DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[FWS–R2–ES–2019–0061; FF09E21000 FXES11110900000 212]

RIN 1018–BD16

Endangered and Threatened Wildlife and Plants; Endangered Species Status With Critical Habitat for Guadalupe Fatmucket, Texas Fatmucket, Guadalupe Orb, Texas Pimpleback, and False Spike, and Threatened Species Status With Section 4(d) Rule and Critical Habitat for Texas Fawnsfoot

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Proposed rule.

SUMMARY: We, the U.S. Fish and Wildlife Service (Service or USFWS), propose to list six Central Texas mussel species: The Guadalupe fatmucket (*Lampsilis bergmanni*), Texas fatmucket (*Lampsilis bracteata*), Texas fawnsfoot (*Truncilla macrodon*), Guadalupe orb (*Cyclonaias necki*), Texas pimpleback (*Cyclonaias* (=*Quadrula*) *petrina*), and false spike (*Fusconaia* (=*Quincuncina*) *mitchelli*) as endangered or threatened under the Endangered Species Act of 1973, as amended (Act). After review of the best available scientific and commercial information, we find that listing Guadalupe fatmucket, Texas fatmucket, Guadalupe orb, Texas pimpleback, and false spike as endangered species is warranted, and listing Texas fawnsfoot as a threatened species is warranted. We propose a rule issued under section 4(d) of the Act (''4(d) rule'') for the Texas fawnsfoot. If we finalize this rule as proposed, it would add these species to the List of Endangered and Threatened Wildlife and extend the Act's protections to the species. We also propose to designate critical habitat for all six species under the Act. In total, approximately 1,944 river miles (3,129 river kilometers) in Texas fall within the boundaries of the proposed critical habitat designations. We also announce the availability of a draft economic analysis (DEA) of the proposed designation of critical habitat. We also are notifying the public that we have scheduled two informational meetings followed by public hearings on the proposed rule.

DATES:

Comment submission: We will accept comments received or postmarked on or before October 25, 2021. Comments submitted electronically using the Federal eRulemaking Portal (see **ADDRESSES**, below) must be received by 11:59 p.m. Eastern Time on the closing date.

Public informational meeting and public hearing: We will hold public informational sessions from 5:00 p.m. to 6:00 p.m., Central Time, followed by public hearings from 6:30 p.m. to 8:30 p.m., Central Time, on September 14, 2021, and September 16, 2021.

ADDRESSES: You may submit comments by one of the following methods:

(1) *Electronically:* Go to the Federal eRulemaking Portal: *http://www.regulations.gov.* In the Search box, enter FWS–R2–ES–2019–0061, which is the docket number for this rulemaking. Then, in the Search panel on the left side of the screen, under the Document Type heading, check the Proposed Rules box to locate this document. You may submit a comment by clicking on ''Comment Now!''

(2) *By hard copy:* Submit by U.S. mail to: Public Comments Processing, Attn: FWS–R2–ES–2019–0061, U.S. Fish and Wildlife Service, MS: JAO/1N, 5275 Leesburg Pike, Falls Church, VA 22041–3803.

We request that you send comments only by the methods described above. We will post all comments on *http://www.regulations.gov.* This generally means that we will post any personal information you provide us (see Information Requested, below, for more information).

Public informational meetings and public hearings: The public informational meetings and the public hearings will be held virtually using the Zoom platform. See Public Hearing, below, for more information.

Availability of supporting materials: For the critical habitat designation, the coordinates or plot points or both from which the maps are generated are included in the decision file and are available at *https://www.fws.gov/southwest/es/AustinTexas/ESA_Sp_Mussels.html* and at *http://www.regulations.gov* under Docket No. FWS–R2–ES–2019–0061. Any additional tools or supporting information that we may develop for the critical habitat designation will also be available at the Service website set out above, and may also be included in the preamble and/or at *http://www.regulations.gov.*

FOR FURTHER INFORMATION CONTACT: Adam Zerrenner, Field Supervisor, U.S. Fish and Wildlife Service, Austin Ecological Services Field Office, 10711 Burnet Rd., Suite 200, Austin, TX 78758; telephone (512) 490–0057. Persons who use a telecommunications device for the deaf (TDD) may call the Federal Relay Service at 800–877–8339.

SUPPLEMENTARY INFORMATION:

Executive Summary

Why we need to publish a rule. Under the Act, if we determine that a species may be an endangered or threatened species throughout all or a significant portion of its range, we are required to promptly publish a proposal in the **Federal Register** and make a determination on our proposal within 1 year. To the maximum extent prudent and determinable, we must designate critical habitat for any species that we determine to be an endangered or threatened species under the Act. Listing a species as an endangered or threatened species and designation of critical habitat can only be completed by issuing a rule.

What this document does. This document proposes the Guadalupe fatmucket (*Lampsilis bergmanni*), Texas fatmucket (*Lampsilis bracteata*), Guadalupe orb (*Cyclonaias necki*), Texas pimpleback (*Cyclonaias* (=*Quadrula*) *petrina*), and false spike (*Fusconaia* (=*Quincuncina*) *mitchelli*) as endangered species and Texas fawnsfoot (*Truncilla macrodon*) as a threatened species. This document also proposes the designation of critical habitat for all six species, as well as a 4(d) rule providing protective regulations for the Texas fawnsfoot.

The basis for our action. Under the Act, we may determine that a species is an endangered or threatened species based on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. We have determined habitat loss through changes in water quality and quantity, as well as increased fine sediments (Factor A), are the primary threats to these species.

Under the Act, for any species that is determined to be threatened, we must provide protective regulations to provide for the conservation of that species. For the Texas fawnsfoot, we are proposing to prohibit take and possession.

Section 4(a)(3) of the Act requires the Secretary of the Interior (Secretary) to designate critical habitat concurrent with listing to the maximum extent prudent and determinable. Section 4(b)(2) of the Act states that the Secretary must make the designation on the basis of the best scientific data available and after taking into consideration the economic impact, the impact on national security, and any other relevant impacts of specifying any particular area as critical habitat. Section 3(5)(A) of the Act defines critical habitat as (i) the specific areas within the geographical area occupied by the species, at the time it is listed, on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protections; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed, upon a determination by the Secretary that such areas are essential for the conservation of the species.

Supporting analyses. We prepared an analysis of the economic impacts of the proposed critical habitat designations and hereby announce the availability of the draft economic analysis for public review and comment.

Our species status assessment report (SSA report) documents the results of the comprehensive biological status review for the central Texas mussels and provides an account of the species' overall viability through forecasting of the species' condition in the future (Service 2019a, entire). Additionally, the SSA report contains our analysis of required habitat and the existing conditions of that habitat.

Peer review. In accordance with our joint policy on peer review published in the **Federal Register** on July 1, 1994 (59 FR 34270), and our August 22, 2016, memorandum updating and clarifying the role of peer review of listing actions under the Act, we sought the expert opinions of eight appropriate specialists regarding the species status assessment report. We received responses from six specialists, which informed this proposed rule. The purpose of peer review is to ensure that our listing determinations, critical habitat designations, and 4(d) rules are based on scientifically sound data, assumptions, and analyses. The peer reviewers have expertise in the biology, habitat, and threats to the species.

We sought comments from independent specialists on the SSA report to ensure that our proposal is based on scientifically sound data and analyses. We received feedback from six scientists with expertise in freshwater mussel biology, ecology, genetics, climate science, and hydrology as peer review of the SSA report. The reviewers were generally supportive of our approach and made suggestions and comments that strengthened our analysis. The SSA report and other materials relating to this proposal can be found at *http://www.regulations.gov* under Docket No. FWS–R2–ES–2019–0061.

Because we will consider all comments and information received during the comment period, our final determinations may differ from this proposal. Based on the new information we receive (and any comments on that new information), we may conclude that any of these species are threatened instead of endangered, or endangered instead of threatened, or we may conclude that any of these species do not warrant listing as either an endangered species or a threatened species. Such final decisions would be a logical outgrowth of this proposal, as long as we: (a) Base the decisions on the best scientific and commercial data available after considering all of the relevant factors; (2) do not rely on factors Congress has not intended us to consider; and (3) articulate a rational connection between the facts found and the conclusions made, including why we changed our conclusion.

Information Requested

We intend that any final action resulting from this proposed rule will be based on the best scientific and commercial data available and be as accurate and as effective as possible. Therefore, we request comments or information from other concerned governmental agencies, Native American tribes, the scientific community, industry, or any other interested parties concerning this proposed rule. We particularly seek comments concerning:

(1) The species' biology, range, and population trends, including:

(a) Biological or ecological requirements of these species, including habitat requirements for feeding, breeding, and sheltering;

(b) Genetics, genomics, systematics, and taxonomy;

(c) Historical and current range, including distribution patterns;

(d) Historical and current population levels, abundance, and current and projected trends; and

(e) Past and ongoing conservation measures for these species, their habitats, or both.

(2) Factors that may affect the continued existence of the species, which may include habitat modification or destruction, overutilization, disease, predation, the inadequacy of existing regulatory mechanisms, or other natural or manmade factors.

(3) Biological, commercial trade, or other relevant data concerning any threats (or lack thereof) to these species and existing regulations that may be addressing those threats.

(4) Additional information concerning the historical and current status, range, distribution, and population size of these species, including the locations of any additional populations of the Central Texas mussels.

(5) Information on regulations that are necessary and advisable to provide for the conservation of the Texas fawnsfoot and that the Service can consider in developing a 4(d) rule for the species. In particular, information concerning the extent to which we should include any of the section 9 prohibitions in the 4(d) rule or whether any other forms of take should be excepted from the prohibitions in the 4(d) rule.

(6) The reasons why we should or should not designate habitat as "critical habitat" under section 4 of the Act, including information to inform the following factors such that a designation of critical habitat may be determined to be not prudent:

(a) The species is threatened by taking or other human activity and identification of critical habitat can be expected to increase the degree of such threat to the species;

(b) The present or threatened destruction, modification, or curtailment of a species' habitat or range is not a threat to the species, or threats to the species' habitat stem solely from causes that cannot be addressed through management actions resulting from consultations under section 7(a)(2) of the Act;

(c) Areas within the jurisdiction of the United States provide no more than negligible conservation value, if any, for a species occurring primarily outside the jurisdiction of the United States;

(d) No areas meet the definition of critical habitat.

(7) Specific information on:

(a) The amount and distribution of habitat for all six Central Texas mussels;

(b) What areas, that were occupied at the time of listing and that contain the physical or biological features essential to the conservation of the species, should be included in the designation and why;

(c) Any additional areas occurring within the range of the species, *i.e.,* Anderson, Austin, Bastrop, Bell, Blanco, Brazoria, Brazos, Brown, Burleson, Caldwell, Coleman, Colorado, Comal, Concho, Dallas, DeWitt, Edwards, Ellis, Falls, Fayette, Fort Bend, Freestone, Gillespie, Gonzales, Grimes, Guadalupe, Hays, Henderson, Houston, Kaufman, Kerr, Kendall, Kimble, Lampasas, Leon, Llano, Madison, Mason, Matagorda, McCulloch, McLennan, Menard, Milam, Mills, Navarro, Palo Pinto, Parker, Robertson, Runnels, San Saba, Shackelford, Stephens, Sutton, Tom Green, Travis, Throckmorton, Waller, Washington, Victoria, Wharton, and Williamson Counties, Texas, that should be included in the designation because they (1) are occupied at the time of listing and contain the physical or biological features that are essential to the conservation of the species and that may require special management considerations, or (2) are unoccupied at the time of listing and are essential for the conservation of the species;

(d) Special management considerations or protection that may be needed in critical habitat areas we are proposing, including managing for the potential effects of climate change; and

(e) What areas not occupied at the time of listing are essential for the conservation of the species. We particularly seek comments:

(i) Regarding whether occupied areas are inadequate for the conservation of the species;

(ii) Providing specific information that supports the determination that unoccupied areas will, with reasonable certainty, contribute to the conservation of the species and contain at least one physical or biological feature essential to the conservation of the species; and

(iii) Explaining whether or not unoccupied areas fall within the definition of ''habitat'' at 50 CFR 424.02 and why.

(8) Land use designations and current or planned activities in the subject areas and their possible impacts on proposed critical habitat.

(9) Any probable economic, national security, or other relevant impacts of designating any area that may be included in the final designation, and the related benefits of including or excluding specific areas.

(10) Information on the extent to which the description of probable economic impacts in the draft economic analysis is a reasonable estimate of the likely economic impacts and any additional information regarding probable economic impacts that we should consider.

(11) Whether any specific areas we are proposing for critical habitat designation should be considered for exclusion under section 4(b)(2) of the Act, and whether the benefits of potentially excluding any specific area outweigh the benefits of including that area under section 4(b)(2) of the Act. If you think we should exclude any additional areas, please provide credible information regarding the existence of a meaningful economic or other relevant impact supporting a benefit of exclusion.

(12) Whether we could improve or modify our approach to designating critical habitat in any way to provide for greater public participation and understanding, or to better accommodate public concerns and comments.

Please include sufficient information with your submission (such as scientific journal articles or other publications) to allow us to verify any scientific or commercial information you include.

Please note that submissions merely stating support for, or opposition to, the action under consideration without providing supporting information, although noted, will not be considered in making a determination, as section 4(b)(1)(A) of the Act directs that determinations as to whether any species is an endangered or a threatened species must be made ''solely on the basis of the best scientific and commercial data available.''

You may submit your comments and materials concerning this proposed rule by one of the methods listed in **ADDRESSES**. We request that you send comments only by the methods described in **ADDRESSES**.

If you submit information via *http://www.regulations.gov,* your entire submission—including any personal identifying information—will be posted on the website. If your submission is made via a hardcopy that includes personal identifying information, you may request at the top of your document that we withhold this information from public review. However, we cannot guarantee that we will be able to do so. We will post all hardcopy submissions on *http://www.regulations.gov.*

Comments and materials we receive, as well as supporting documentation we used in preparing this proposed rule, will be available for public inspection on *http://www.regulations.gov.*

Public Hearing

We have scheduled two public informational meetings and public hearings on this proposed rule to list the Central Texas mussels as endangered or threatened species with critical habitat. We will hold the public informational meetings and public hearings on the date and at the times listed above under *Public informational meeting and public hearing* in **DATES**. We are holding the public informational meetings and public hearings via the Zoom online video platform and via teleconference so that participants can attend remotely. For security purposes, registration is required. To listen and view the meeting and hearing via Zoom, listen to the meeting and hearing by telephone, or provide oral public comments at the public hearing by Zoom or telephone, you must register. For information on how to register, or if you encounter problems joining Zoom the day of the meeting, visit *https://www.fws.gov/southwest/.* Registrants will receive the Zoom link and the telephone number for the public informational meetings and public hearings. If applicable, interested members of the public not familiar with the Zoom platform should view the Zoom video tutorials *(https://support.zoom.us/hc/en-us/articles/206618765-Zoom-video-tutorials*) prior to the public informational meetings and public hearings.

The public hearings will provide interested parties an opportunity to present verbal testimony (formal, oral comments) regarding this proposed rule. While the public informational meetings will be opportunities for dialogue with the Service, the public hearings are not: They are a forum for accepting formal verbal testimony. In the event there is a large attendance, the time allotted for oral statements may be limited. Therefore, anyone wishing to make an oral statement at the public hearing for the record is encouraged to provide a prepared written copy of their statement to us through the Federal eRulemaking Portal, or U.S. mail (see **ADDRESSES**, above). There are no limits on the length of written comments submitted to us. Anyone wishing to make an oral statement at the public hearings must register before the hearing (*https://www.fws.gov/southwest/*). The use of a virtual public hearing is consistent with our regulations at 50 CFR 424.16(c)(3).

Previous Federal Actions

Table 1, below, summarizes the petition history and proposed status of the Central Texas mussels under the Endangered Species Act. On June 25, 2007, we received a formal petition dated June 18, 2007, from Forest Guardians (now WildEarth Guardians), for 475 species in the southwestern United States. The petitioned group of species included the Texas fatmucket.

On October 15, 2008, we received a petition dated October 9, 2008, from WildEarth Guardians, requesting that the Service list as threatened or endangered and designate critical habitat for six species of freshwater mussels, including the Texas pimpleback, Texas fawnsfoot, and false spike.

On December 15, 2009, we published our 90-day finding that the above petitions presented substantial scientific information indicating that listing the Texas fatmucket, Texas pimpleback, Texas fawnsfoot, and false spike may be warranted (74 FR 66260). As a result of the finding, we initiated status reviews for these four species. On October 6, 2011, we published a 12-month finding for five Texas mussels, including the Texas fatmucket, Texas fawnsfoot, and Texas pimpleback, that listing was warranted but precluded by higher priority actions, and these species were added to the candidate list (76 FR 62166). Candidates are those fish, wildlife, and plants for which we have on file sufficient information on biological vulnerability and threats to support preparation of a listing proposal, but for which development of a listing rule is precluded by other higher priority listing activities. The Texas fatmucket, Texas fawnsfoot, and Texas pimpleback were included in all of our subsequent annual Candidate Notices of Review (77 FR 69993, November 21, 2012; 78 FR 70104, November 22, 2013; 79 FR 72450, December 5, 2014; 80 FR 80584, December 24, 2015; 81 FR 87246, December 2, 2016; and 84 FR 54732, October 10, 2019).

The distribution of the newly described Guadalupe orb was previously fully contained within the distribution of the Texas pimpleback. Genetic information received in 2018 (Burlakova *et al.* 2018, entire) confirmed that the Guadalupe orb is a separate species distinct from the Texas pimpleback, and the Guadalupe orb is now a newly described species. Similarly, the Guadalupe fatmucket was split from the Texas fatmucket in 2018 (Inoue *et al.* 2018, entire) and described in 2019 (Inoue *et al.* 2019, in press). As both species were part of the original petitioned entities, we evaluated both of these new species as well as the four original species in our SSA, and all six species are included in this proposed rule.

This document constitutes our concurrent 12-month warranted petition finding for the false spike and proposed listing rule and proposed critical habitat rule for all six Central Texas mussel species.

TABLE 1—LIST OF THE PETITION FINDINGS FOR THE SIX CENTRAL TEXAS MUSSELS

Scientific name	Common name	River basins	Petition received date	90-day finding date	12-month finding date
Lampsilis bergmanni	Guadalupe fatmucket	Guadalupe	Previously included in Texas fatmucket.		
Lampsilis bracteata	Texas fatmucket	Colorado	June 25, 2007	December 15, 2009	October 6, 2011.
Truncilla macrodon	Texas fawnsfoot	Trinity, Brazos, Colorado.	October 15, 2008	December 15, 2009	October 6, 2011.
Cyclonaias necki	Guadalupe orb	Guadalupe	Previously included in Texas pimpleback.		
Cyclonaias petrina	Texas pimpleback	Colorado	October 15, 2008	December 15, 2009	October 6, 2011.
Fusconaia mitchelli	False spike	Brazos, Colorado, Guadalupe.	October 15, 2008	December 15, 2009	This finding.

I. Proposed Listing Determination

Background

General Mussel Biology

Freshwater mussels, including the six Central Texas mussels, have a complex life history involving parasitic larvae, called glochidia, which are wholly dependent on host fish. As freshwater mussels are generally sessile (immobile), dispersal is accomplished primarily through the behavior of host fish and their tendencies to travel upstream and against the current in rivers and streams. Mussels are broadcast spawners; males release sperm into the water column, which is taken in by the female through the incurrent siphon (the tubular structure used to draw water into the body of the mussel). The developing larvae remain with the female until they mature and are ready for release as glochidia, to attach on the gills, head, or fins of fishes (Vaughn and Taylor 1999, p. 913; Barnhart *et al.* 2008, pp. 371–373).

Glochidia die if they fail to find a host fish, attach to the wrong species of host fish, attach to a fish that has developed immunity from prior infestations, or attach to the wrong location on a host fish (Neves 1991, p. 254; Bogan 1993, p. 599). Successful glochidia encyst (enclose in a cyst-like structure) on the host's tissue, draw nutrients from the fish, and develop into juvenile mussels (Arey 1932, pp. 214–215). The glochidia will remain encysted for about a month through a transformation to the juvenile stage. Once transformed, the juveniles will excyst from the fish and drop to the substrate.

Freshwater mussel species vary in both onset and duration of spawning, how long developing larvae are held in the marsupial gill chambers (gills used for holding eggs and glochidia), and which fish species serve as hosts. The mechanisms employed by mussel species to increase the likelihood of interaction between host fish and glochidia vary by species.

Mussels are generally immobile; their primary opportunity for dispersal and movement within the stream comes when glochidia attach to a mobile host fish (Smith 1985, p. 105). Upon release from the host, newly transformed juveniles drop to the substrate on the bottom of the stream. Those juveniles that drop in unsuitable substrates die because their immobility prevents them from relocating to more favorable habitat. Juvenile freshwater mussels burrow into interstitial substrates and grow to a larger size that is less susceptible to predation and displacement from high flow events (Yeager *et al.* 1994, p. 220). Adult mussels typically remain within the same general location where they dropped off (excysted) from their host fish as juveniles.

Host specificity can vary across mussel species, which may have specialized or generalized relationships with one or more taxa of fish. Mussels have evolved a wide variety of adaptations to facilitate transmission of glochidia to host fish including: Display/mantle lures mimicking fish or invertebrates; packages of glochidia (conglutinates) that mimic worms, insect larvae, larval fish, or fish eggs; and release of glochidia in mucous webs that entangle fish (Strayer *et al.* 2004, p. 431). Polymorphism (existence of multiple forms) of mantle lures and conglutinates frequently exists within mussel populations (Barnhart *et al.* 2008, p. 383), representing important adaptive capacity in terms of genetic diversity and ecological representation.

