was starting to get choked out from weedy species. The site was very wet from heavy rain events, therefore we recommended potential mowing when/if dry enough (A. Miller, pers. comm. 2017). Recent freeze events in winter of 2017-2018 might have killed off some of this vegetation; site should be re-evaluated.
Camp Olympia	Trinity	Unknown	

MONITORING NEEDED

Monitoring of extant rose-mallow populations can track recovery and management needs and help plan for future funding opportunities. By monitoring rose-mallow at the known populations, the Service can:

- Track the known threats at each population, specifically the primary threat of habitat alteration and modification from nonnative and native invasive species. These survey efforts will ensure that the Service, PFW program, and partners can plan accordingly for future management to leverage future funding opportunities. Survey frequency should be established on a case-by-case basis.
- Monitor the encroachment of the more common Hibiscus species (*H. moscheutos* and *H. laevis*). Some sites are more threatened by genetic swamping (like the Hwy 204/Mud Creek site), but this should be reviewed during each site visit.
- Inventory sites to track population and individual species counts. This information can be used to delineate the recovery targets in a recovery plan.

The Service should also survey habitat identified through niche modeling efforts (Banta 2017), as to provide areas of expansion for the rose-mallow.

SUMMARY STATEMENT OF RECOVERY NEEDS

- Survey sites that have not been visited in over 20-30 years and determine if they contain the physical and biological features of habitat.
- Engage landowners to conduct conservation and stewardship on their property.
- Using current niche models to identify other areas of potential habitat for rose-mallow and plan to conduct surveys at those sites. Niche models can also be used in future scenarios where climate change might alter the species current range (i.e. range expansion).
- Consider introductions and reintroductions that would further the representation and resiliency of the rose-mallow across its range, but that are also in-line with the species' propagation and reintroduction plan.
- Communicate with partners, academics, nurseries, and plant communities about proper introduction procedures and encourage collaboration with the Service.
- Continue to monitor existing populations for threats.
- Conduct key biological studies to better understand the species reproductive needs (i.e. longevity, seed dispersal, age structure). This information can inform the recovery targets and needs in a recovery plan.
- Develop a species Recovery Plan in FY2020.

PRELIMINARY RECOVERY STRATEGY

Recovery Priority Number: 8

A Recovery Priority Number of 8 indicates the species has a moderate degree of threat, a high potential for recovery, and that it is a subspecies. The rose-mallow's final listing determination was the most comprehensive status review of the species to date. The principal threats affecting the rose-mallow include habitat loss and modification through the encroachment of nonnative

plants species; hydrologic changes; and, construction and development projects. Additionally, disturbance and management strategies have increased the encroachment of native woody species into rose-mallow habitat. These significant threats coupled with a restricted species' range (of which at least half of the properties are on private land) and potential hybridization with other hibiscus congeners (*H. leavis* and *H. moscheutos*), constitutes a high level of threat to the ecosystem throughout the East Texas Pineywoods ecoregion. The three populations that exist along the state highway right-of-ways (SH ROWs) operate under a revised 1988 Memorandum of Understanding (MOU) that governs management actions targeting conservation of listed species and key habitats on SH ROWs. These threats are moderated given that 7 sites are found on private or federal lands that are undergoing ongoing management and/or are bound by Endangered Species Act regulations. The rose-mallow is successfully propagated from cuttings and has benefited from planned transplants, thereby providing potential restoration opportunities. Based on this information, the Service has determined the current recovery priority number of 8 for the rose-mallow (48 FR 43104).

Recovery Vision Statement – Ensure that the rose-mallow shows resiliency, redundancy, and representation across its range in East Texas.

This Vision can be accomplished by engaging with key partners (Federal, State, local, academics, land owners, and land managers) to conduct sound science on the species needs' and habitat; to conserve, protect, and acquire land for conservation now and into the future.

PREPLANNING DECISIONS

Recovery Plan Preparation: The Service plans to complete the recovery plan by end of FY 2020. In support of developing the status review, we will conduct a Species Status Assessment (SSA) for the rose-mallow. The SSA will use the best available scientific information to evaluate the species' needs and threats it faces. The SSA will also be the biological basis for the Service's recovery plan.

Recovery Plan Coordinator and Preparer: Amber Miller
Lead Field Office (FO) for the Recovery Plan: Texas Coastal Ecological Services FO, Houston

Appointment of Recovery Team: At this time, it is unlikely that a regionally-approved recovery team will be appointed to work on the rose-mallow recovery plan. The Service will engage key partners and the public during the SSA process.

Key implementers of recovery actions:

Federal: Service, PFW program, National Wildlife Refuges; USFS, USDA-NRCS

State: TPWD, TxDOT (could engage the Texas Comptroller's Office)

Private: land owners, land managers, The Conservation Fund, the Texas Land Conservancy, academia and universities (UT-Tyler, SFASU, UT-Austin), nurseries and private gardens, CPC

City and County: Harris County botanic gardens (Mercer), Harris County Flood Control District, other flood control districts, River authorities

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