Guadalupe Fatmucket

The Guadalupe fatmucket (*Lampsilis bergmanni*) was recently discovered to be a separate and distinct species from Texas fatmucket (*L. bracteata;* Inoue *et al.* 2018, pp. 5–6; Inoue *et al.* 2019, in press), and the Service now recognizes the Guadalupe fatmucket as a new species that occurs only in the Guadalupe River basin. Because the Guadalupe fatmucket has recently been split from Texas fatmucket, the species are very similar, and better information is not yet available, we believe the Guadalupe fatmucket has similar habitat needs (headwater habitats in gravel or bedrock fissures) and host fish (sunfishes) as the Texas fatmucket.

The Guadalupe fatmucket is a small to medium-sized freshwater mussel (to 4 inches (in) (100 millimeters (mm))) that exhibits sexual dimorphism and has a yellow-green-tan shell, and is similar in appearance to the Texas fatmucket (a more detailed description of the Texas fatmucket is found in Howells *et al.* 2011, pp. 14–16). Related species in the genus *Lampsilis* from the southeast United States reach a maximum age of 13–25 years (Haag and Rypel 2010, pp. 4–6).

Guadalupe fatmucket is currently found in one population, which occurs in 54 miles (87 km) of the Guadalupe River basin in Kerr and Kendall Counties, Texas (Randklev *et al.* 2017, p. 4) (table 2; figure 1). For more information on this population, see the SSA report.

TABLE 2—CURRENT GUADALUPE FATMUCKET POPULATION

Population	Streams included	Counties	Occupied reach length (mi (km))	Recent collection years (numbers)
Guadalupe River	Guadalupe River; North Fork, Guadalupe River; Johnson Creek.	Kerr and Kendall Co., TX	54 (87)	2018 (22), 2019 (shells).

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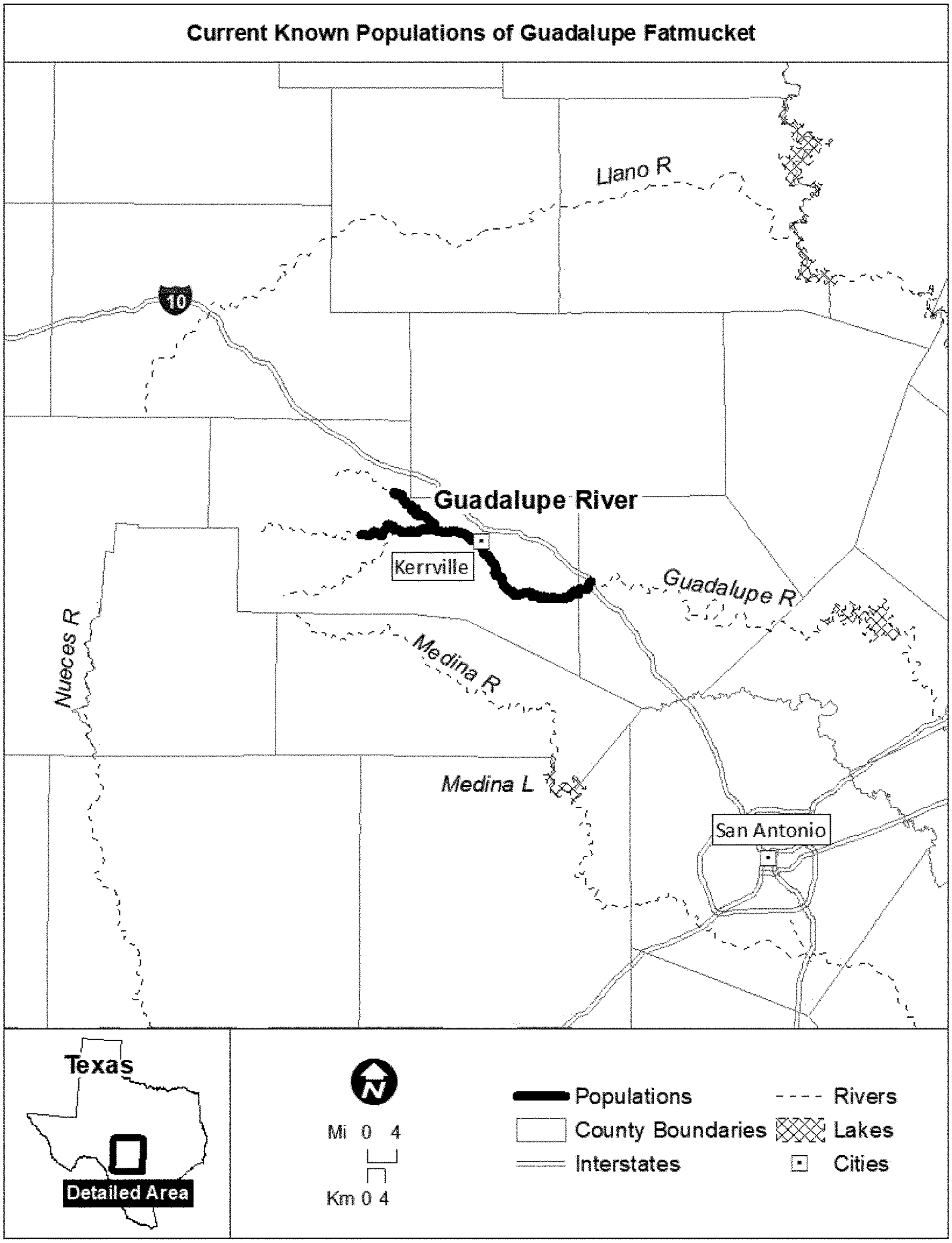

Figure 1. Map showing location of known Guadalupe fatmucket population.

Texas Fatmucket

A thorough review of the taxonomy, life history, and ecology of the Texas fatmucket is presented in the SSA report. Texas fatmucket has been characterized as a rare Texas endemic (Burlakova *et al.* 2011a, p. 158) and was originally described as the species *Unio bracteatus* by A.A. Gould in 1855 (p. 228) from the ''Llanos River'' in ''Upper'' Texas. The species is currently recognized as *Lampsilis bracteata* (Williams *et al.* 2017, pp. 35, 39). Recently, individuals that had been known as Texas fatmucket in the Guadalupe River basin were found to be a new species (Inoue *et al.* 2019, in press); therefore, the Texas fatmucket occurs only in the Colorado River basin.

The Texas fatmucket is a small to medium-sized freshwater mussel (to 4 in (100 mm)) that exhibits sexual dimorphism (males and females have different shapes) and has a yellow-green-tan shell (Howells *et al.* 2011, pp. 14–16). For a detailed morphological description see Howells *et al.* 1996 (p. 61) and Howells 2014 (p. 41).

Host fishes for Texas fatmucket are members of the Family Centrarchidae (sunfishes) including bluegill (*Lepomis macrochirus*), green sunfish (*L. cyanellus*), Guadalupe bass (*Micropterus treculii*), and largemouth bass (*M. salmoides*) (Howells 1997, p. 257; Johnson *et al.* 2012, p. 148; Howells 2014, p. 41; Ford and Oliver 2015, p. 4; Bonner *et al.* 2018, p. 9).

Related species can expel conglutinates (packets of glochidia) and are known to use mantle lures (Barnhart *et al.* 2008, pp. 377, 380) to attract sight-feeding fishes that attack and rupture the marsupium where the glochidia are held, thereby becoming infested by glochidia. These species are long-term brooders (bradytictic), spawning and becoming gravid in the fall and releasing glochidia in the spring (Barnhart *et al.* 2008, p. 384).

Related species in the genus *Lampsilis* from the southeast United States reach a maximum age of 13–25 years (Haag and Rypel 2010; pp. 4–6). Texas fatmucket occur in firm mud, stable sand, and gravel bottoms, in shallow waters, sometimes in bedrock fissures or among roots of bald cypress (*Taxodium distichum*) and other aquatic vegetation (Howells 2014, p. 41). The species typically occurs in free-flowing rivers but can survive in backwater areas, such as in areas upstream of lowhead dams (*e.g.* Llano Park Lake (BioWest, Inc., 2018, pp. 2–3)).

Texas fatmucket currently occur only in the upper reaches of major tributaries within the Colorado River basin (Randklev *et al.* 2017, p. 4) in five populations: Lower Elm Creek, upper/middle San Saba River, Llano River, Pedernales River, and lower Onion Creek (table 3; figure 2). Isolated individuals not considered part of larger functioning populations have been found in Cherokee Creek, Bluff Creek, and the North Llano River. For more information on these populations, see the SSA report.

TABLE 3—CURRENT TEXAS FATMUCKET POPULATIONS

Population	Streams included	Counties	Occupied reach length (mi (km))	Recent collection years (number collected)
Lower Elm Creek	Elm Creek	Runnels Co., TX	12.5 (20)	* 2005 2008 (1) 2019 (1)
Upper/Middle San Saba River	San Saba River	Menard, Mason, San Saba, and McCulloch Co., TX.	62 (100)	2016 (29) 2017 (87) 2017 (71)
Llano River	Llano River, South Llano River.	Kimble, Mason, Llano Co., TX	127 (204)	2016 (72) 2017 (47) 2017 (5)
Pedernales River	Pedernales River, Live Oak Creek.	Gillespie, Hays, and Blanco Co., TX.	79 (127)	2017 (17)
Lower Onion Creek	Onion Creek	Travis Co., TX	5 (8)	2010 (3) 2018 (1)

* No live animals.

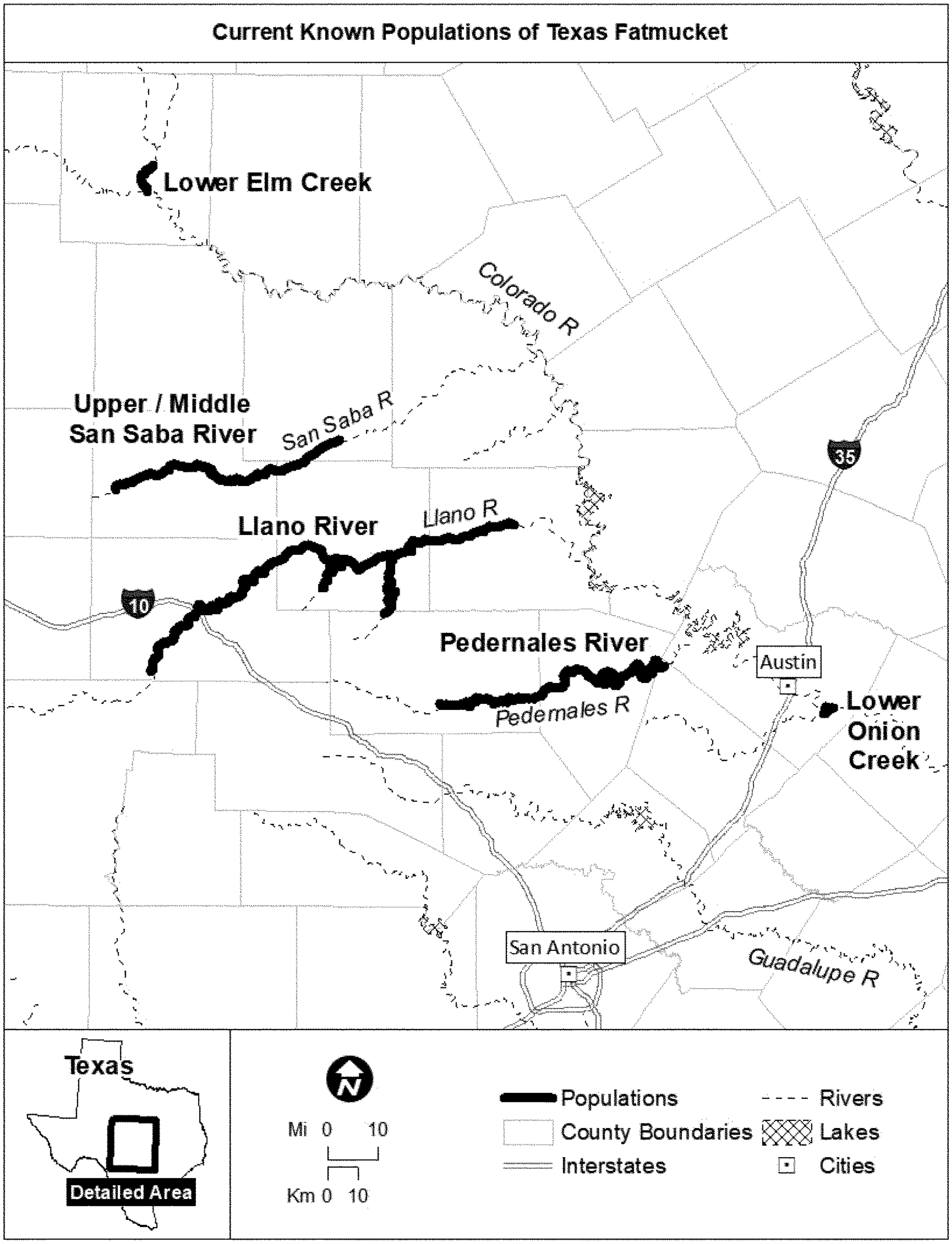

Figure 2. Map showing locations of known Texas fatmucket populations.

Texas Fawnsfoot

The Texas fawnsfoot was originally described as *Unio macrodon* 1859 from a location near Rutersville, Fayette County, Texas (Lea 1859, pp. 154–155). Texas fawnsfoot is recognized by the scientific community as *Truncilla macrodon* (Williams *et al.* 2017, pp. 35, 44).

Texas fawnsfoot is a small- to medium-sized (2.4 in (60 mm)) mussel with an elongate oval shell (Howells 2014, p. 111). For a detailed description, see Howells *et al.* 1996 (p. 143) and Howells 2014 (p. 111).

Host fish species are not confirmed for the Texas fawnsfoot, but we conclude they use freshwater drum (*Aplodinotus grunniens;* Howells 2014, p. 111), like other *Truncilla* species occurring in Texas and elsewhere (Ford and Oliver 2015, p. 8). Freshwater drum are molluscivorous (mollusk-eating) and become infested with glochidia when they consume gravid female mussels (Barnhart *et al.* 2008, p. 373). This strategy of host infestation may limit population size, as reproductively successful females are sacrificed (*i.e.,* eaten by freshwater drum). Related species are bradytictic, brooding larvae over the winter instead of releasing them immediately (Barnhart *et al.* 2008, p. 384). Other species in the genus *Truncilla* from the Southeast and Midwest reach a maximum age ranging from 8–18 years (Haag and Rypel 2010, pp. 4–6).

Texas fawnsfoot are found in medium- to large-sized streams and rivers with flowing waters and mud, sand, and gravel substrates (Howells 2014, p. 111). Adults are most often found in bank habitats and occasionally in backwater, riffle, and point bar habitats, with low to moderate velocities that appear to function as flow refuges during high flow events (Randklev *et al.* 2017c, p. 137).

Texas fawnsfoot occurs in the lower reaches of the Colorado and Brazos Rivers, and in the Trinity River (Randklev *et al.* 2017b, p. 4) in seven populations: East Fork Trinity River, Middle Trinity River, Clear Fork Brazos River, Upper Brazos River, Middle/Lower Brazos River, San Saba/Colorado Rivers, and Lower Colorado River (table 4; figure 3). Texas fawnsfoot was historically distributed throughout the Colorado and Brazos River basins (Howells 2014, pp. 111–112; and reviewed in Randklev *et al.* 2017c, pp. 136–137) and in the Trinity River basin (Randklev *et al.* 2017b, p. 11). Texas fawnsfoot historically occurred in, but is now absent from, the Leon River (Popejoy *et al.* 2016, p. 477). Randklev *et al.* (2017c, p. 135) surveyed the Llano, San Saba, and Pedernales Rivers and found neither live individuals nor dead shells of Texas fawnsfoot. Isolated individuals not considered part of functioning populations have been found in the Little River. For more information on Texas fawnsfoot populations, see the SSA report.

TABLE 4—CURRENT TEXAS FAWNSFOOT POPULATIONS

Population	Streams included	Counties	Occupied reach length (mi (km))	Recent collection years (numbers)
East Fork Trinity River	East Fork Trinity River	Kaufman Co., TX	12 (19)	2017 (40) 2018 (12)
Middle Trinity River	Trinity River	Navarro, Anderson, Leon, Houston, and Madison Co., TX.	140 (225)	2016—2017 (59)
Clear Fork Brazos River	Clear Fork Brazos River	Shackelford and Throckmorton Co., TX.	13 (21)	2010 (1) 2018 (0)
Upper Brazos River	Brazos River	Palo Pinto and Parker Co., TX	62 (100)	2017 (23)
Middle/Lower Brazos River	Brazos River	McLennan, Falls, Robertson, Milam, Brazos, Burleson, Grimes, Washington, Waller, Austin, and Fort Bend Co., TX.	346 (557)	2014 (188) 2017 (28)
San Saba/Colorado Rivers	San Saba River, Colorado River	San Saba and Mills Co., TX	43 (69)	2017 (0) 2018 (2)
Lower Colorado River	Colorado River	Colorado, Wharton, and Matagorda Co., TX.	109 (175)	2010 (52) 2015 (10) 2017 (9)

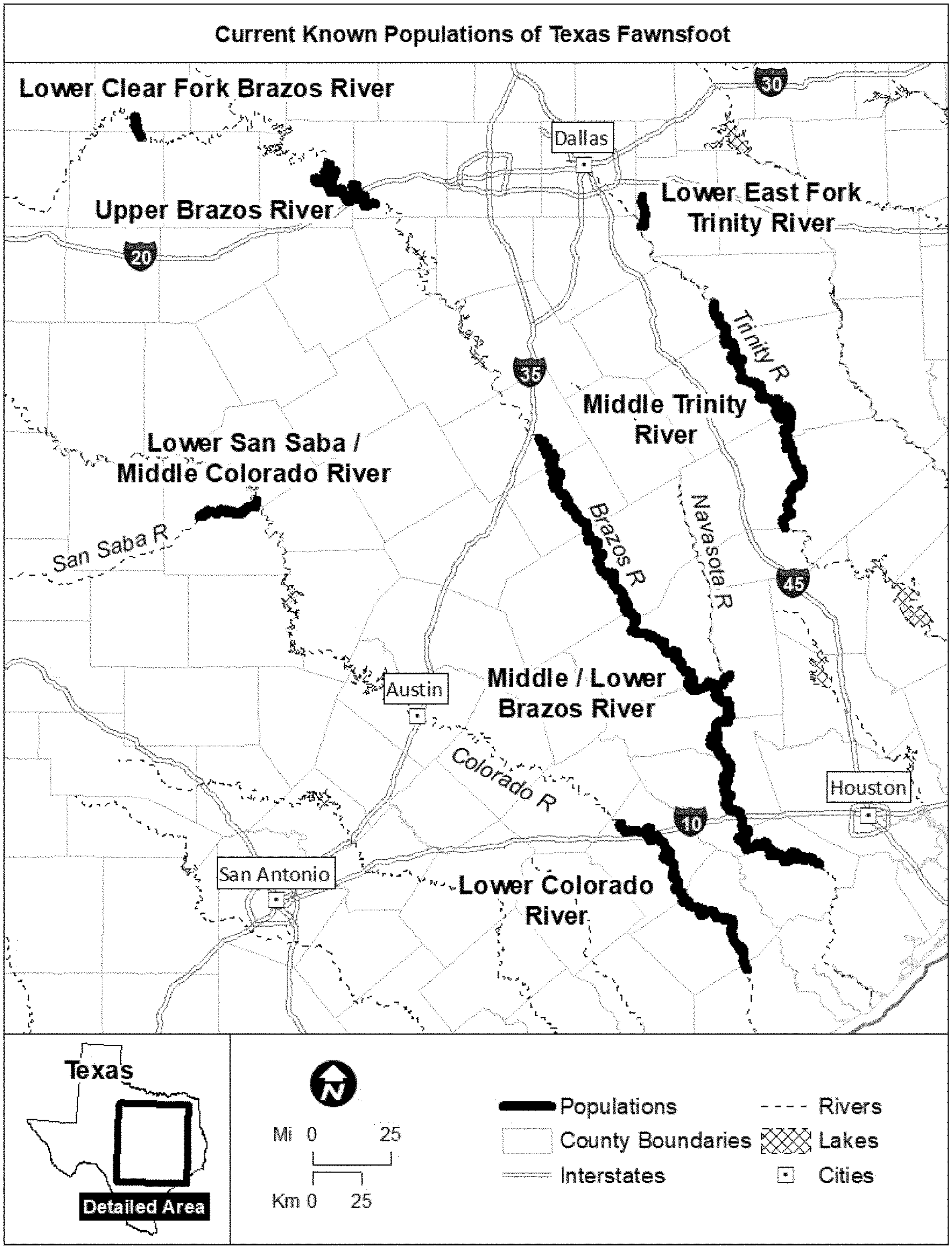

Figure 3. Map showing locations of known Texas fawnsfoot populations.

Guadalupe Orb

Burlakova *et al.* (2018, entire) recently described the Guadalupe orb (*Cyclonaias necki*) from the Guadalupe River basin as a separate species distinct from Texas pimpleback. The Guadalupe orb occurs only in the Guadalupe basin and is a small-sized mussel with a shell length that reaches up to 2.5 in (63 mm) (Burlakova *et al.* 2018, p. 48). Guadalupe orb shells are thinner and more compressed but otherwise morphologically similar to the closely related Texas pimpleback. The posterior ridge is more distinct and prominent, and the umbo is more compressed than in Texas pimpleback (Burlakova *et al.* 2018, p. 48). Individuals collected from the upper Guadalupe River (near Comfort, Texas) averaged 1.9 in (48 mm) (Bonner *et al.* 2018, p. 221). Channel catfish, flathead catfish, and tadpole madtom are host fish for the Guadalupe orb (Dudding *et al.* 2019, p. 15). Dudding *et al.* (2019, p. 16) cautioned that the apparent clumped distribution of Guadalupe orb (and closely related species) in ''strongholds'' could be related to observed ongoing declines in native catfishes, including the small and rare tadpole madtom, a riffle specialist. The best available information leads us to believe that reproduction, ecological interactions and habitat requirements of Guadalupe orb are similar to those of the closely related Texas pimpleback.

The Guadalupe orb occurs only in the Guadalupe River basin in two separate and isolated populations: The upper Guadalupe River and the lower Guadalupe River (table 5; figure 4). An isolated individual not considered part of a functioning population has been found in the Blanco River, a tributary to the San Marcos River (Johnson *et al.* 2018, p. 7). For more information on these populations, see the SSA report.

TABLE 5—CURRENT GUADALUPE ORB POPULATIONS

Population	Streams included	Counties	Occupied reach length (mi (km))	Recent collection years (numbers)
Upper Guadalupe River	Guadalupe River	Kerr, Kendall, and Comal Co., TX	95 (153)	2013 (1) 2017 (10) 2018 (2)
Lower Guadalupe River	Guadalupe River, San Marcos River.	Caldwell, Guadalupe, Gonzales, DeWitt, and Victoria Co., TX.	181 (291)	2014–2015 (893) 2017 (41)

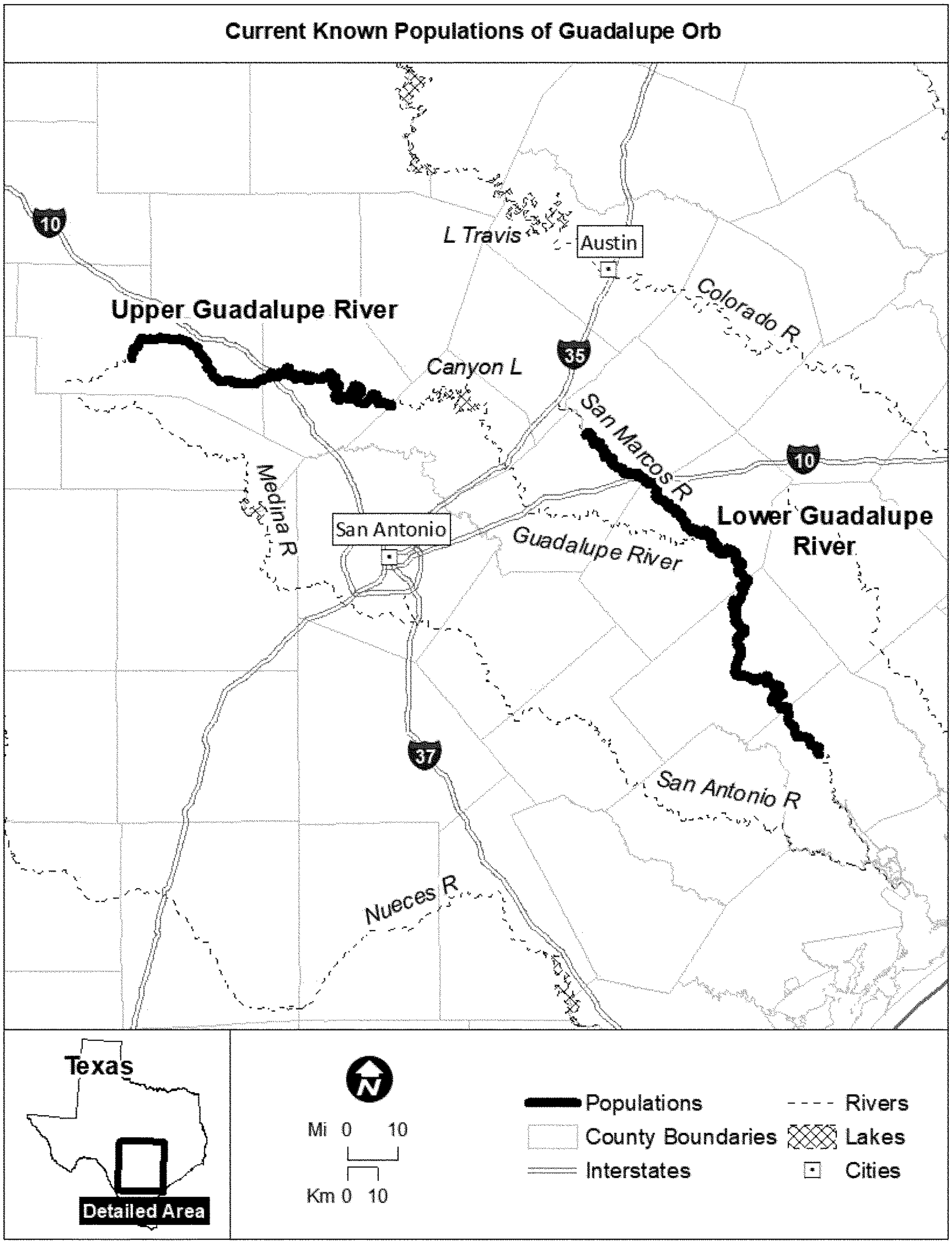

Figure 4. Map showing locations of known Guadalupe orb populations.

Texas Pimpleback

The Texas pimpleback was originally described as *Unio petrinus* from the ''Llanos River'' in ''Upper'' Texas (Gould 1855, p. 228). The species is now recognized as *Cyclonaias petrina* by the scientific community (Williams *et al.* 2017, pp. 35, 37). Burlakova *et al.* (2018, entire) recently described the Guadalupe orb (*C. necki*) from the Guadalupe River basin as a separate species distinct from Texas pimpleback. Texas pimpleback is now considered to occur only in the Colorado River basin of Texas. Texas pimpleback is a small- to medium-sized (up to 4 in (103 mm)) mussel with a moderately inflated, yellow, brown, or black shell, occasionally with vague green rays or concentric blotches (Howells 2014, p. 93).

Recent laboratory studies of the closely related Guadalupe orb suggest that channel catfish (*Ictalurus* *punctatus*), flathead catfish (*Pylodictus olivarus*) and tadpole madtom (*Noturus gyrinus*) are host fish for Texas pimpleback (Dudding *et al.* 2019, p. 2). Related species have miniature glochidia and use catfish as hosts (Barnhart *et al.* 2008, pp. 373, 379). Additionally, related species can also produce conglutinates (Barnhart *et al.* 2008, p. 376) and tend to exhibit short-term brooding (tachytictia; releasing glochidia soon after the larvae mature) (Barnhart *et al.* 2008, p. 384). Texas pimpleback are reproductively active between April and August (Randklev *et al.* 2017c, p. 110). Related species live as long as 15–72 years (Haag and Rypel 2010, p. 10).

Texas pimpleback occurs in the Colorado River basin in five isolated populations: Concho River, Upper San Saba River, Lower San Saba River/Colorado River, Llano River, and the Lower Colorado River (table 6; figure 5). Only the Lower San Saba and Llano River populations are known to be successfully reproducing. Texas pimpleback was historically distributed throughout the Colorado River basin (Howells 2014, pp. 93–94; reviewed in Randklev *et al.* 2017, pp. 109–110). For more information on Texas pimpleback populations, see the SSA report.

TABLE 6— CURRENT TEXAS PIMPLEBACK POPULATIONS

Population	Streams included	Counties	Occupied reach length (mi (km))	Recent collection years (numbers)
Concho River	Concho River	Concho Co., TX	14 (23)	2008 (47) 2012 (1)
Upper San Saba River	San Saba River	Menard Co., TX	30 (48)	2017 (1)
Lower San Saba/Colorado Rivers	San Saba River, Colorado River	San Saba, McCulloch, Mills, Brown, and Coleman Co., TX.	178 (286)	2012 (247) 2014 (481) 2017 (97) 2018 (42)
Llano River	Llano River	Mason Co., TX	5 (8)	2012 (10) 2016 (1) 2017 (23)
Lower Colorado River	Colorado River	Colorado and Wharton Co., TX	98 (158)	2014 (49) 2017 (8) 2018 (30)

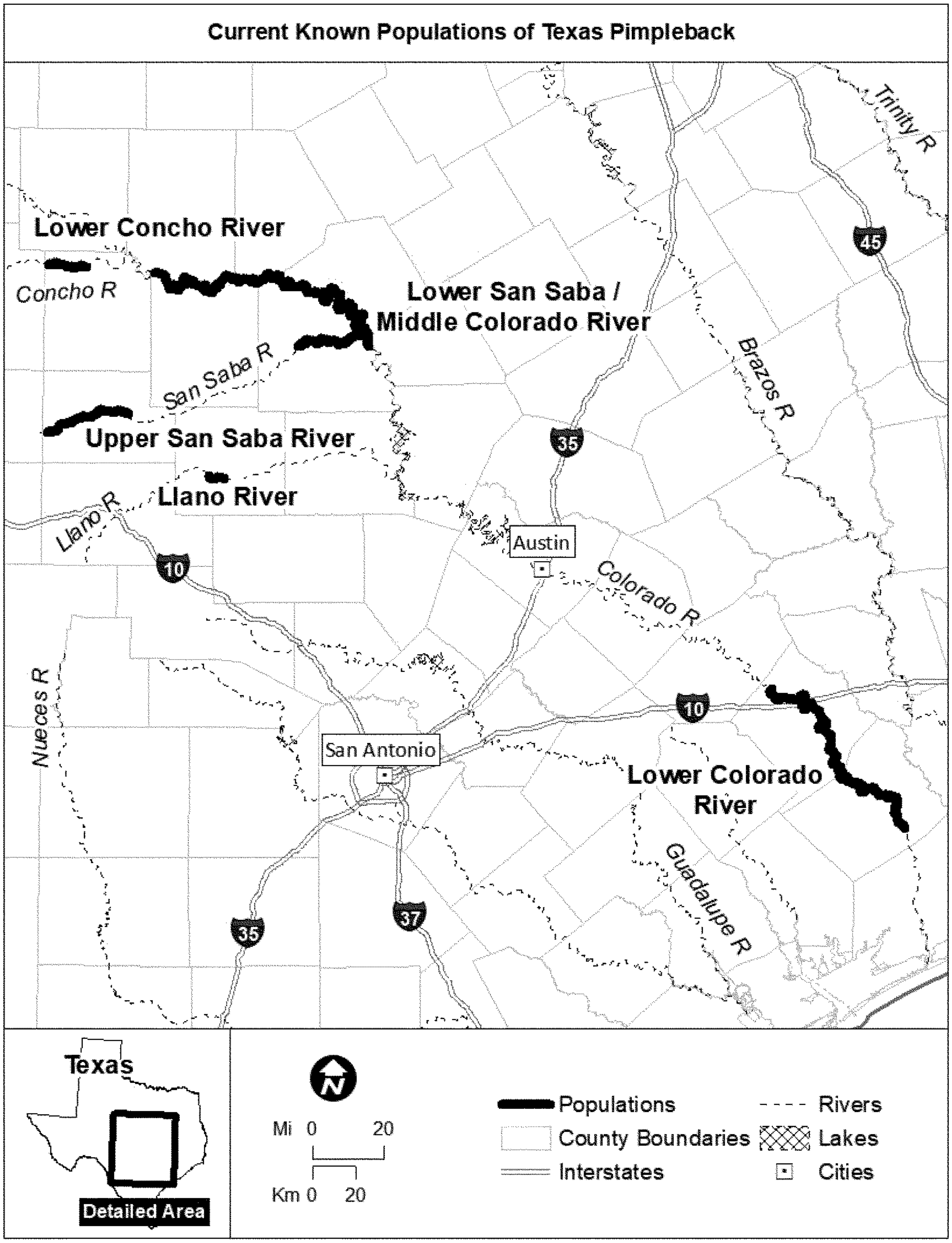

Figure 5. Map showing locations of known Texas pimpleback populations.

False Spike

The false spike is native to the Brazos, Colorado, and Guadalupe basins in central Texas (Howells 2010, p. 4; Randklev *et al.* 2017c, p. 12). It was thought to have historically occurred in the Rio Grande based on the presence of fossil and subfossil shells there (Howells 2010, p. 4), but those specimens have now been attributed to *Sphenonaias taumilapana* Conrad 1855 (no common name; Randklev *et al.* 2017c, p. 12; Graf and Cummings 2007, p. 309).

The false spike was originally described as *Unio mitchelli* by Charles T. Simpson in 1895 from the Guadalupe River in Victoria County, Texas (Dall 1896, pp. 5–6). The species has been assigned as *Quincuncina mitchelli* by Turgeon *et al.* (1988, p. 33) and was recognized as such by Howells *et al.* (1996, p. 127), and it was referenced as *Quadrula mitchelli* by Haag (2012, p.

71). Finally, it was recognized as *Fusconaia mitchelli,* its current nomenclature, by Pfeiffer *et al.* (2016, p. 289). False spike is considered a valid taxon by the scientific community (Williams *et al.* 2017, pp. 35, 39).

The false spike is a medium-sized freshwater mussel (to 5.2 in (132 mm)) with a yellow-green to brown or black elongate shell, sometimes with greenish rays. For a detailed description see Howells *et al.* 1996 (pp. 127–128) and Howells 2014 (p. 85).

Based on closely related species, false spike likely brood eggs and larvae from early spring to late summer and host fish are expected to be minnows (family Cyprinidae) (Pfeiffer *et al.* 2016, p. 287). Confirmed host fish for false spike include blacktail shiner (*Cyprinella venusta*) and red shiner (*C. lutrensis;* Dudding *et al.* 2019, p. 16).

Related species in the genus *Fusconaia* from the southeast United States are reach a maximum age of 15–51 years (Haag and Rypel 2010, pp. 4–6). No information on age at maturity currently exists for false spike (Howells 2010d, p. 3). In part because of their long lifespan and episodic recruitment strategy, populations may be slow to recover from disturbance.

False spike occur in larger creeks and rivers with sand, gravel, or cobble substrates, and in areas with slow to moderate flows. The species is not known from impoundments, nor from deep waters (Howells 2014, p. 85).

False spike was once considered common wherever it was found; however, beginning in the early 1970s, the species began to be regarded as rare throughout its range, based on collection information (Strecker 1931, pp. 18–19; Randklev *et al.* 2017c, p. 13). It was considered to be extinct until 2011, when the discovery of seven live false spike in the Guadalupe River, near Gonzales, Texas, was the first report of living individuals in nearly four decades (Howells 2010d, p. 4; Randklev *et al.* 2011, p. 17). Dudding *et al.* (2019, pp. 16–17) cautioned that the patchy distribution of false spike could be related to host fish relationships; that is, because their host fish have a small home range, limited dispersal ability, and are sensitive to human impacts, distribution of false spike could be limited by access to, and movement of, host fish.

Currently, the false spike occurs in four populations: In the Little River and some tributaries (Brazos River basin), the lower San Saba and Llano Rivers (Colorado River basin), and in the lower Guadalupe River (Guadalupe River Basin) (table 7; figure 6). For more information on these populations, see the SSA report. False spike is presumed to have been extirpated from the remainder of its historical range throughout the Brazos, Colorado, and Guadalupe Basins of central Texas (reviewed in Randklev *et al.* 2017c, pp. 12–13).

TABLE 7—CURRENT FALSE SPIKE POPULATIONS

Population	Streams included	Counties	Occupied reach length (mi (km))	Recent collection years (number collected)
Little River and tributaries	Little River Brushy Creek, San Gabriel River	Milam and Williamson Co., TX	41 (66)	2015 (29)
Lower San Saba River	San Saba River	San Saba Co., TX	42 (67)	2012 (3)
Llano River	Llano River	Mason Co., TX	<1 (~1)	2017 (1)
Lower Guadalupe River	Guadalupe River	Gonzales, DeWitt, and Victoria Co., TX.	102 (164)	2014–2015 (652)

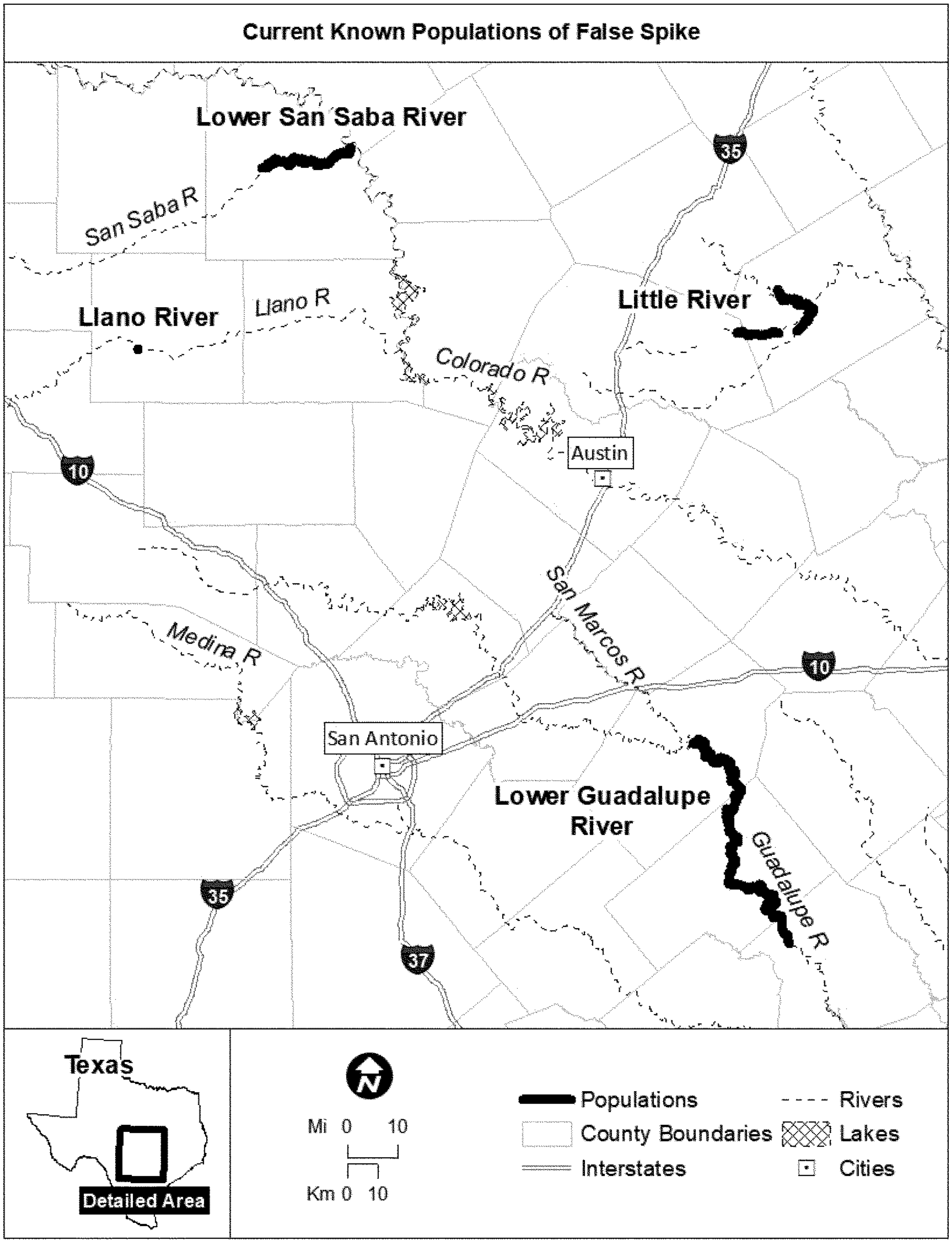

Figure 6. Map showing locations of known false spike populations.

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Regulatory and Analytical Framework

Regulatory Framework

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species is an "endangered species" or a "threatened species." The Act defines an endangered species as a species that is "in danger of extinction throughout all or a significant portion of its range," and a threatened species as a species that is "likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The Act requires that we determine whether any species is an "endangered species" or a "threatened species" because of any of the following factors:

(A) The present or threatened destruction, modification, or curtailment of its habitat or range;

(B) Overutilization for commercial, recreational, scientific, or educational purposes;

(C) Disease or predation;

(D) The inadequacy of existing regulatory mechanisms; or

(E) Other natural or manmade factors affecting its continued existence.

These factors represent broad categories of natural or human-caused actions or conditions that could have an effect on a species' continued existence. In evaluating these actions and conditions, we look for those that may have a negative effect on individuals of the species, as well as other actions or conditions that may ameliorate any negative effects or may have positive effects (*e.g.* conservation measures).

We use the term ''threat'' to refer in general to actions or conditions that are known to or are reasonably likely to negatively affect individuals of a species. The term ''threat'' includes actions or conditions that have a direct impact on individuals (direct impacts), as well as those that affect individuals through alteration of their habitat or required resources (stressors). The term ''threat'' may encompass—either together or separately—the source of the action or condition or the action or condition itself.

However, the mere identification of any threat(s) does not necessarily mean that the species meets the statutory definition of an ''endangered species'' or a ''threatened species.'' In determining whether a species meets either definition, we must evaluate all identified threats by considering the expected response by the species, and the effects of the threats—in light of those actions and conditions that will ameliorate the threats—on an individual, population, and species level. We evaluate each threat and its expected effects on the species, then analyze the cumulative effect of all of the threats on the species as a whole. We also consider the cumulative effect of the threats in light of those actions and conditions that will have positive effects on the species, such as any existing regulatory mechanisms or conservation efforts. The Secretary determines whether the species meets the definition of an ''endangered species'' or a ''threatened species'' only after conducting this cumulative analysis and describing the expected effect on the species now and in the foreseeable future.

The Act does not define the term ''foreseeable future,'' which appears in the statutory definition of ''threatened species.'' Our implementing regulations at 50 CFR 424.11(d) set forth a framework for evaluating the foreseeable future on a case-by-case basis. The term foreseeable future extends only so far into the future as the Services can reasonably determine that both the future threats and the species' responses to those threats are likely. In other words, the foreseeable future is the period of time in which we can make reliable predictions. ''Reliable'' does not mean ''certain''; it means sufficient to provide a reasonable degree of confidence in the prediction. Thus, a prediction is reliable if it is reasonable to depend on it when making decisions.

It is not always possible or necessary to define foreseeable future as a particular number of years. Analysis of the foreseeable future uses the best scientific and commercial data available and should consider the timeframes applicable to the relevant threats and to the species' likely responses to those threats in view of its life-history characteristics. Data that are typically relevant to assessing the species' biological response include species-specific factors such as lifespan, reproductive rates or productivity, certain behaviors, and other demographic factors.

Analytical Framework

The SSA report documents the results of our comprehensive biological status review for the Guadalupe fatmucket, Texas fatmucket, Texas fawnsfoot, Guadalupe orb, Texas pimpleback, and false spike, including an assessment of the potential stressors to each species. The SSA report does not represent a decision by the Service on whether the species should be proposed for listing as endangered or threatened species under the Act. The SSA report provides the scientific basis that informs our regulatory decision, which involves the further application of standards within the Act and its implementing regulations and policies. The following is a summary of the key results and conclusions from the SSA report; the full SSA report can be found at Docket No. FWS–R2–ES–2019–0061 on *http://www.regulations.gov*.

To assess the viability of the six Central Texas mussels, we used the three conservation biology principles of resiliency, redundancy, and representation (Shaffer and Stein 2000, pp. 306–310). Briefly, resiliency supports the ability of the species to withstand environmental and demographic stochasticity (for example, wet or dry, warm or cold years), redundancy supports the ability of the species to withstand catastrophic events (for example, droughts, large pollution events), and representation supports the ability of the species to adapt over time to long-term changes in the environment (for example, climate changes). In general, the more resilient and redundant a species is and the more representation it has, the more likely it is to sustain populations over time, even under changing environmental conditions. Using these principles, we identified the species' ecological requirements for survival and reproduction at the individual, population, and species levels, and described the beneficial and risk factors influencing the species' viability.

The SSA process can be categorized into three sequential stages. During the first stage, we evaluated individual species' life-history needs. The next stage involved an assessment of the historical and current condition of the species' demographics and habitat characteristics, including an explanation of how the species arrived at its current condition. The final stage of the SSA involved making predictions about the species' responses to positive and negative environmental and anthropogenic influences. This process used the best available information to characterize viability as the ability of a species to sustain populations in the wild over time. We use this information to inform our regulatory decision.

Summary of Biological Status and Threats

In this discussion, we review the biological condition of the species and their resources, and the threats that influence the species' current and future conditions, in order to assess the species' overall viability and the risks to that viability.

Using various timeframes and the current and projected future resiliency, redundancy, and representation, we describe the species' levels of viability over time. For the Central Texas mussels to maintain viability, their populations or some portion thereof must be resilient. A number of factors influence the resiliency of Central Texas mussel populations, including occupied stream length, abundance, and recruitment. While some of the six species have life-history adaptations that help them tolerate dewatering and other stressors to some extent, each of these stressors diminishes the resiliency of populations to some degree and especially in combination. Elements of the species' habitat that determine whether Central Texas mussel populations can grow to maximize habitat occupancy influence those factors, thereby increasing the resiliency of populations. These resiliency factors and habitat elements are discussed in detail in the SSA report and summarized here.

Species Needs

Occupied Stream Length: Most freshwater mussels, including the Central Texas mussel species, are found in aggregations, called mussel beds, that vary in size from about 50 to >5,000 square meters (m^2), separated by stream reaches in which mussels are absent or rare (Vaughn 2012, p. 2). We define a mussel population at a larger scale than a single mussel bed; it is the collection of mussel beds within a stream reach between which infested host fish may travel, allowing for ebbs and flows in mussel bed density and abundance over time throughout the entirety of the population's occupied reach. Therefore, resilient mussel populations must occupy stream reaches long enough such that stochastic events that affect individual mussel beds do not eliminate the entire population. Repopulation by infested fish from other mussel beds within the reach can allow the population to recover from these events. We consider populations extending more than 50 miles (80 kilometers (km)) to be highly resilient to stochastic events because a single event is unlikely to affect the entire population. Populations occupying reaches between 20 and 49 river miles (32–79 km) have some resiliency to stochastic events, and populations occupying reaches less than 20 miles (32 km) have little resiliency. Note that, by definition, an extirpated or functionally extirpated population occupies a stream length of approximately (or approaching) zero miles (0 km).

Abundance: Mussel abundance in a given stream reach is a product of the number of mussel beds and the density of mussels within those beds. For populations of Central Texas mussel species to be healthy (*i.e.,* resilient), there must be many mussel beds of sufficient density such that local stochastic events do not necessarily eliminate the bed(s), allowing the mussel bed and the overall local population within a stream reach to recover from any single event. Mussel abundance is indicated by the number of individuals found during a sampling event; mussel surveys rarely represent a complete census of the population. Instead, density is estimated by the number found during a survey event using various statistical techniques. Because we do not have population estimates for most populations of Central Texas mussels, nor are the techniques directly comparable (*i.e.,* same area size searched, similar search time, etc.), we used the number of individuals captured as an index over time, presuming relatively similar levels of effort. While we cannot precisely determine population abundance at the sites using these numbers, we are able to determine if the species is dominant at the site or rare and examine this over time if those data are available.

Reproduction: Resilient Central Texas mussel populations must also be reproducing and recruiting young individuals into the population. Population size and abundance reflects previous influences on the population and habitat, while reproduction and recruitment reflect population trends that may be stable, increasing, or decreasing over time. For example, a large, dense mussel population that contains mostly old individuals is not likely to remain large and dense into the future, as there are few young individuals to sustain the population over time (*i.e.,* death rates exceed birth rates and subsequent recruitment of reproductive adults resulting in negative population growth). Conversely, a population that is less dense but has many young and/or gravid individuals may likely grow to a higher density in the future (*i.e.,* birth rates and subsequent recruitment of reproductive adults exceeds death rates resulting in positive population growth). Detection rates of very young juvenile mussels during routine abundance and distribution surveys are extremely low due to sampling bias because sampling for these species involves tactile searches and mussels <35 mm are very difficult to detect (Strayer and Smith 2003, pp. 47–48).

Evidence of reproduction is demonstrated by repeated captures of small-sized individuals (juveniles and subadults near the low end of the detectable range size ~35 mm; Randklev *et al.* 2013, p. 9) over time and by observing gravid (with eggs in the marsupium, gills, or gill pouches) females during the reproductively active time of year. While small-sized mussels and gravid females can be difficult to detect, it is important that surveyors attempt to detect them as reproduction and subsequent recruitment are important demographic parameters that affect growth rates in mussel populations (Berg *et al.* 2008, pp. 396, 398–399; Matter *et al.* 2013, pp. 122–123, 134–135).

Risk Factors for the Central Texas Mussels

We reviewed the potential risk factors (*i.e.,* threats, stressors) that could be affecting the six Central Texas mussels now and in the future. In this proposed rule, we will discuss only those factors in detail that could meaningfully impact the status of the species. Those risks that are not known to have effects on Central Texas mussel populations, such as disease, are not discussed here but are evaluated in the SSA report. Many of the threats and risk factors are the same or similar for each of the six species. Where the effects are expected to be similar, we present one discussion that applies to all six species. Where the effects may be unique or different to one species, we will address that specifically. The primary risk factors (*i.e.,* threats) affecting the status of the Central Texas mussels are: (1) Increased fine sediment (Factor A from the Act), (2) changes in water quality (Factor A), (3) altered hydrology in the form of inundation (Factor A), (4) altered hydrology in the form of loss of flow and scour of substrate (Factor A), (5) predation and collection (Factor C), and (6) barriers to fish movement (Factor E). These factors are all exacerbated by the ongoing and expected effects of climate change. Finally, we also reviewed the conservation efforts being undertaken for the species.

Increased Fine Sediment

Juvenile and adult Central Texas mussels inhabit microsites that have abundant interstitial spaces, or small openings in an otherwise closed matrix of substrate, created by gravel, cobble, boulders, bedrock crevices, tree roots, and other vegetation. Inhabited interstitial spaces have some amount of fine sediment (*i.e.,* clay and silt) necessary to provide appropriate shelter. However, excessive amounts of fine sediments can reduce the number of appropriate microsites in an otherwise suitable mussel bed by filling in these interstitial spaces and can smother mussels in place. All six species of Central Texas mussels generally require stable substrates, and loose silt deposits do not generally provide for substrate stability that can support mussels. Interstitial spaces provide essential habitat for juvenile mussels. Juvenile freshwater mussels burrow into interstitial substrates, making them particularly susceptible to degradation of this habitat feature. When clogged with sand or silt, interstitial flow may become reduced (Brim Box and Mossa 1999, p. 100), thus reducing juvenile habitat availability and quality. While adult mussels can be physically buried by excessive sediment, ''the main impacts of excess sedimentation on unionids (freshwater mussels) are often sublethal'' and include interference with feeding mediated by valve closure (Brim Box and Mossa 1999, p. 101). Many land use activities can result in excessive erosion, sediment production, and channel instability, including, but not limited to: logging, crop farming, ranching, mining, and urbanization (Brim Box and Mossa 1999, p. 102).

Under a natural flow regime, a stream's sediment load is in equilibrium such that as sediments are naturally moved downstream from one microsite to another, the amount of sediment in the substrate is relatively stable, given that different reaches within a river or stream may be aggrading (gaining) or degrading (losing) sediment (Poff *et al.* 1997, pp. 770–772). Current and past human activities result in enhanced sedimentation in river systems, and legacy sediment, resulting from past land disturbance and reservoir construction, continues to persist and influence river processes and sediment dynamics (Wohl 2015, p. 31) and these legacy effects can degrade mussel habitats. Fine sediments collect on the streambed and in crevices during low flow events, and much of the sediment is washed downstream during high flow events (also known as cleansing flows) and deposited elsewhere. However, increased frequency of low flow events (from groundwater extraction, instream surface flow diversions, and drought) combined with a decrease in cleansing flows (from reservoir management and drought) causes sediment to accumulate. Sediments deposited by large-scale flooding or other disturbance may persist for several years until adequate cleansing flows can redistribute that sediment downstream. When water velocity decreases, which can occur from reduced streamflow or inundation, water loses its ability to carry sediment in suspension, and sediment falls to the substrate, eventually smothering mussels not adapted to soft substrates (Watters 2000, p. 263). Sediment accumulation can be exacerbated when there is a simultaneous increase in the sources of fine sediments in a watershed.

In the range of the Central Texas mussels, these sources include streambank erosion from development, agricultural activities, livestock and wildlife grazing and browsing, in-channel disturbances, roads, and crossings, among others (Poff *et al.* 1997, p. 773). In areas with ongoing development, runoff can transport substantial amounts of sediment from ground disturbance related to construction activities with inadequate or absent sedimentation controls. While these construction impacts can be transient (lasting only during the construction phase), the long-term effects of development are long lasting and can result in hydrological alterations as increased impervious cover increases runoff and resulting shear stress causes streambank instability and additional sedimentation.

All populations of Central Texas mussels face the risk of fine sediment accumulation to varying degrees. Multiple populations of the six Central Texas mussel species are experiencing increased sedimentation, including in particular the Clear Fork Brazos River (Texas fawnsfoot), middle and lower Brazos River (false spike and Texas fawnsfoot), and lower Colorado River (Texas pimpleback, Texas fawnsfoot). In the future, we expect sediment deposition to continue to increase across the range of all six species due to low water levels and decreasing frequency of cleansing flows at all populations and for longer periods due to climate change and additional human development in the watershed.

Changes in Water Quality

Freshwater mussels and their host fish require water in sufficient quantity and quality on a consistent basis to complete their life cycles. Urban growth and other anthropogenic activities across Texas are placing increased demands on limited freshwater resources that, in turn, can have deleterious effects on water quality. Water quality can be degraded through contamination or alteration of water chemistry. Chemical contaminants are ubiquitous throughout the environment and are a major reason for the current declining status of freshwater mussel species nationwide (Augspurger *et al.* 2007, p. 2025). Immature mussels (*i.e.,* juveniles and glochidia) are especially sensitive to water quality degradation and contaminants (Cope *et al.* 2008, p. 456, Wang *et al.* 2017, pp. 791–792; Wang *et al.* 2018, p. 3041).

Chemicals enter the environment through both point and nonpoint source discharges, including hazardous spills, industrial wastewater, municipal effluents, and agricultural runoff. These sources contribute organic compounds, trace metals, pesticides, and a wide variety of newly emerging contaminants (*e.g.,* pharmaceuticals) that comprise some 85,000 chemicals in commerce today that are released to the aquatic environment (Environmental Protection Agency (EPA) 2018, p. 1). The extent to which environmental contaminants adversely affect aquatic biota can vary depending on many variables such as concentration, volume, and timing of the release. Species diversity and abundance consistently ranks lower in waters that are polluted or otherwise impaired by contaminants. Freshwater mussels are not generally found for many miles downstream of municipal wastewater treatment plants (Gillis *et al.* 2017, p. 460; Goudreau *et al.* 1993, p. 211; Horne and McIntosh 1979, p. 119). For example, transplanted common freshwater mussels (including threeridge (*Amblema plicata*) and the nonnative Asian clam (*Corbicula fluminea*) showed reduced growth and survival below a wastewater treatment plant (WWTP) outfall relative to sites located upstream of the WWTP in Wilbarger Creek (a tributary to the Colorado River in Travis County, Texas); water chemistry was altered by the wastewater flows at downstream sites, with elevated constituents in the water column that included copper, potassium, magnesium, and zinc (Duncan and Nobles 2012, p. 8; Nobles and Zhang 2015, p. 11). Contaminants released during hazardous spills are also of concern. Although spills are relatively short-term localized events, depending on the types of substances and volume released, water resources nearby can be severely impacted and degraded for years following an incident.

Ammonia is of particular concern below wastewater treatment plants because freshwater mussels are particularly sensitive to increased ammonia levels (Augspurger *et al.* 2003, p. 2569). Elevated concentrations of un-ionized ammonia (NH_3) in the interstitial spaces of benthic habitats (>0.2 parts per billion) have been implicated in the reproductive failure of other freshwater mussel populations (Strayer and Malcom 2012, pp. 1787–1788), and sublethal effects (valve closures) have recently been described as total ammonia nitrogen approaches 2.0 milligrams per liter (mg/L = ppm; Bonner *et al.* 2018, p. 186). Immature mussels (*i.e.,* juveniles and glochidia) are especially sensitive to water quality degradation and contaminants, including ammonia (Wang *et al.* 2007, p. 2055). For smooth pimpleback (*Cyclonaias houstonensis,* a species native to central Texas but not included in this listing), the revised EPA ammonia benchmarks are sufficient to protect from short term effects of ammonia on the species' physiological processes (Bonner *et al.* 2018, p. 151). However, the long-term effects of chronic exposure (*i.e.,* years or decades) to freshwater mussels has yet to be experimentally investigated.

Municipal wastewater contains both ionized and un-ionized ammonia, and wastewater discharge permits issued by Texas Commission on Environmental

Quality (TCEQ) do not always impose limits on ammonia, particularly for smaller volume dischargers. Therefore, at a minimum, concentrations of ammonia are likely to be elevated in the immediate mixing zone of some WWTP outfalls. To give some insight into the potential scope of WWTP related impacts, approximately 480 discharge permits are issued for the Brazos River watershed alone from its headwaters above Possum Kingdom Lake down to the Gulf of Mexico (TCEQ 2018c, entire). In addition, some industrial permits, such as animal processing facilities, have ammonia limits in the range of 3 to 4 mg/L or higher, which exceeds levels that inhibited growth in juvenile fatmucket (*Lampsilis siliquoidea*) and rainbow mussel (*Villosa iris*) (Wang *et al.* 2007, entire). Similar to the Brazos River, WWTP outfalls are numerous throughout the ranges of the Central Texas mussels.

An additional type of water quality degradation that affects the Central Texas mussels is alteration of water quality parameters such as dissolved oxygen, temperature, and salinity levels. Dissolved oxygen levels may be reduced from increased nutrient inputs or other sources of organic matter that increase the biochemical oxygen demand in the water column as microorganisms decompose waste. Organic waste can originate from storm water or irrigation runoff or wastewater effluent, and juvenile mussels seem to be particularly sensitive to low dissolved oxygen (with sublethal effects evident at 2 ppm and lethal effects evident at 1.3 ppm; Sparks and Strayer 1998, pp. 132–133). Increased water temperature (over 30 °C and approaching 40 °C) from climate change and from low flows during drought can exacerbate low dissolved oxygen levels in addition to other drought-related effects on both juvenile and adult mussels (Sparks and Strayer 1998, pp. 132–133). Finally, high salinity concentrations are an additional concern in certain watersheds, where dissolved salts can be particularly limiting to Central Texas mussels. Upper portions of the Brazos and Colorado Rivers, originating from the Texas High Plains, contain saline water, sourced from both natural geological formations, and from oil and gas development. Salinity in river water is diluted by surface flow and as surface flow decreases salt concentrations increase, resulting in adverse effects to freshwater mussels. Even low levels of salinity (2–4 parts per thousand (ppt)) have been demonstrated to have substantial negative effects on reproductive success, metabolic rates, and survival of freshwater mussels (Blakeslee *et al.* 2013, p. 2853). Bonner *et al.* (2018, pp. 155–156) suggest that the behavioral response of valve closure to high salinity concentrations (>2 ppt) is the likely mechanism for reduced metabolic rates, reduced feeding, and reduced reproductive success based on reported sublethal effects of salinity >2 ppt for Texas pimpleback.

Water quality and quantity are interdependent, so reductions in surface flow from drought, instream diversion, and groundwater extraction serve to concentrate contaminants by reducing flows that would otherwise dilute point and non-point source pollution. For example, salinity inherently poses a greater risk to aquatic biota under low flow conditions as salinity concentrations and water temperatures increase. Drought conditions can place additional stressors on stream systems beyond reduced flow by exacerbating contaminant-related effects to aquatic biota, including Central Texas mussels. Not only can temperature be a biological, physical, and chemical stressor, the toxicity of many pollutants to aquatic organisms increases at higher temperatures (*e.g.,* ammonia, mercury). We foresee threats to water quality increasing into the future as demand and competition for limited water resources grows.

Altered Hydrology—Inundation

Central Texas mussels are adapted to flowing water (lotic habitats) rather than standing water (lentic habitats) and require free-flowing water to survive. Low flow events (including stream drying) and inundation can eliminate habitat appropriate for Central Texas mussels, and while these species can survive these events for a short duration, populations that experience prolonged drying events or repeated drying events will not persist over time.

Inundation has primarily occurred upstream of dams, both large (such as the Highland Lakes on the Colorado River and other major flood control and water supply reservoirs) and small (low water crossings and diversion dams typical of the tributaries and occurring usually on privately owned lands throughout Central Texas). Inundation causes an increase in sediment deposition, eliminating the crevices that many Central Texas mussel species inhabit. Inundation also includes the effects of reservoir releases where frequent variation in surface water elevation acts to make habitats unsuitable for Central Texas mussels. In large reservoirs, deep water is very cold and often devoid of oxygen and necessary nutrients. Cold water (less than 11 °Celsius (C) or 52 °F (F)) stunts mussel growth and delays or hinders spawning. The Central Texas mussels do not tolerate inundation under large reservoirs. Further, deep-water reservoirs with bottom release (like Canyon Reservoir) can affect water temperatures several miles downriver. The water temperature remains below 21.1 °C for the first 3.9 miles (6.3 km) of the 13.8-mile (22.2-km) Canyon Reservoir tailrace (Texas Parks and Wildlife Department (TPWD) 2007c, p. ii), cold enough to support a recreational non-native rainbow and brown trout fishery.

The construction of dams, inundation of reservoirs, and management of water releases have significant effects on the natural hydrology of a river or stream. For example, dams trap sediment in reservoirs, and managed releases typically do not conform to the natural flow regime (*i.e.,* higher baseflows, and peak flows of reduced intensity but longer duration). Rivers transport not only water but also sediment, which is transported mostly as suspended load (held by the water column), and most sediment transport occurs during floods as sediment transport increases as a power function (greater than linear) of flow (Kondolf 1997, p. 533). It follows that increased severity of flooding would result in greater sediment transport, with important effects on substrate stability and benthic habitats for freshwater mussels and other organisms dependent on stable benthic habitats. Further, water released by dams is usually clear and does not carry a sediment load and is considered ''hungry water because the excess energy is typically expended on erosion of the channel bed and banks . . . resulting in incision (downcutting of the bed) and coarsening of the bed material until a new equilibrium is reached'' (Kondolf 1997, p. 535). Conversely, depending on how dam releases are conducted, reduced flood peaks can lead to accumulations of fine sediment in the river bed (*i.e.,* loss of flushing flows, Kondolf 1997, pp. 535, 548).

Operation of flood-control, water-supply, and recreation reservoirs results in altered hydrologic regimes, including an attenuation of both high- and low-flow events. Flood-control dams store floodwaters and then release them in a controlled manner; this extended release of flood waters can result in significant scour and loss of substrates that provide mussel habitat. Along with this change in the flow of water, sediment dynamics are affected as sediment is trapped above and scoured below major impoundments. These changes in water and sediment transport have negatively affected freshwater mussels and their habitats.

There are numerous dams throughout the range of Central Texas mussels. There are now 27 major reservoirs in the Brazos River basin (16 have >50,000 acre-feet of storage) (Brazos River and Associated Bay Estuary System Basin and Bay Expert Science Team (BBEST) 2012, p. 33); 31 major reservoirs in the Colorado River basin, including the Highland Lakes (Texas Water Development Board (TWDB) 2018d, p. 1); 9 major reservoirs on the Guadalupe River (BBEST 2011b, p. 2.2); and 31 major reservoirs in the Trinity River basin (BBEST 2009, p. 10). These reservoirs, subsequent inundation, and resulting fragmentation of mussel populations has been the primary driver of the current distribution of the Central Texas mussels. Additional reservoirs are planned for the future, including the Cedar Ridge Reservoir, proposed by the City of Abilene on the Clear Fork of the Brazos River near the town of Lueders, Texas (83 FR 16061), and more than one reservoir is proposed to be built off the main channel of the Lower Colorado River in Wharton and Colorado Counties, Texas (Lower Colorado River Authority (LCRA) 2018c, p. 1). The Allens Creek Reservoir is proposed for construction on Allens Creek near the City of Wallis, to provide water supply and storage for the City of Houston (Brazos River Authority (BRA) 2018b, p. 1). Water that is planned to be pumped from the Brazos River during high flows will be stored and released back into the river to meet downstream needs during periods of low flow.

Altered Hydrology—Flow Loss and Scour

Extreme water levels—both low flows and high flows—threaten population persistence of the Central Texas mussels. The effects of population losses associated with excessively low flows are compounded by population losses associated with excessively high flows. Whereas persistent low flow during times of drought results in drying of mussel habitats and desiccation of exposed mussels, rapid increases in flows associated with large-scale rain events and subsequent flooding results in scour of the streambed and physical displacement of mussels and appropriate substrates. Appropriately-sized substrates are moved during scouring high flow events and mussels are transported downstream to inappropriate sites or are buried by inappropriately sized materials. The Central Texas mussels are experiencing a repeating cycle of alternating droughts and flooding that, in combination with hydrological alterations, threatens population persistence.

Droughts that have occurred in the recent past have led to extremely low flows in several Central Texas rivers. Many of these rivers have some resiliency to drought because they are spring-fed (Colorado River tributaries, Guadalupe River), are very large (lower Brazos and Colorado Rivers), or have significant return flows (Trinity River), but drought in combination with increased groundwater pumping may lead to lower river flows of longer duration than have been recorded in the past. Reservoir releases can be managed to some extent during drought conditions to prevent complete dewatering below many major reservoirs. During the months of July and August 2018, the Clear Fork Brazos, Concho, San Saba, Llano, Pedernales, and upper Colorado and upper Guadalupe Rivers all had very low flows (U.S. Geological Survey (USGS) 2019).

Streamflow in the Colorado River above the Highland Lakes and downstream of the confluence with Concho River has been declining since the 1960s as evidenced by annual daily mean streamflow (USGS 2008b, pp. 812, 814, 848, 870, 878, 880), and overall river discharge for each of the rivers can be expected to continue to decline due to increased drought as a result of climate change, absent significant return flows. There are a few exceptions including the Llano River at Llano (USGS 2008b, p. 892), Pedernales River at Fredericksburg (USGS 2008b, p. 896), Onion Creek near Driftwood, and Onion Creek at Highway 183 (flows appear to become more erratic, characteristic of a developing watershed; USGS 2008b, pp. 930, 946). In the San Saba River, continuing or increasing surface and alluvial aquifer groundwater withdrawals in combination with drought is likely to result in reduced streamflow, affecting mussels in the future (Randklev *et al.* 2017c, pp. 10–11).

Flows have declined due to drought in the Brazos River in recent years upstream of Lake Whitney (USGS 2008b, pp. 578, 600, 626, 638; BRA 2018e, p. 6), although baseflows are maintained somewhat due to releases from Lake Granbury and other reservoirs in the upper basin (USGS 2008b, p. 644; BRA 2018e, p. 6). In the middle Brazos, U.S. Army Corps of Engineers (USACE) dams have reduced the magnitude of floods on the mainstem of the Brazos River downstream of Lake Whitney (USGS 2008b, pp. 652, 676 766, 776; BRA 2018e, p. 6), while flows in the lower Brazos and Navasota Rivers appear to have higher baseflows due to water supply operations in the upper basin that deliver to downstream users (USGS 2008b, pp. 754, 766, 776; BRA 2018e, p. 6). Lake Limestone releases also appear to be contributing to higher base flows in the Lower Brazos (BRA 2018e, p. 6). Flows have declined in the upper Guadalupe River (USGS 2008b, pp. 992, 994, 1000, 1018) but appear relatively unchanged at Comfort and Spring Branch and in the San Marcos River (USGS 2008b, pp. 1004, 1006, 1022), and in the lower Guadalupe River (USGS 2008b, pp. 1036, 1040). In the lower sections of the Colorado River, lower flows and reduced high flow events are more common now decades after major reservoirs were constructed (USGS 2008b, pp. 964, 966). In the Trinity River, low flows are higher (elevated baseflows) than they were in the past (USGS 2008b, pp. 370, 398, 400, 430) because of substantial return flows from Dallas area wastewater treatment plants.

Many of the tributary streams (*i.e.,* Concho, San Saba, Llano, and Pedernales Rivers) historically received significant groundwater inputs from multiple springs associated with the Edwards and other aquifers. As spring flows decline due to drought or groundwater lowering from pumping, habitat for Central Texas mussels in the tributary streams is reduced and could eventually cease to exist (Randklev *et al.* 2018, pp. 13–14). While Central Texas mussels may survive short periods of low flow, as low flows persist, mussels face oxygen deprivation, increased water temperature, increased predation risk, and ultimately stranding, all reducing survivorship, reproduction, and recruitment in the population.

Low-flow events lead to increased risk of desiccation (physical stranding and drying) and exposure to elevated water temperature and other water quality degradations, such as contaminants, as well as to predation. For example, sections of the San Saba River, downstream of Menard, Texas, experienced very low flows during the summer of 2015, which led to dewatering of occupied habitats as evidenced by observations of recent dead shell material of Texas pimpleback and Texas fatmucket (TPWD 2015, pp. 2–3; described in detail by Randklev *et al.* 2018, entire). Several USGS stream gauges reported very low flows during the 2017–2018 water year, including: the Clear Fork of the Brazos River, Elm Creek, Concho River at Paint Rock, San Saba River, Colorado River at San Saba, Llano River, Pedernales River, and upper Guadalupe River (USGS 2018a, entire). Service, TPWD, and Texas

Department of Transportation (TxDOT) biologists noted in 2017 that at one site on the Brazos River near Highbank, Texas, the presence of 42 dead to fresh dead (with tissue intact) Texas fawnsfoot that likely died as a result of recent drought or scouring events (Tidwell 2017, entire).

High flow events lead to increased risk of physical removal, transport, and burial (entrainment) of mussels as unstable substrates are transported downstream by floodwaters and later redeposited in locations that may not be suitable. A site in the lower Colorado River near Altair, Texas, suffered significant changes in both mussel community structure and bathymetry (measurement of water depths) during extensive flooding (and resulting high flows) in August 2017, as a result of Hurricane Harvey (Bonner *et al.* 2018, p. 266). This site previously held the highest mussel abundance (Bonner *et al.* 2018, pp. 242–243) and represented high-quality habitat within the Colorado River basin, prior to the flooding events. Mussel abundance significantly decreased by nearly two orders of magnitude (Bonner *et al.* 2018, p. 266). This location had two of the Central Texas mussel species (Texas fawnsfoot and Texas pimpleback) present during initial surveys in 2017 (Bonner *et al.* 2018, p. 242). Widespread flooding was reported in the Colorado and Guadalupe River basins of Central Texas in October 2018.

The distribution of mussel beds and their habitats is affected by large floods returning at least once during the typical life span of an individual mussel (generally from 3 to 30 years). The presence of flow refuges mediates the effects of these floods, as shear stress is relatively low in flow refuges and where sediments are relatively stable, and individual mussels ''must either tolerate high-frequency disturbances or be eliminated, and can colonize areas that are infrequently disturbed between events'' (Strayer 1999, pp. 468–469). Shear stress and relative substrate stability are limiting to mussel abundance and species richness (Randklev *et al.* 2017a, p. 7), and riffle habitats may be more resilient to high flow events than littoral (bank) habitats.

The Central Texas mussels have historically been, and currently remain, exposed to extreme hydrological conditions, including severe drought leading to dewatering, and heavy rains leading to damaging scour events with movement of mussels and substrate (*i.e.,* ''flash flooding''). For example, in 2018, over the span of 69 days, the Llano River near Llano, Texas, experienced extreme low flows (0.08 cfs on August 8, 2018), and extreme high flows leading to severe flooding, which resulted in substantial scour of streambed and riparian area habitats (278,000 cfs on October 16, 2018) (Llano River Watershed Alliance (LRWA) 2019, entire). Prolonged drought followed by severe flooding can result in failure and collapse of river banks and subsequent sedimentation, as demonstrated by slumping and undercutting on the lower Guadalupe River near Cuero, Texas, in 2015 (Giardino and Rowley 2016, pp. 70–72), which is occupied by the false spike and Guadalupe orb. The usual drought/flood cycle in Central Texas can be characterized by long periods of time absent of rain interrupted by short periods of heavy rain, resulting in often severe flooding. These same patterns led to the development of flood control and storage reservoirs throughout Texas in the twentieth century. It follows that, given the extreme and variable climate of Central Texas, mussels must have life-history strategies and other adaptations that allow them to persist by withstanding severe conditions and repopulating during more favorable conditions. However, it is also likely that there is a limit to how the mussels might respond to increasing variability, frequency, and severity of extreme weather events, combined with habitat fragmentation and population isolation.

Sediment deposition may arise from human activities, as well. Sand and gravel can be mined from rivers or from adjacent alluvial deposits, and instream gravels often require less processing and are thus more attractive from a business perspective (Kondolf 1997, p. 541). Instream mining directly affects river habitats, and can indirectly affect river habitats through channel incision, bed coarsening, and lateral channel instability (Kondolf 1997, p. 541). Excavation of pits in or near to the channel can create a nickpoint, which can contribute to erosion (and mobilization of substrate) associated with head cutting (Kondolf 1997, p. 541). Off-channel mining of floodplain pits can become involved during floods, such that the pits become hydrologically connected and thus can affect sediment dynamics in the stream (Kondolf 1997, p. 545).

Predation and Collection

Predation on freshwater mussels is a natural phenomenon. Raccoons, muskrats, snapping turtles, wading birds, and fish are known to prey upon Central Texas mussels. Under natural conditions, the level of predation occurring within Central Texas mussel populations is not likely to pose a significant risk to any given population. However, during periods of low flow, terrestrial predators and wading birds have increased access to portions of the river that are otherwise too deep under normal flow conditions. High levels of predation during drought have been observed on the Llano and San Saba Rivers. As drought and low flow are predicted to occur more often and for longer periods due to the effects of future climate change, the Hill Country tributaries (of the Colorado River) in particular are expected to experience additional predation pressure into the future, and this may become especially problematic in the Llano and San Saba Rivers. Predation is expected to be less of a problem for the lower portions of the mainstem river populations because the rivers are significantly larger than the tributary streams and Central Texas mussels are less likely to be found by predators in exposed or very shallow habitats.

Certain mussel beds within some populations, due to ease of access, are vulnerable to overcollection and vandalism. These areas, primarily on the Llano and San Saba Rivers, have well-known and well-documented mussel beds that have been sampled repeatedly over the past few years by multiple researchers and others for a variety of projects. Given the additional stressors aforementioned in this section, these populations are being put at additional risk due to over-collection and over-harvest for scientific needs.

Barriers to Fish Movement

Central Texas mussels historically colonized new areas through movement of infested host fish, as newly metamorphosed juveniles would excyst from host fish in new locations. Today, the remaining Central Texas mussel populations are significantly isolated due to habitat fragmentation by major reservoirs such that recolonization of areas previously extirpated is extremely unlikely, if not impossible, due to existing dams creating permanent barriers to host fish movement. There is currently no opportunity for interaction among any of the extant Central Texas mussel populations, as they are isolated from one another by major reservoirs.

The overall distribution of mussels is, in part, a function of host fish dispersal (Smith 1985, p. 105). There is limited potential for immigration and emigration between populations other than through the movement of infected host fish between mussel populations. Small populations are more affected by this limited immigration potential because they are susceptible to genetic drift, resulting from random loss of genetic diversity, and inbreeding depression. At the species level, isolated populations that are eliminated due to stochastic events cannot be recolonized naturally due to barriers to host fish movement, leading to reduced overall redundancy and representation.

Many of the Central Texas mussels' known or assumed primary host fish species are known to be common, widespread species in the Central Texas river basins. We know that populations of mussels and their host fish have become fragmented and isolated over time following the construction of major dams and reservoirs throughout Central Texas. We do not currently have information demonstrating that the distribution of host fish is a factor currently limiting Central Texas mussels distribution. However, a recent study suggested that the currently restricted distribution of false spike, Guadalupe orb, and other related species could be related to declining abundance of their host fish, particularly those fish having small home ranges and specialized habitat affinities (Dudding *et al.* 2019, entire). Further research into the relationships between each of the Central Texas mussel species and their host fish is needed to more fully examine the possible role of declining host fish abundance in declining mussel populations.

Effects of Climate Change

Climate change has been documented to have already taken place, and continued greenhouse gas emissions at or above current rates will cause further warming (Intergovernmental Panel on Climate Change (IPCC) 2013, pp. 11–12). Warming in Texas is expected to be greatest in the summer (Maloney *et al.* 2014, p. 2236). The number of extremely hot days (high temperatures exceeding 95 °F) is expected to double by around 2050 (Kinniburgh *et al.* 2015, p. 83). Western Texas, including portions of the ranges of the Central Texas mussels, is an area expected to show greater responsiveness to the effects of climate change (Diffenbaugh *et al.* 2008, p. 3). Changes in stream temperatures are expected to reflect changes in air temperature, at a rate of approximately 0.6–0.8 °C increase in stream water temperature for every 1 °C increase in air temperature (Morrill *et al.* 2005, pp. 1–2, 15) and with implications for temperature-dependent water quality parameters such as dissolved oxygen and ammonia toxicity. The Central Texas mussels exist at or near a climate and habitat gradient in North America, with the eastern United States having more rainfall and higher freshwater mussel diversity, and the western United States receiving less rainfall and having fewer species of freshwater mussels. As such, it is likely that the Central Texas mussels may be particularly vulnerable to future climate changes in combination with current and future stressors (Burlakova *et al.* 2011a, pp. 156, 161, 163; Burlakova *et al.* 2011b, pp. 395, 403).

While projected changes to rainfall in Texas are small (U.S. Global Change Research Program (USGCRP) 2017, p. 217), higher temperatures caused by anthropogenic factors lead to increased soil water deficits because of higher rates of evapotranspiration. This is likely to result in increasing drought severity in future climate scenarios just as ''extreme precipitation, one of the controlling factors in flood statistics, is observed to have generally increased and is projected to continue to do so across the United States in a warming atmosphere'' (USGCRP 2017, p. 231). Even if precipitation and groundwater recharge remain at current levels, increased groundwater pumping and resultant aquifer shortages due to increased temperatures are nearly certain (Loaiciga *et al.* 2000, p. 193; Mace and Wade 2008, pp. 662, 664–665; Taylor *et al.* 2013, p. 325). Higher temperatures are also expected to lead to increased evaporative losses from reservoirs, which could negatively affect downstream releases and flows (Friedrich *et al.* 2018, p. 167). Effects of climate change, such as air temperature increases and an increase in drought frequency and intensity, have been shown to be occurring throughout the range of Central Texas mussels (USGCRP 2017, p. 188; Andreadis and Lettenmaier 2006, p. 3), and these effects are expected to exacerbate several of the stressors discussed above, such as water temperature and flow loss (Wuebbles *et al.* 2013, p. 16).

A recent review of future climate projections for Texas concludes that both droughts and floods could become more common in Central Texas and projects that years like 2011 (the warmest on record) could be commonplace by the year 2100 (Mullens and McPherson 2017, pp. 3, 6). This trend toward more frequent drought is attributed to increases in hot temperatures, and the number of days at or above 100 °F are projected to ''increase in both consecutive events and the total number of days'' (Mullens and McPherson 2017, pp. 14–15). Similarly, floods are projected to become more common and severe because of increases in the magnitude of extreme precipitation (Mullens and McPherson 2017, p. 20). Recent ''historic'' flooding of the Llano River resulted in the transport of high levels of silt and debris to Lake Travis, so much so that the City of Austin's ability to treat raw water was affected and the City issued a boil water notice and call for water conservation (City of Austin 2018c, p. 3)

In the analysis of the future condition of the Central Texas mussels, we considered climate change to be an exacerbating factor, contributing to the increase of fine sediments, changes in water quality, loss of flowing water, and predation. Due to the effects of ongoing climate change (represented by representative concentration pathway (RCP) 4.5), we expect the frequency and duration of cleansing flows to decrease, leading to the increase in fine sediments at all populations. Many populations will experience increased frequency of low flows. More extreme climate change projections (RCP 8.5 and beyond) lead to further increases in fine sediment within the populations. Similarly, as lower water levels concentrate contaminants and cause unsuitable temperature and dissolved oxygen levels, we expect water quality to decline to some degree in the future. The SSA report includes a detailed analysis of the species' responses to both RCP 4.5 and 8.5.

Conservation Actions and Regulatory Mechanisms

Since 2011, when three of the Central Texas mussel species became candidates for listing under the Endangered Species Act, many agencies, non-governmental organizations, and other interested parties have been working to develop voluntary agreements with private landowners to restore or enhance habitats for fish and wildlife in the region, including in the watersheds where Central Texas mussels occur. These agreements provide voluntary conservation including upland habitat enhancements that will, if executed properly, reduce threats to the species while improving in-stream physical habitat and water quality, as well as adjacent riparian and upland habitats. Additionally, as many as three river authorities are developing (or have already developed) conservation plans that may lead to candidate conservation agreements with assurances to benefit one or more species of candidate mussels (including the Central Texas mussels) in their basins. Because these plans and agreements are not yet fully drafted and implemented, we are not considering the conservation actions in our evaluation of the status of the Central Texas mussels; however, we will evaluate any new information on these actions prior to making our final listing determination for these species.

Some publicly and privately owned lands in the watersheds occupied by Central Texas mussels are protected with conservation easements or are otherwise managed to support populations of native fish, wildlife, and plant populations. The Natural Resources Conservation Service (NRCS), along with the Service and State and local partners, are working with private landowners to develop and implement comprehensive conservation plans to address soil, water, and wildlife resource concerns in the lower Colorado River basin through a Working Lands for Wildlife project (NRCS 2019a, entire).

The Service has been hosting annual mussel research and coordination meetings to help manage and monitor scientific collection of mussel populations and encourage collaboration among researchers and other conservation partners since 2018 (USFWS 2018, p. 1, USFWS 2019a, p. 1). Additionally, work is under way to evaluate methods of captive propagation for the Central Texas mussel species at the Service's hatchery and research facilities (San Marcos Aquatic Research Center, Inks Dam National Fish Hatchery, and Uvalde National Fish Hatchery), including efforts to collect gravid females from the wild to infest host fish (Bonner *et al.* 2018, pp. 8, 9, 11).

Species Condition

Here we discuss the current condition of each known population, taking into account the risks to those populations that are currently occurring, as well as management actions that are currently occurring to address those risks. We consider climate change to be currently occurring, resulting in changes to the timing and amount of rainfall affecting streamflow, increased stream temperatures, and increased accumulation of fine sediments. In the SSA report, for each species and population, we developed and assigned condition categories for three population and three habitat factors that are important for viability of each species. The condition scores for each factor were then used to determine an overall condition of each population: healthy, moderately healthy, unhealthy, or functionally extirpated. These overall conditions translate to our presumed probability of persistence of each population, with healthy populations having the highest probability of persistence over 20 years (greater than 90 percent), moderately healthy populations having a probability of persistence that falls between 60 and 90 percent, and unhealthy populations having the lowest probability of persistence (between 10 and 60 percent). Functionally extirpated populations are not expected to persist over 20 years or are already extirpated.

Guadalupe Fatmucket

Overall, there is one known remaining population of Guadalupe fatmucket, in the Guadalupe River. Historically, Guadalupe fatmucket likely occurred through the Guadalupe River basin, but it currently only occurs in the upper Guadalupe River in an unhealthy population due to low abundance and little evidence of reproduction and recruitment. Very few individuals have been found in recent years, and the upper Guadalupe River in this reach already experiences very low water levels. These low water events are expected to continue into the future, and the population will be unlikely to rebound from any degraded habitat conditions.

Texas Fatmucket

Overall, there are five known remaining populations of Texas fatmucket, all limited to the headwater reaches of the Colorado River and its tributaries (see figure 2, above). Historically, most Texas fatmucket populations were likely connected by fish migration throughout the Colorado River basin, but due to impoundments and low water conditions in the Colorado River and tributaries they are currently isolated from one another, and repopulation of extirpated locations is unlikely to occur without human assistance. Two of the current populations are moderately healthy, two are unhealthy, and one is functionally extirpated.

Lower Elm Creek: The Elm Creek population of Texas fatmucket is extremely small and isolated. This population will continue to be threatened by excessive sedimentation and deterioration of substrate, altered hydrology associated with anthropogenic activities and the effects of climate change, and water quality degradation. The poor habitat conditions and only a single individual found at this site more than a decade ago indicate a population that is unlikely to persist and may already be extirpated.

Upper/Middle San Saba River: The population of Texas fatmucket in the upper/middle San Saba River is currently moderately healthy. Most of the flows in the Upper San Saba River (in Menard County, Texas) are from Edwards Formation springs, where it gains streamflow from groundwater except for, and due to a change in the underlying geology, a reach that loses flow to the aquifer (called a losing reach) near the Menard/Mason County line (LBG-Guyton 2002, p. 3). It is in this losing reach where drought effects are especially noticeable, as some flows may percolate downward to the aquifer. Much of the middle San Saba River below Menard is reported to have gone dry for 10 of the last 16 years by landowners downstream of Menard (Carollo Engineers 2015, p. 2). Regardless of the cause, low flows in the San Saba River have resulted in significant stream drying, and stranded Central Texas mussels have been identified following dewatering as recently as 2015 near and below the losing reach (TPWD 2015, p. 3). During the 2011–2013 drought, stream flows in the San Saba River were critically low, such that several water rights in Schleicher, Menard, and McCulloch Counties were suspended by the Texas Commission on Environmental Quality (TCEQ). These very low flow events are expected to continue into the future and put the upper/middle San Saba River population of Texas fatmucket at risk of extirpation. Even if the locations of Texas fatmucket do not become dry, water quality degradation and increased sedimentation associated with low flows is expected.

Llano River: The Llano River population of Texas fatmucket is currently moderately healthy, although there has been limited evidence that the population is successfully reproducing, and collection of the species is frequent at this location. We expect flows to continue to decline and the frequency of extreme flow events to increase, leading to increased sedimentation and decreased water quality, and scour, and the population is expected to decline as a result.

Pedernales River: The population of Texas fatmucket in the Pedernales River is very small and isolated. The Pedernales River is a flashy system, which experiences extreme high flow events, especially in the lower reaches in the vicinity of Pedernales Falls State Park and below. Occasional, intense thunderstorms can dramatically increase streamflow and mobilize large amounts of silt and organic debris (LCRA 2017, p. 82). The continued increasing frequency of high flow events combined with the very low abundances in the river result in a population that is likely to be extirpated and currently is unhealthy.

Onion Creek: Only a single live individual of Texas fatmucket has been found in Onion Creek since 2010, and we consider this population to be functionally extirpated with little chance of persistence. The upper reaches of Onion Creek frequently go dry, and several privately owned low-head in-channel dams currently exist along upper and lower Onion Creek, which further provide barriers to fish passage and mussel dispersal, preventing recolonization after low water events. Onion Creek is in close proximity to the City of Austin, and continued development in the watershed is expected to continue to degrade habitat conditions.

Texas Fawnsfoot

There are seven remaining populations of Texas fawnsfoot, in the Trinity, Brazos, and Colorado River basins. Historically, Texas fawnsfoot occurred throughout each basin with populations connected by fish migration within each basin, but due to impoundments and low water conditions, they are currently isolated from one another, and repopulation of extirpated locations is unlikely to occur without human assistance. Four Texas fawnsfoot populations are moderately healthy, and three are unhealthy.

East Fork Trinity River: The Texas fawnsfoot population in the East Fork Trinity River occupies a small stream reach (12 mi (19 km)), making it especially vulnerable to a single stochastic event such as a spill or flood and changes to water quality. Further, no evidence of reproduction exists for this population. The population is expected to decline as a result of the lack of reproduction. This population is small and isolated from the middle and lower Trinity River population by unsuitable habitat affected primarily by altered hydrology as flows from the Dallas-Fort Worth metro area are too flashy to provide suitable habitat for Texas fawnsfoot. Therefore, this population is unhealthy.

Middle Trinity River: Texas fawnsfoot in the Trinity River have experienced improved water quality over the past 30 years due to advancements in wastewater treatment technology and facilities, and streamflows have been subsidized by return flows originating in part from other basins, although water quality degradation and sedimentation are still of concern. Additionally, the middle Trinity River is a relatively long and unobstructed reach of river. While habitat may decline, we expect the population of Texas fawnsfoot to persist in the middle Trinity River, as we expect that flows will remain within a normal range of environmental variation in this reach.

Clear Fork Brazos River: Texas fawnsfoot in the Clear Fork of the Brazos River is very small and isolated. This population likely experienced extensive mortality associated with prolonged dewatering during the 2011–2013 drought, combined with ambient water quality degradation associated with naturally occurring elevated salinity levels from the upper reaches of the river. This population is likely functionally extirpated, although more survey effort is needed to reach a definitive conclusion. Further, the proposed Cedar Ridge Reservoir, if constructed, will likely result in significant hydrologic alterations, all of which would not be expected to improve the overall condition of this population of Texas fawnsfoot.

Upper Brazos River: The population of Texas fawnsfoot in the Upper Brazos River is characterized by low abundances and lack of reproduction, and reduced flows associated with continued drought and upstream dam operations. Further, water quality degradation associated with naturally occurring salinity is expected to continue. This population is at risk of extirpation due to its small population size and continued poor habitat conditions.

Middle/Lower Brazos River: The population of Texas fawnsfoot in the middle and lower Brazos River occupies a fairly long reach of river (346 mi (557 km)) and exhibits evidence of reproduction. The lack of major impoundments and diversions in the Brazos River below Waco, Texas, benefits this population through maintenance of a relatively natural hydrological regime. Even so, Texas fawnsfoot surveys have yet to yield the species in numbers that would indicate a healthy population, and future habitat degradation from reduced flows, increased temperatures, and decreased water quality will likely reduce the resiliency of this population.

Lower San Saba: Texas fawnsfoot in the lower San Saba River are found in low abundance with little evidence of reproductive success and subsequent recruitment of new individuals to the population. Habitat factors are currently unhealthy overall, due primarily to degraded substrate conditions caused, in part, by reductions in flowing water over time due to a combination of increased water withdrawals and drought. We expect this population to become functionally extirpated due to lack of water and degradation of substrate.

Lower Colorado River: The Texas fawnsfoot population in the lower Colorado River is expected to remain extant under current conditions, as this reach is expected to remain wetted but flowing at reduced amounts that reduce available habitat. Despite increasing demands for municipal water, we expect that the lower Colorado River will continue to provide water associated with priority downstream agricultural and industrial water rights. Similar to the lower Brazos River population, the Lower Colorado River is vulnerable to reduced flows and associated habitat degradation, because the Texas fawnsfoot occurs in bank habitats that are likely to become exposed to desiccation, predation, and increased water temperatures as river elevations decline while the river still flows in its main channel. Over time, we expect flows in the lower Colorado River to be reduced, negatively affecting substrate quality and water quality (through increased sediment load and water temperature) such that reproduction and abundance are negatively affected, resulting in overall unhealthy population conditions.

Guadalupe Orb

There are two remaining populations of the Guadalupe orb, all in the Guadalupe River basin. Historically, Guadalupe orb likely occurred throughout the basin with populations connected by fish migration, but due to impoundments and low water conditions, they are currently isolated from one another, and repopulation of extirpated locations is unlikely to occur without human assistance. Both of the Guadalupe orb populations are moderately healthy.

Upper Guadalupe River: The Guadalupe orb population in the upper Guadalupe River occurs over approximately 95 river miles (153 river km), and water quantity and quality are in moderate condition. However, the population occurs in low numbers, and there appears to be a lack of reproduction; this population is unhealthy and is expected to become functionally extirpated in the near future. This stream reach is expected to be sensitive to potential changes in groundwater inputs to stream flow and thus is vulnerable to ongoing and future hydrological alterations that reduce flows during critical conditions, resulting in substrate quality degradations as well as water quality degradation.

San Marcos/Lower Guadalupe Rivers: In the San Marcos and Lower Guadalupe River, the Guadalupe orb population currently occupies a relatively long stream length, is observed in relatively high abundances, and exhibits evidence of reproduction. Significant spring complexes contribute substantially to baseflow during dry periods in this system and are expected to continue to contribute to baseflows for the next 50 years due to conservation measures implemented by the Edwards Aquifer Habitat Conservation Plan partners, bolstering the resiliency of this population. However, this population is subject to extreme high flow events that scour and mobilize the substrate, and water quality degradation and sedimentation are threats, putting it at risk of decline.

Texas Pimpleback

There are five remaining Texas pimpleback populations, all in the Colorado River basin. Historically, Texas pimpleback likely occurred throughout the basin with populations connected by fish migration, but due to impoundments and low water conditions, they are currently fragmented and isolated from one another and repopulation of extirpated locations is unlikely to occur without human assistance. Three of the remaining Texas pimpleback populations are unhealthy and are not reproducing, and two of the populations are moderately healthy.

CONCHO RIVER: The Texas pimpleback population in the Concho River is limited by very low levels of flowing water (including periods of almost complete dewatering), poor water quality, and poor substrate quality associated with excessive sedimentation. The drought of 2011–2013 resulted in extremely low flows in this river, and only one live adult has been found since that time. This population may currently be functionally extirpated.

Middle Colorado/Lower San Saba Rivers: The population of Texas pimpleback in the middle Colorado and lower San Saba River is the largest known. This population has relatively high abundance but little evidence of reproduction, so we expect this population to decline as old individuals die and very few young individuals are recruited into the reproducing population. The combination of reduced flows, degraded water quality, and substrate degradation will reduce the resiliency of this population and may cause it to become extirpated.

Upper San Saba River: Similar to other populations of Texas pimpleback, the population in the Upper San Saba River is currently unhealthy and does not appear to be reproducing. Regardless of the high risk of low water levels, the very small population size and lack of reproduction will likely result in the extirpation of this population. Because of the losing reach near Hext, Texas, that serves to separate the upper and lower San Saba River populations, along with differences in substrate, this population is isolated and no longer connected to the lower San Saba River population.

Llano River: The population of Texas pimpleback in the Llano River occupies a very short stream length, which is negatively affected by substrate degradation during periods of low flows. This population, due to ease of access to the location, is especially vulnerable to the threat of overcollection and vandalism. The small population size and frequency of low water levels, and flooding with scour, cause this population to be unhealthy.

Lower Colorado River: Currently, the population of Texas pimpleback in the lower Colorado River is relatively abundant over a long stream length. However, because the species is a riffle specialist, the Texas pimpleback is especially sensitive to hydrological alterations leading to both extreme drying (dewatering) during low flow events, and to extreme high flow events leading to scouring of substrate and movement of mature individuals to sites that may or may not be appropriate (as evidenced by the August 2017 scouring flood event that substantially degraded the quality of the Altair Riffle in the lower Colorado River, a formerly robust mussel bed). We expect this population to be at risk of extirpation due to these extreme flow events.

False Spike

Overall, there are four known remaining populations of false spike (see figure 6, above), comprising less than 10 percent of the species' known historical range. Historically, most false spike populations were likely connected by fish migration throughout each of the Brazos, Colorado, and Guadalupe river basins, but due to impoundments they are currently fragmented and isolated from one another and repopulation of extirpated locations is unlikely to occur without human assistance. Based on our analysis as described in the SSA Report, one population is moderately healthy, and three are unhealthy.

Little River and tributaries: The Little River population is considered to have low resiliency currently due to the small size of the population. Development in the watershed has reduced water quality and substrate conditions currently, and habitat factors are expected to continue to decline because of alterations to flows and water quality associated primarily with increasing development in the watershed as the Austin-Round Rock (Texas) metropolitan area continues to expand. Low water levels remain a concern that is mediated somewhat by the likelihood that enhanced return flows associated with the development and use of alternative water supplies will bolster base flows somewhat. The small size of the population combined with continued habitat degradation put this population at high risk of extirpation.

Lower San Saba River: The lower San Saba River population is currently small and isolated and therefore has low resiliency. The population has low abundance, and a lack of reproduction and subsequent recruitment, and we expect it to become functionally extirpated in the next 10 years. Future degradation of habitat factors is expected as flows continue to be diminished, most notably by altered precipitation patterns (that result in dewatering droughts and scouring floods) combined with enhanced evaporative demands and anthropogenic withdrawals to support existing and future demands for municipal and agricultural water.

Llano River: The Llano River population is currently very small and isolated and therefore has low resiliency. The population occupies an extremely small area, and degradation of habitat is expected to continue as flows continue to decline due to altered precipitation patterns (dewatering droughts and scouring floods) combined with enhanced evaporative demands and anthropogenic withdrawals to support existing and future demands for municipal and agricultural water. Further, this population is well known and easy to access and therefore has experienced high collection pressure in recent years, and the population has not shown recent evidence of reproduction. Therefore, we expect the population to become extirpated.

Lower Guadalupe River: The lower Guadalupe River population of false spike is the largest population of the species and the most resilient. This population has fairly high abundance over a long reach, and flow protections afforded by the Edwards Aquifer Habitat Conservation Plan have contributed substantially to the resiliency of this population by sustaining base flows above critical levels. However, despite these base flow protections, this population remains vulnerable to changes in water quality, sedimentation, and extreme high flow events, such as from hurricanes or other strong storms, which scour and deplete mussel beds (Strayer 1999, pp. 468–469). Overall, this population is moderately healthy.

We note that, by using the SSA framework to guide our analysis of the scientific information documented in the SSA report, we have not only analyzed individual effects on the species, but we have also analyzed their potential cumulative effects. We incorporate the cumulative effects into our SSA analysis when we characterize the current and future condition of the species. Our assessment of the current and future conditions encompasses and incorporates the threats individually and cumulatively. Our current and future condition assessment is iterative because it accumulates and evaluates the effects of all the factors that may be influencing the species, including threats and conservation efforts. Because the SSA framework considers not just the presence of the factors, but to what degree they collectively influence risk to the entire species, our assessment integrates the cumulative effects of the factors and replaces a standalone cumulative effects analysis.

Determination of Status

Section 4 of the Act (16 U.S.C. 1533) and its implementing regulations (50 CFR part 424) set forth the procedures for determining whether a species meets the definition of ''endangered species'' or ''threatened species.'' The Act defines an ''endangered species'' as a species that is ''in danger of extinction throughout all or a significant portion of its range,'' and a ''threatened species'' as a species that is ''likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.'' The Act requires that we determine whether a species meets the definition of ''endangered species'' or ''threatened species'' because of any of the following factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) Overutilization for commercial, recreational, scientific, or educational purposes; (C) Disease or predation; (D) The inadequacy of existing regulatory mechanisms; or (E) Other natural or manmade factors affecting its continued existence.

Status Throughout All of Its Range

After evaluating threats to the six Central Texas mussel species and assessing the cumulative effect of the threats under the section 4(a)(1) factors, we found that all six species of Central Texas mussels have declined significantly in overall distribution and abundance. At present, most of the known populations exist in very low abundances and show limited evidence of recruitment. Furthermore, existing available habitats are reduced in quality and quantity, relative to historical conditions. Our analysis revealed five primary threats that caused these declines and pose a meaningful risk to the viability of the species. These threats are primarily related to habitat changes (Factor A from the Act): The accumulation of fine sediments, altered hydrology, and impairment of water quality, all of which are exacerbated by the effects of climate change. Predation and collection (Factor C) are also affecting those populations already experiencing low stream flow, and barriers to fish movement (Factor E) limit dispersal and prevent recolonization after stochastic events.

Because of historic and ongoing habitat destruction and fragmentation, remaining Central Texas mussel populations are now fragmented and isolated from one another, interrupting the once functional metapopulation dynamic that historically made mussel populations robust and very resilient to change. The existing fragmented and isolated mussel populations are largely in a state of chronic degradation due to a number of historical and ongoing stressors affecting flows, water quality, sedimentation, and substrate quality. Given the high risk of catastrophic events including droughts and floods, both of which are exacerbated by climate change, many Central Texas mussel populations are at a high risk of extirpation.

Beginning around the turn of the twentieth century until 1970, over 100 major dams had been constructed, creating reservoirs across Texas, including several reservoirs in the Brazos and Trinity basins, the chain of Highland Lakes on the Lower Colorado River, the Guadalupe Valley Hydroelectric Project, and the Canyon Reservoir on the Guadalupe River (Dowell 1964, pp. 3–8). The inundation and subsequent altered hydrology and sediment dynamics associated with operation of these flood-control, hydropower, and municipal water supply reservoirs have resulted in irreversible changes to the natural flow regime of these rivers. These changes have re-shaped and fragmented these aquatic ecosystems and fish and invertebrate communities, including populations of the six species of Central Texas mussels, which all depend on natural river flows.

Water quality has benefited from dramatically improved wastewater treatment technology in recent years, such that fish populations have rebounded but not completely recovered (Perkin and Bonner 2016, p. 97). However, water quality degradation continues to affect mussels and their habitats, especially as low flow conditions and excessive sedimentation interact to diminish instream habitats, and substrate-mobilizing and mussel-scouring flood events have become more extreme and perhaps more frequent.

Additionally, while host fish may still be adequately represented in contemporary fish assemblages, access to fish hosts can be reduced during critical reproductive times by barriers such as the many low-water crossings and low-head dams that now exist and fragment the landscape. Diminished access to host fish leads to reduced reproductive success just as barriers to fish passage impede the movement of fish, and thus compromise the ability of mussels to disperse and colonize new habitats following a disturbance (Schwalb *et al.* 2013, p. 447).

Populations of each of the six Central Texas mussels face risks from declining water quantity in both large and small river segments. Low flows lead to dewatering of habitats and desiccation of individuals, elevated water temperatures, and other quality degradations, as well as increased exposure to predation. Future higher air temperatures, higher rates of evaporation and transpiration, and changing precipitation patterns are expected in central Texas (Jiang and Yang 2012, pp. 234–239, 242). Future climate changes are expected to lead to human responses, such as increased groundwater pumping and surface water diversions, associated with increasing demands for and decreasing availability of freshwater resources in the State (reviewed in Banner *et al.* 2010, entire). Finally, direct mortality due to predation and collection further limits population sizes of those populations already experiencing the stressors discussed above.

These threats, alone or in combination, are expected to cause the extirpation of additional mussel populations, further reducing the overall redundancy and representation of each of the six species of Central Texas mussels. Historically, each species, with a large range of interconnected populations (*i.e.,* having metapopulation dynamics), would have been resilient to stochastic events such as drought, excessive sedimentation, and scouring floods because even if some locations were extirpated by such events, they could be recolonized over time by dispersal from nearby survivors and facilitated by movements by ''affiliate species'' of host fish (Douda *et al.* 2012, p. 536). This connectivity across potential habitats would have made for highly resilient species overall, as evidenced by the long and successful evolutionary history of freshwater mussels as a taxonomic group, and in

North America in particular. However, under present circumstances, restoration of that connectivity on a regional scale is not feasible. As a consequence of these current conditions, the viability of the six species of Central Texas mussels now primarily depends on maintaining and improving the remaining isolated populations and potentially restoring new populations where feasible.

Guadalupe Fatmucket

The Guadalupe fatmucket has only one remaining population, and very few individuals have been detected and reported in recent years. The upper Guadalupe River in this reach already experiences very low water levels, putting this population at high risk of extirpation. The species has very low viability, with a single population at high risk of extirpation, and no additional representation or redundancy. Our analysis of the species' current and future conditions, as well as the conservation efforts discussed above, show that the Guadalupe fatmucket is in danger of extinction throughout all of its range due to the severity and immediacy of threats currently impacting the species.

Texas Fatmucket

Of the five remaining fragmented and isolated populations of Texas fatmucket, two are small in abundance and occupied stream length and have low to no resiliency (unhealthy), and one population is functionally extirpated. The other two current populations are moderately healthy. The upper/middle San Saba and Llano River populations are larger, with increased abundance and occupied stream length, but these populations are vulnerable to stream drying and overcollection. These very low flow events are expected to continue into the future, and both of these populations of Texas fatmucket are at risk of extirpation. Even if the locations of Texas fatmucket do not become dry, water quality degradation and increased sedimentation associated with low flows is expected. Additionally, the Llano River population does not appear to be successfully reproducing, further increasing the species' risk of extirpation at this location. The Texas fatmucket has no populations that are currently considered healthy. Loss of populations at high risk of extirpation leads to low levels of redundancy and representation. Overall, these low levels of resiliency, redundancy, and representation result in the Texas fatmucket having low viability, and the species currently faces a high risk of extinction. Our analysis of the species' current and future conditions shows that the Texas fatmucket is in danger of extinction throughout all of its range due to the severity and immediacy of threats currently impacting the species.

Texas Fawnsfoot

Seven populations of Texas fawnsfoot remain. Four populations are moderately healthy, and three are unhealthy or are functionally extirpated. Currently, two of the moderately healthy populations are not subject to flow declines similar to the remaining populations of this species, due to increased flow returns in the Trinity River from wastewater treatment facilities and a lack of impoundments on the mainstem of the lower Brazos River. In the future, however, as extreme flow events become more frequent as rainfall patterns change, and increased urbanization results in reduced groundwater levels, we expect even these populations to be at an increased risk of extirpation. Within 25 to 50 years, even under the best conditions and with additional conservation efforts undertaken, given the ongoing effects of climate change and human activities on altered hydrology and habitat degradation, we expect only one population to be in healthy condition, one population to remain in moderately healthy condition, four populations to be in unhealthy condition, and one population to become functionally extirpated. Given the likelihood of increased climate and anthropogenic effects in the foreseeable future, as many as five populations are expected to become functionally extirpated, leaving no more than three unhealthy populations remaining after 50 years. In the future, we anticipate that the Texas fawnsfoot will have reduced viability, with no highly resilient populations and limited representation and redundancy. Thus, after assessing the best available information, we determine that the Texas fawnsfoot is not currently in danger of extinction but is likely to become in danger of extinction within the foreseeable future throughout all of its range.

Guadalupe Orb

Only two fragmented and isolated populations of Guadalupe orb remain, and one of these populations is functionally extirpated. The San Marcos/Lower Guadalupe River population is more resilient but is at risk of catastrophic events, such as hurricane flooding, that can scour and reduce the abundance and distribution of this population. The Guadalupe orb has no populations that are considered healthy. Loss of populations at high risk of extirpation leads to low levels of redundancy and representation, and results in overall low viability. The Guadalupe orb currently faces a high risk of extinction. Our analysis of the species' current and future conditions, as well as the conservation efforts discussed above, show that the Guadalupe orb is in danger of extinction throughout all of its range due to the severity and immediacy of threats currently impacting the species.

Texas Pimpleback

Of the five remaining Texas pimpleback populations, three are unhealthy and are not reproducing, and two are moderately healthy. The populations that are not reproducing are considered functionally extirpated, and the two moderately healthy populations are expected to continue to decline. The population in the middle Colorado and lower San Saba Rivers has very little evidence of reproduction and is therefore likely to decline due to a lack of young individuals joining the population as the population ages. The lower Colorado River population has very recently experienced an extreme high flow event (*i.e.,* associated with Hurricane Harvey flooding in August and September of 2017) that vastly changed the substrate and mussel composition of much of its length, putting this population at high risk of extirpation. The Texas pimpleback has no healthy populations, and all populations are expected to continue to decline. Loss of populations at high risk of extirpation leads to low levels of redundancy and representation. Overall, these low levels of resiliency, redundancy, and representation result in the Texas pimpleback having low viability, and the species currently faces a high risk of extinction. Our analysis of the species' current and future conditions, as well as the conservation efforts discussed above, show that the Texas pimpleback is in danger of extinction throughout all of its range due to the severity and immediacy of threats currently impacting the species.

False Spike

Of the four remaining fragmented and isolated populations of false spike, three are small in abundance and occupied stream length, having low to no resiliency. The remaining lower Guadalupe River population is larger, with increased abundance and occupied stream length; however, the risk of extreme high flow events in this reach is high. Therefore, the false spike has no populations that are currently considered healthy (*i.e.,* highly resilient). Loss of populations at high risk of extirpation leads to low levels of redundancy (few populations will persist to withstand catastrophic events) and representation (little to no ecological or genetic diversity will persist to respond to changing environmental conditions). The threats identified above are occurring now and are expected to continue into the future. Overall, these low levels of resiliency, redundancy, and representation result in the false spike having low viability, and the species currently faces a high risk of extinction. Our analysis of the species' current and future conditions demonstrate that the false spike is in danger of extinction throughout all of its range due to the severity and immediacy of threats currently impacting the species.

Summary of Status Throughout All of Its Range: Guadalupe Fatmucket, Texas Fatmucket, Guadalupe Orb, Texas Pimpleback, and False Spike

Our analysis of the species' current and future conditions, as well as the conservation efforts discussed above, show that the Guadalupe fatmucket, Texas fatmucket, Guadalupe orb, Texas pimpleback, and false spike are in danger of extinction throughout all their ranges due to the severity and immediacy of threats currently impacting their populations. The risk of extinction is high because the remaining fragmented populations have a high risk of extirpation, are isolated, and have limited potential for recolonization. We find that a threatened species status is not appropriate for Guadalupe fatmucket, Texas fatmucket, Guadalupe orb, Texas pimpleback, and false spike because of their currently contracted ranges, because all populations are fragmented and isolated from one another, because the threats are occurring across the entire range of these species, and because the threats are ongoing currently and are expected to continue or worsen into the future. Because these species are already in danger of extinction throughout their ranges, a threatened status is not appropriate.

Summary of Status Throughout All of Its Range: Texas Fawnsfoot

After evaluating threats to the species and assessing the cumulative effect of the threats under the section 4(a)(1) factors, we find that that Texas fawnsfoot populations will continue to decline over the next 25 years so that this species is likely to become in danger of extinction throughout all or a significant portion of its range within the foreseeable future due to increased frequency of drought and extremely high flow events, decreased water quality, and decreased substrate suitability. We considered whether the Texas fawnsfoot is presently in danger of extinction and determined that endangered status is not appropriate. The current conditions as assessed in the SSA report show two of the populations in two of the representative units are not currently subject to declining flows or extreme flow events. While threats are currently acting on the species and many of those threats are expected to continue into the future, we did not find that the species is currently in danger of extinction throughout all of its range. According to our assessment of plausible future scenarios in the SSA report, the species is likely to become an endangered species in the foreseeable future of 25 years throughout all of its range. Twenty-five years encompasses about 5 generations of the Texas fawnsfoot; additionally, models of human demand for water (Texas Water Development Board 2017, p. 30) and climate change (*e.g.,* Kinniburgh *et al.* 2015, p. 83) project decreased water availability over 25 and 50 years, respectively. As a result, we expect increased incidences of low flows followed by scour events as well as persistent decreased water quality to be occurring in 25 years. Thus, after assessing the best available information, we determine that the Texas fawnsfoot is not currently in danger of extinction but is likely to become in danger of extinction within the foreseeable future throughout all of its range.

Status Throughout a Significant Portion of Its Range: Guadalupe Fatmucket, Texas Fatmucket, Guadalupe Orb, Texas Pimpleback, and False Spike

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so in the foreseeable future throughout all or a significant portion of its range. We have determined that the Guadalupe fatmucket, Texas fatmucket, Guadalupe orb, Texas pimpleback, and false spike are in danger of extinction throughout all of their ranges, and accordingly did not undertake an analysis of whether there are any significant portions of these species' ranges. Because the Guadalupe fatmucket, Texas fatmucket, Guadalupe orb, Texas pimpleback, and false spike warrant listing as endangered throughout all of their ranges, our determination is consistent with the decision in *Center for Biological Diversity* v. *Everson,* 2020 WL 437289 (D.D.C. Jan. 28, 2020), in which the court vacated the aspect of the 2014 Significant Portion of its Range Policy that provided the Services do not undertake an analysis of significant portions of a species' range if the species warrants listing as threatened throughout all of its range.

Status Throughout a Significant Portion of Its Range: Texas Fawnsfoot

Under the Act and our implementing regulations, a species may warrant listing if it is in danger of extinction or likely to become so within the foreseeable future throughout all or a significant portion of its range. The court in *Center for Biological Diversity* v. *Everson,* 2020 WL 437289 (D.D.C. Jan. 28, 2020) (*Center for Biological Diversity*), vacated the aspect of the 2014 Significant Portion of its Range Policy that provided that the Services do not undertake an analysis of significant portions of a species' range if the species warrants listing as threatened throughout all of its range. Therefore, we proceed to evaluating whether the species is endangered in a significant portion of its range—that is, whether there is any portion of the species' range for which both (1) the portion is significant; and, (2) the species is in danger of extinction in that portion. Depending on the case, it might be more efficient for us to address the ''significance'' question or the ''status'' question first. We can choose to address either question first. Regardless of which question we address first, if we reach a negative answer with respect to the first question that we address, we do not need to evaluate the other question for that portion of the species' range.

Following the court's holding in *Center for Biological Diversity,* we now consider whether there are any significant portions of the species' range where the species is in danger of extinction now (*i.e.,* endangered). In undertaking this analysis for the Texas fawnsfoot, we choose to address the status question first—we consider information pertaining to the geographic distribution of both the species and the threats that the species faces to identify any portions of the range where the species is endangered.

We considered whether any of the threats acting on the species are geographically concentrated in any portion of the range at a biologically meaningful scale. We examined the following threats throughout the range of the species: The accumulation of fine sediments, altered hydrology, and impairment of water quality (Factor A); predation and collection (Factor C); and barriers to fish movement (Factor E).

We identified a portion of the range of Texas fawnsfoot, the upper Brazos

River (including the populations in the Upper Brazos River and Clear Fork Brazos River), that is experiencing a concentration of the following threats: Altered hydrology and impaired water quality. Although these threats are not unique to this area, they are acting at a greater intensity here (*e.g.,* populations higher in the watershed and that receive less rainfall are more vulnerable to stream drying because there is a smaller volume of water in the river), either individually or in combination, than elsewhere in the range. In addition, the small sizes of each population, coupled with the current condition information in the SSA report suggesting the two populations in this area are unhealthy, leads us to find that this portion provides substantial information indicating the populations occurring here *may* be in danger of extinction now.

We then proceeded to the significance question, asking whether there is substantial information indicating that this portion of the range (*i.e.,* the Upper Brazos River and Clear Fork Brazos River) *may* be significant. As an initial note, the Service's most recent definition of ''significant'' within agency policy guidance has been invalidated by court order (see *Desert Survivors* v. *Dep't of the Interior,* No. 16–cv–01165 (N.D. Cal. Aug. 24, 2018)). In undertaking this analysis for the Texas fawnsfoot, we considered whether the Upper Brazos River portion of the species' range may be significant based on its biological importance to the overall viability of the Texas fawnsfoot. Therefore, for the purposes of this analysis, when considering whether this portion may be biologically significant, we considered whether the portion may (1) occur in a unique habitat or ecoregion for the species, (2) contain high quality or high value habitat relative to the remaining portions of the range, for the species' continued viability in light of the existing threats, or (3) contain habitat that is essential to a specific life-history function for the species and that is not found in the other portions (for example, the principal breeding ground for the species).

We evaluated the available information about the portion of the range of Texas fawnsfoot that occupies the upper Brazos River in this context, assessing its biological significance in terms of these three habitat criteria, and determined the information did not substantially indicate it may be significant. Texas fawnsfoot in these populations exhibit similar habitat and host fish use to Texas fawnsfoot in the remainder of its range; thus, there is no unique observable environmental usage or behavioral characteristics attributable to just this area's populations. The Upper Brazos River is not essential to any specific life-history function of the Texas fawnsfoot that is not found elsewhere in the range. Further, the habitat in the Upper Brazos River does not contain higher quality or higher value than the remainder of the species' range. The Upper Brazos River populations have a small number of individuals compared to most of the other populations throughout the range of Texas fawnsfoot (see Table 4, above). The Clear Fork Brazos River population may already be extirpated, and the Upper Brazos River population had 23 individuals found in 2017. These populations do not interact with other populations of the species.

Overall, we found no substantial information that would indicate the Upper Brazos River may be significant. While this area provides some contribution to the species' overall ability to withstand catastrophic or stochastic events (redundancy and resiliency, respectively), the species has a larger population that occupies a larger area downstream in the Brazos River. The best scientific and commercial information available indicates that the Upper Brazos River population's contribution is very limited in scope due to the small population sizes and isolation from other populations. Therefore, because we could not answer both the status and significance questions in the affirmative, we conclude that the Upper Brazos River portion of the range does not warrant further consideration as a significant portion of the range.

We did not identify any portions of the Texas fawnsfoot's range where: (1) The portion is significant; and, (2) the species is in danger of extinction in that portion. Therefore, we conclude that the Texas fawnsfoot is likely to become in danger of extinction within the foreseeable future throughout all of its range. This is consistent with the courts' holdings in *Desert Survivors* v. *Department of the Interior,* No. 16-cv–01165–JCS, 2018 WL 4053447 (N.D. Cal. Aug. 24, 2018), and *Center for Biological Diversity* v. *Jewell,* 248 F. Supp. 3d, 946, 959 (D. Ariz. 2017).

Determination of Status: Guadalupe Fatmucket, Texas Fatmucket, Guadalupe Orb, Texas Pimpleback, and False Spike

Our review of the best available scientific and commercial information indicates that the Guadalupe fatmucket, Texas fatmucket, Guadalupe orb, Texas pimpleback, and false spike meet the definition of endangered species. Therefore, we propose to list the Guadalupe fatmucket, Texas fatmucket, Guadalupe orb, Texas pimpleback, and false spike as endangered species in accordance with sections 3(6) and 4(a)(1) of the Act.

Determination of Status: Texas Fawnsfoot

Our review of the best available scientific and commercial information indicates that the Texas fawnsfoot meets the definition of a threatened species. Therefore, we propose to list the Texas fawnsfoot as a threatened species in accordance with sections 3(20) and 4(a)(1) of the Act.

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened species under the Act include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing results in public awareness, and conservation by Federal, State, tribal, and local agencies, private organizations, and individuals. The Act encourages cooperation with the States and other countries and calls for recovery actions to be carried out for listed species. The protection required by Federal agencies and the prohibitions against certain activities are discussed, in part, below.

The primary purpose of the Act is the conservation of endangered and threatened species and the ecosystems upon which they depend. The ultimate goal of such conservation efforts is the recovery of these listed species, so that they no longer need the protective measures of the Act. Section 4(f) of the Act calls for the Service to develop and implement recovery plans for the conservation of endangered and threatened species. The recovery planning process involves the identification of actions that are necessary to halt or reverse species' decline by addressing the threats to survival and recovery. The goal of this process is to restore listed species to a point where they are secure, self-sustaining, and functioning components of their ecosystems.

Recovery planning consists of preparing draft and final recovery plans, beginning with the development of a recovery outline and making it available to the public within 30 days of a final listing determination. The recovery outline guides the immediate implementation of urgent recovery actions and describes the process to be used to develop a recovery plan. Revisions of the plan may be done to address continuing or new threats to the species, as new substantive information becomes available. The recovery plan also identifies recovery criteria for review of when a species may be ready for reclassification from endangered to threatened (''downlisting'') or removal from protected status (''delisting''), and methods for monitoring recovery progress. Recovery plans also establish a framework for agencies to coordinate their recovery efforts and provide estimates of the cost of implementing recovery tasks. Recovery teams (composed of species experts, Federal and State agencies, nongovernmental organizations, and stakeholders) are often established to develop recovery plans. When completed, the recovery outline, draft recovery plan, and the final recovery plan will be available on our website (*http://www.fws.gov/endangered*).

Implementation of recovery actions generally requires the participation of a broad range of partners, including other Federal agencies, States, Tribes, nongovernmental organizations, businesses, and private landowners. Examples of recovery actions include habitat restoration (*e.g.,* restoration of native vegetation), research, captive propagation and reintroduction, and outreach and education. The recovery of many listed species cannot be accomplished solely on Federal lands because their range may occur primarily or solely on non-Federal lands. To achieve recovery of these species requires cooperative conservation efforts on private, State, and tribal lands.

If these species are listed, funding for recovery actions will be available from a variety of sources, including Federal budgets, State programs, and cost-share grants for non-Federal landowners, the academic community, and nongovernmental organizations. In addition, pursuant to section 6 of the Act, the State of Texas would be eligible for Federal funds to implement management actions that promote the protection or recovery of the Central Texas mussels. Information on our grant programs that are available to aid species recovery can be found at: *http://www.fws.gov/grants.*

Although the Central Texas mussels are only proposed for listing under the Act at this time, please let us know if you are interested in participating in recovery efforts for these species. Additionally, we invite you to submit any new information on this species whenever it becomes available and any information you may have for recovery planning purposes (see **FOR FURTHER INFORMATION CONTACT**).

Section 7(a) of the Act requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as an endangered or threatened species and with respect to its critical habitat, if any is designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR part 402. Section 7(a)(4) of the Act requires Federal agencies to confer with the Service on any action that is likely to jeopardize the continued existence of a species proposed for listing or result in destruction or adverse modification of proposed critical habitat. If a species is listed subsequently, section 7(a)(2) of the Act requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of the species or destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into consultation with the Service.

Federal agency actions within the species' habitat that may require conference or consultation or both as described in the preceding paragraph include management and any other landscape-altering activities on Federal lands administered by the National Park Service.

The Act and its implementing regulations set forth a series of general prohibitions and exceptions that apply to endangered wildlife. The prohibitions of section 9(a)(1) of the Act, codified at 50 CFR 17.21, make it illegal for any person subject to the jurisdiction of the United States to take (which includes harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect; or to attempt any of these) endangered wildlife within the United States or on the high seas. In addition, it is unlawful to import; export; deliver, receive, carry, transport, or ship in interstate or foreign commerce in the course of commercial activity; or sell or offer for sale in interstate or foreign commerce any species listed as an endangered species. It is also illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been taken illegally. Certain exceptions apply to employees of the Service, the National Marine Fisheries Service, other Federal land management agencies, and State conservation agencies.

We may issue permits to carry out otherwise prohibited activities involving endangered wildlife under certain circumstances. Regulations governing permits are codified at 50 CFR 17.22. With regard to endangered wildlife, a permit may be issued for the following purposes: For scientific purposes, to enhance the propagation or survival of the species, and for incidental take in connection with otherwise lawful activities. There are also certain statutory exemptions from the prohibitions, which are found in sections 9 and 10 of the Act.

It is our policy, as published in the **Federal Register** on July 1, 1994 (59 FR 34272), to identify to the maximum extent practicable at the time a species is listed, those activities that would or would not constitute a violation of section 9 of the Act. The intent of this policy is to increase public awareness of the effect of a proposed listing on proposed and ongoing activities within the range of the species proposed for listing. The discussion below regarding protective regulations under section 4(d) of the Act for the Texas fawnsfoot complies with our policy.

Based on the best available information, the following actions are unlikely to result in a violation of section 9, if these activities are carried out in accordance with existing regulations and permit requirements; this list is not comprehensive:

(1) Normal agricultural and silvicultural practices, including herbicide and pesticide use, which are carried out in accordance with any existing regulations, permit and label requirements, and best management practices; and,

(2) Normal residential landscape activities.

Based on the best available information, the following activities may potentially result in a violation of section 9 of the Act if they are not authorized in accordance with applicable law; this list is not comprehensive:

(1) Unauthorized handling or collecting of the species;

(2) Modification of the channel or water flow of any stream in which the Central Texas mussels are known to occur;

(3) Livestock grazing that results in direct or indirect destruction of stream habitat; and

(4) Discharge of chemicals or fill material into any waters in which the Central Texas mussels are known to occur.

Questions regarding whether specific activities would constitute a violation of section 9 of the Act should be directed to the Austin Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

II. Proposed Rule Issued Under Section 4(d) of the Act

Background

Section 4(d) of the Act contains two sentences. The first sentence states that the ''Secretary shall issue such regulations as he deems necessary and advisable to provide for the conservation'' of species listed as threatened. The U.S. Supreme Court has noted that statutory language like ''necessary and advisable'' demonstrates a large degree of deference to the agency (see *Webster* v. *Doe,* 486 U.S. 592 (1988)). Conservation is defined in the Act to mean ''the use of all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to [the Act] are no longer necessary.'' Additionally, the second sentence of section 4(d) of the Act states that the Secretary ''may by regulation prohibit with respect to any threatened species any act prohibited under section 9(a)(1), in the case of fish or wildlife, or section 9(a)(2), in the case of plants.'' Thus, the combination of the two sentences of section 4(d) provides the Secretary with wide latitude of discretion to select and promulgate appropriate regulations tailored to the specific conservation needs of the threatened species. The second sentence grants particularly broad discretion to the Service when adopting the prohibitions under section 9.

The courts have recognized the extent of the Secretary's discretion under this standard to develop rules that are appropriate for the conservation of a species. For example, courts have upheld rules developed under section 4(d) as a valid exercise of agency authority where they prohibited take of threatened wildlife, or include a limited taking prohibition (see *Alsea Valley Alliance* v. *Lautenbacher,* 2007 U.S. Dist. Lexis 60203 (D. Or. 2007); *Washington Environmental Council* v. *National Marine Fisheries Service,* 2002 U.S. Dist. Lexis 5432 (W.D. Wash. 2002)). Courts have also upheld 4(d) rules that do not address all of the threats a species faces (*see State of Louisiana* v. *Verity,* 853 F.2d 322 (5th Cir. 1988)). As noted in the legislative history when the Act was initially enacted, ''once an animal is on the threatened list, the Secretary has an almost infinite number of options available to him with regard to the permitted activities for those species. He may, for example, permit taking, but not importation of such species, or he may choose to forbid both taking and importation but allow the transportation of such species'' (H.R. Rep. No. 412, 93rd Cong., 1st Sess. 1973).

Exercising its authority under section 4(d), the Service has developed a proposed rule that is designed to address the Texas fawnsfoot's specific threats and conservation needs. Although the statute does not require the Service to make a ''necessary and advisable'' finding with respect to the adoption of specific prohibitions under section 9, we find that this rule as a whole satisfies the requirement in section 4(d) of the Act to issue regulations deemed necessary and advisable to provide for the conservation of the Texas fawnsfoot. As discussed in the Summary of Biological Status and Threats section, the Service has concluded that the Texas fawnsfoot is likely to become in danger of extinction within the foreseeable future primarily due to habitat changes such as the accumulation of fine sediments, altered hydrology, and impairment of water quality, predation and collection, and barriers to fish movement. The provisions of this proposed 4(d) rule would promote conservation of the Texas fawnsfoot by encouraging riparian landscape conservation while also meeting the conservation needs of Texas fawnsfoot. By streamlining those projects that follow best management practices and improve instream habitat (such as streambank stabilization, instream channel restoration, and upland restoration that improves instream habitat), conservation is more likely to occur for Texas fawnsfoot, improving the condition of populations in those reaches. The provisions of this proposed rule are one of many tools that the Service would use to promote the conservation of the Texas fawnsfoot. This proposed 4(d) rule would apply only if and when the Service makes final the listing of the Texas fawnsfoot as a threatened species.

Provisions of the Proposed 4(d) Rule

This proposed 4(d) rule would provide for the conservation of the Texas fawnsfoot by prohibiting the following activities, except as otherwise authorized or permitted: Take, possession, and import/export of unlawfully taken specimens.

As discussed in the Summary of Biological Status and Threats (above), habitat loss, predation and collection, and barriers to fish movement are affecting the status of the Texas fawnsfoot. A range of activities have the potential to impact the Texas fawnsfoot, including: Instream construction, water withdrawals, flow releases from upstream dams, riparian vegetation removal, improper handling, and wastewater treatment facility outflows. Regulating these activities will help preserve the species' remaining populations, slow their rate of decline, and decrease synergistic, negative effects from other stressors.

Under the Act, ''take'' means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Some of these provisions have been further defined in regulation at 50 CFR 17.3. Take can result knowingly or otherwise, by direct and indirect impacts, intentionally or incidentally. Regulating incidental and intentional take will help preserve the species' remaining populations, slow their rate of decline, and decrease synergistic, negative effects from other stressors.

We have identified some exceptions to the prohibition on incidental and intentional take. Those exceptions include the following activities:

(1) Channel restoration projects that create natural, physically stable (streambanks and substrate remaining relatively unchanging over time), ecologically functioning streams or stream and wetland systems (containing an assemblage of fish, mussels, other invertebrates, and plants) that are reconnected with their groundwater aquifers. These projects can be accomplished using a variety of methods, but the desired outcome is a natural channel with low shear stress (force of water moving against the channel); bank heights that enable reconnection to the floodplain; a reconnection of surface and groundwater systems, resulting in perennial flows in the channel; riffles and pools composed of existing soil, rock, and wood instead of large imported materials; low compaction of soils within adjacent riparian areas; and inclusion of riparian wetlands and woodland buffers. This exception to the proposed 4(d) rule for incidental take would promote conservation of Texas fawnsfoot by creating stable stream channels that are less likely to scour during high flow events, thereby increasing population resiliency.

(2) Bioengineering methods such as streambank stabilization using live stakes (live, vegetative cuttings inserted or tamped into the ground in a manner that allows the stake to take root and grow), live fascines (live branch cuttings, usually willows, bound together into long, cigar-shaped bundles), or brush layering (cuttings or branches of easily rooted tree species layered between successive lifts of soil fill). These methods would not include the sole use of quarried rock (rip-rap) or the use of rock baskets or gabion

structures. In addition, to reduce streambank erosion and sedimentation into the stream, work using these bioengineering methods would be performed at base flow or low water conditions and when significant rainfall is not predicted. Further, streambank stabilization projects must keep all equipment out of the stream channels and water. Similar to channel restoration projects, this exception to the proposed 4(d) rule for incidental take would promote conservation of Texas fawnsfoot by creating stable stream channels that are less likely to scour during high flow events, thereby increasing population resiliency.

(3) Soil and water conservation practices and riparian and adjacent upland habitat management activities that restore instream habitats for the species, restore adjacent riparian habitats that enhance stream habitats for the species, stabilize degraded and eroding stream banks to limit sedimentation and scour of the species' habitats, and restore or enhance nearby upland habitats to limit sedimentation of the species' habitats and comply with conservation practice standards and specifications and technical guidelines developed by the Natural Resources Conservation Service (NRCS) and available in the Field Office Technical Guide (FOTG). Soil and water conservation practices and aquatic species habitat restoration projects associated with NRCS conservation plans are designed to improve water quality and enhance fish and aquatic species habitats. This exception to the proposed 4(d) rule for incidental take would promote conservation of Texas fawnsfoot by creating stable stream channels and reducing sediment inputs to the stream, thereby increasing population resiliency.

(4) Presence or abundance surveys for Texas fawnfoot conducted by individuals who successfully complete and show proficiency by passing the end-of-course test with a score equal to or greater than 90 percent, with 100 percent accuracy in identification of mussel species listed under the Endangered Species Act, in an approved freshwater mussel identification and sampling course (specific to the species and basins in which the Texas fawnsfoot is known to occur), such as that administered by the Service, State wildlife agency, or qualified university experts. Those individuals exercising this exemption should provide reports to the Service annually on number, specific location (*e.g.* GPS coordinates), and date of encounter. This exemption does not apply if lethal take or collection is anticipated. This exemption only applies for 5 years from the date of successful completion of the course. This provision of the 4(d) rule for intentional take would promote conservation of Texas fawnsfoot by ensuring surveyors are proficient at identification of freshwater mussels and would add to the knowledge and understanding of the distribution of Texas fawnsfoot populations.

We may issue permits to carry out otherwise prohibited activities, including those described above, involving threatened wildlife under certain circumstances. Regulations governing permits are codified at 50 CFR 17.32. With regard to threatened wildlife, a permit may be issued for the following purposes: Scientific purposes, to enhance propagation or survival, for economic hardship, for zoological exhibition, for educational purposes, for incidental taking, or for special purposes consistent with the purposes of the Act. There are also certain statutory exemptions from the prohibitions, which are found in sections 9 and 10 of the Act.

The Service recognizes the special and unique relationship with our State natural resource agency partners in contributing to conservation of listed species. State agencies often possess scientific data and valuable expertise on the status and distribution of endangered, threatened, and candidate species of wildlife and plants. State agencies, because of their authorities and their close working relationships with local governments and landowners, are in a unique position to assist the Services in implementing all aspects of the Act. In this regard, section 6 of the Act provides that the Services shall cooperate to the maximum extent practicable with the States in carrying out programs authorized by the Act. Therefore, any qualified employee or agent of a State conservation agency that is a party to a cooperative agreement with the Service in accordance with section 6(c) of the Act, who is designated by his or her agency for such purposes, will be able to conduct activities designed to conserve Texas fawnsfoot that may result in otherwise prohibited take without additional authorization.

Nothing in this proposed 4(d) rule would change in any way the recovery planning provisions of section 4(f) of the Act, the consultation requirements under section 7 of the Act, or the ability of the Service to enter into partnerships for the management and protection of the Texas fawnsfoot. However, interagency cooperation may be further streamlined through planned programmatic consultations for the species between Federal agencies and the Service. We ask the public, particularly State agencies and other interested stakeholders that may be affected by the proposed 4(d) rule, to provide comments and suggestions regarding additional guidance and methods that the Service could provide or use, respectively, to streamline the implementation of this proposed 4(d) rule (see Information Requested, above).

III. Proposed Critical Habitat Designation

Background

Critical habitat is defined in section 3 of the Act as:

(1) The specific areas within the geographical area occupied by the species, at the time it is listed in accordance with the Act, on which are found those physical or biological features

(a) Essential to the conservation of the species, and

(b) Which may require special management considerations or protection; and

(2) Specific areas outside the geographical area occupied by the species at the time it is listed, upon a determination that such areas are essential for the conservation of the species.

Our regulations at 50 CFR 424.02 define the geographical area occupied by the species as an area that may generally be delineated around species' occurrences, as determined by the Secretary (*i.e.,* range). Such areas may include those areas used throughout all or part of the species' life cycle, even if not used on a regular basis (*e.g.,* migratory corridors, seasonal habitats, and habitats used periodically, but not solely by vagrant individuals). Additionally, our regulations at 50 CFR 424.02 define the word ''habitat'' as follows: ''for the purposes of designating critical habitat only, habitat is the abiotic and biotic setting that currently or periodically contains the resources and conditions necessary to support one or more life processes of a species.''

Conservation, as defined under section 3 of the Act, means to use and the use of all methods and procedures that are necessary to bring an endangered or threatened species to the point at which the measures provided pursuant to the Act are no longer necessary. Such methods and procedures include, but are not limited to, all activities associated with scientific resources management such as research, census, law enforcement, habitat acquisition and maintenance, propagation, live trapping, and transplantation, and, in the extraordinary case where population pressures within a given ecosystem cannot be otherwise relieved, may include regulated taking.

Critical habitat receives protection under section 7 of the Act through the requirement that Federal agencies ensure, in consultation with the Service, that any action they authorize, fund, or carry out is not likely to result in the destruction or adverse modification of critical habitat. The designation of critical habitat does not affect land ownership or establish a refuge, wilderness, reserve, preserve, or other conservation area. Designation also does not allow the government or public to access private lands, nor does designation require implementation of restoration, recovery, or enhancement measures by non-Federal landowners. Where a landowner requests Federal agency funding or authorization for an action that may affect a listed species or critical habitat, the Federal agency would be required to consult with the Service under section 7(a)(2) of the Act. However, even if the Service were to conclude that the proposed activity would result in destruction or adverse modification of the critical habitat, the Federal action agency and the landowner are not required to abandon the proposed activity, or to restore or recover the species; instead, they must implement ''reasonable and prudent alternatives'' to avoid destruction or adverse modification of critical habitat.

Under the first prong of the Act's definition of critical habitat, areas within the geographical area occupied by the species at the time it was listed are included in a critical habitat designation if they contain physical or biological features (1) which are essential to the conservation of the species and (2) which may require special management considerations or protection. For these areas, critical habitat designations identify, to the extent known using the best scientific and commercial data available, those physical or biological features that are essential to the conservation of the species (such as space, food, cover, and protected habitat). In identifying those physical or biological features that occur in specific occupied areas, we focus on the specific features that are essential to support the life-history needs of the species, including but not limited to, water characteristics, soil type, geological features, prey, vegetation, symbiotic species, or other features. A feature may be a single habitat characteristic, or a more-complex combination of habitat characteristics. Features may include habitat characteristics that support ephemeral or dynamic habitat conditions. Features may also be expressed in terms relating to principles of conservation biology, such as patch size, distribution distances, and connectivity.

Under the second prong of the Act's definition of critical habitat, we can designate critical habitat in areas outside the geographical area occupied by the species at the time it is listed, upon a determination that such areas are essential for the conservation of the species. The implementing regulations at 50 CFR 424.12(b)(2) further delineate unoccupied critical habitat by setting out three specific parameters: (1) When designating critical habitat, the Secretary will first evaluate areas occupied by the species; (2) the Secretary will only consider unoccupied areas to be essential where a critical habitat designation limited to geographical areas occupied by the species would be inadequate to ensure the conservation of the species; and (3) for an unoccupied area to be considered essential, the Secretary must determine that there is a reasonable certainty both that the area will contribute to the conservation of the species and that the area contains one or more of those physical or biological features essential to the conservation of the species.

Section 4 of the Act requires that we designate critical habitat on the basis of the best scientific data available. Further, our Policy on Information Standards under the Endangered Species Act (published in the **Federal Register** on July 1, 1994 (59 FR 34271)), the Information Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001 (Pub. L. 106–554; H.R. 5658)), and our associated Information Quality Guidelines, provide criteria, establish procedures, and provide guidance to ensure that our decisions are based on the best scientific data available. They require our biologists, to the extent consistent with the Act and with the use of the best scientific data available, to use primary and original sources of information as the basis for recommendations to designate critical habitat.

When we are determining which areas should be designated as critical habitat, our primary source of information is generally the information from the SSA report and information developed during the listing process for the species. Additional information sources may include any generalized conservation strategy, criteria, or outline that may have been developed for the species; the recovery plan for the species; articles in peer-reviewed journals; conservation plans developed by States and counties; scientific status surveys and studies; biological assessments; other unpublished materials; or experts' opinions or personal knowledge.

As the regulatory definition of ''habitat'' reflects (50 CFR 424.02), habitat is dynamic, and species may move from one area to another over time. We recognize that critical habitat designated at a particular point in time may not include all of the habitat areas that we may later determine are necessary for the recovery of the species. For these reasons, a critical habitat designation does not signal that habitat outside the designated area is unimportant or may not be needed for recovery of the species. Areas that are important to the conservation of the species, both inside and outside the critical habitat designation, will continue to be subject to: (1) Conservation actions implemented under section 7(a)(1) of the Act; (2) regulatory protections afforded by the requirement in section 7(a)(2) of the Act for Federal agencies to ensure their actions are not likely to jeopardize the continued existence of any endangered or threatened species; and (3) section 9 of the Act's prohibitions on taking any individual of the species, including taking caused by actions that affect habitat. Federally funded or permitted projects affecting listed species outside their designated critical habitat areas may still result in jeopardy findings in some cases. These protections and conservation tools will continue to contribute to recovery of these species. Similarly, critical habitat designations made on the basis of the best available information at the time of designation will not control the direction and substance of future recovery plans, habitat conservation plans (HCPs), or other species conservation planning efforts if new information available at the time of these planning efforts calls for a different outcome.

Prudency Determinations

Section 4(a)(3) of the Act, as amended, and implementing regulations (50 CFR 424.12), require that the Secretary shall designate critical habitat at the time the species is determined to be an endangered or threatened species to the maximum extent prudent and determinable. Our regulations (50 CFR 424.12(a)(1)) state that the Secretary may, but is not required to, determine that a designation would not be prudent in the following circumstances:

(i) The species is threatened by taking or other human activity and identification of critical habitat can be expected to increase the degree of such threat to the species;

(ii) The present or threatened destruction, modification, or curtailment of a species' habitat or range is not a threat to the species, or threats to the species' habitat stem solely from causes that cannot be addressed through management actions resulting from consultations under section 7(a)(2) of the Act;

(iii) Areas within the jurisdiction of the United States provide no more than negligible conservation value, if any, for a species occurring primarily outside the jurisdiction of the United States;

(iv) No areas meet the definition of critical habitat; or

(v) The Secretary otherwise determines that designation of critical habitat would not be prudent based on the best scientific data available.

As discussed in the proposed listing rule, above, while collection at certain locations has been identified as a threat to certain populations of Texas pimpleback, Texas fatmucket, and false spike in the Llano River, the location of these populations is well known and the identification and mapping of critical habitat is not expected to increase the degree of this threat. In our SSA report and proposed listing rule for the Central Texas mussels, we determined that the present or threatened destruction, modification, or curtailment of habitat or range is a threat to the Central Texas mussels and that those threats in some way can be addressed by section 7(a)(2) consultation measures. The species occurs wholly in the jurisdiction of the United States, and we are able to identify areas that meet the definition of critical habitat. Therefore, because none of the circumstances enumerated in our regulations at 50 CFR 424.12(a)(1) have been met and because there are no other circumstances the Secretary has identified for which this designation of critical habitat would be not prudent, we have determined that the designation of critical habitat is prudent for the Central Texas mussels.

Critical Habitat Determinability

Having determined that designation is prudent, under section 4(a)(3) of the Act we must find whether critical habitat for the Central Texas mussels is determinable. Our regulations at 50 CFR 424.12(a)(2) state that critical habitat is not determinable when one or both of the following situations exist:

(i) Data sufficient to perform required analyses are lacking, or

(ii) The biological needs of the species are not sufficiently well known to identify any area that meets the definition of ''critical habitat.''

When critical habitat is not determinable, the Act allows the Service an additional year to publish a critical habitat designation (16 U.S.C. 1533(b)(6)(C)(ii)).

We reviewed the available information pertaining to the biological needs of the species and habitat characteristics where these species are located. This and other information represent the best scientific data available and led us to conclude that the designation of critical habitat is determinable for the Central Texas mussels.

Physical or Biological Features Essential to the Conservation of the Species

In accordance with section 3(5)(A)(i) of the Act and regulations at 50 CFR 424.12(b), in determining which areas we will designate as critical habitat from within the geographical area occupied by the species at the time of listing, we consider the physical or biological features that are essential to the conservation of the species and that may require special management considerations or protection. The regulations at 50 CFR 424.02 define ''physical or biological features essential to the conservation of the species'' as the features that occur in specific areas and that are essential to support the life-history needs of the species, including but not limited to, water characteristics, soil type, geological features, sites, prey, vegetation, symbiotic species, or other features. A feature may be a single habitat characteristic, or a more complex combination of habitat characteristics. Features may include habitat characteristics that support ephemeral or dynamic habitat conditions. Features may also be expressed in terms relating to principles of conservation biology, such as patch size, distribution distances, and connectivity.

For example, physical features essential to the conservation of the species might include gravel of a particular size required for spawning, alkali soil for seed germination, protective cover for migration, or susceptibility to flooding or fire that maintains necessary early-successional habitat characteristics. Biological features might include prey species, forage grasses, specific kinds or ages of trees for roosting or nesting, symbiotic fungi, or a particular level of nonnative species consistent with conservation needs of the listed species. The features may also be combinations of habitat characteristics and may encompass the relationship between characteristics or the necessary amount of a characteristic essential to support the life history of the species.

In considering whether features are essential to the conservation of the species, the Service may consider an appropriate quality, quantity, and spatial and temporal arrangement of habitat characteristics in the context of the life-history needs, condition, and status of the species. These characteristics include, but are not limited to, space for individual and population growth and for normal behavior; food, water, air, light, minerals, or other nutritional or physiological requirements; cover or shelter; sites for breeding, reproduction, or rearing (or development) of offspring; and habitats that are protected from disturbance.

We derive the specific physical or biological features (PBFs) essential for Central Texas mussels from studies of these species' habitat, ecology, and life history. The life histories of the six Central Texas mussel species are very similar—mussels need flowing water, suitable substrate, suitable water quality, flow refuges, and appropriate host fish—and so we will discuss their common habitat needs and then describe species-specific needs thereafter.

Space for Individual and Population Growth and for Normal Behavior

Most freshwater mussels, including the Central Texas mussels, are found in aggregations, called mussel beds, that vary in size from about 50 to greater than 5,000 square meters (m^2), separated by stream reaches in which mussels are absent or rare (Vaughn 2012, p. 983). Freshwater mussel larvae (called glochidia) are parasites that must attach to a host fish. A population incorporates more than one mussel bed; it is the collection of mussel beds within a stream reach between which infested host fish may travel, allowing for ebbs and flows in mussel bed density and abundance over time throughout the population's occupied reach. Therefore, resilient mussel populations must occupy stream reaches long enough so that stochastic events that affect individual mussel beds do not eliminate the entire population. Repopulation by infested host fish from other mussel beds within the reach can allow the population to recover from these events. Longer stream reaches are more likely to support populations of Central Texas mussels into the future than shorter stream reaches. Therefore, we determine that long stream reaches, over 50 miles (80.5 km), are an important component of a riverine system with habitat to support all life stages of Central Texas mussels.

All six species of Central Texas mussels need flowing water for survival. They are not found in lakes, reservoirs, or in pools without flow, or in areas that are regularly dewatered. River reaches with continuous flow support all life stages of Central Texas mussels, while those with little or no flow do not. Flow rates needed by each species will vary depending on the species and the river size, location, and substrate type.

Additionally, each species of Central Texas mussel has specific substrate needs, including gravel/cobble (Guadalupe orb, Texas pimpleback, and false spike), gravel/sand/silt (Texas fawnsfoot), and bedrock crevices/vegetated runs (Guadalupe fatmucket and Texas fatmucket). Except for habitats for Texas fawnsfoot, these locations must be relatively free of fine sediments such that the mussels are not smothered.

Physiological Requirements: Water Quality Requirements

Freshwater mussels, as a group, are sensitive to changes in water quality parameters such as dissolved oxygen, salinity, ammonia, and pollutants. Habitats with appropriate levels of these parameters are considered suitable, while those habitats with levels outside of the appropriate ranges are considered less suitable. We have used information for these six Central Texas mussel species, where available, and data from other species when species-specific information is not available. Juvenile freshwater mussels are particularly susceptible to low dissolved oxygen levels. Juveniles will reduce feeding behavior when dissolved oxygen is between 2–4 milligrams per liter (mg/L), and mortality has been shown to occur at dissolved oxygen levels below 1.3 mg/L. Increased salinity levels may also be stressful to freshwater mussels, and additionally, Central Texas mussels show signs of stress at salinity levels of 2 ppt or higher (Bonner *et al.* 2018; pp. 155–156).

The release of pollutants into streams from point and nonpoint sources have immediate impacts on water quality conditions and may make environments unsuitable for habitation by mussels. Early life stages of freshwater mussels are some of the most sensitive organisms of all species to ammonia and copper (Naimo 1995, pp. 351–352; Augsperger *et al.* 2007, p. 2025). Additionally, sublethal effects of contaminants over time can result in reduced feeding efficiency, reduced growth, decreased reproduction, changes in enzyme activity, and behavioral changes to all mussel life stages. Even wastewater discharges with low ammonia levels have been shown to negatively affect mussel populations.

Finally, water temperature plays a critical role in the life history of freshwater mussels. High water temperatures can cause valve closure, reduced reproductive output, and death. The Central Texas mussels differ in their optimal temperature ranges, with some species much more tolerant of high temperatures than others. Laboratory studies investigating the effects of thermal stress on glochidia and adults has indicated thermal stress may occur at 29 °C (84.2) °F) (Bonner *et al.* 2018; Khan *et al.* 2019, entire)).

Based on the above information, we determine that stream reaches with the following water quality parameters are suitable for the Guadalupe fatmucket, Texas fatmucket, Texas fawnsfoot, Guadalupe orb, Texas pimpleback, and false spike:

- Low salinity (less than 2 ppt);
- Low total ammonia (less than 0.77 mg/L total ammonia nitrogen);
- Low levels of contaminants;
- Dissolved oxygen levels greater than 2 mg/L;
- Water temperatures below 29 °C (84.2 °F).

Sites for Development of Offspring

As discussed above, freshwater mussel larvae are parasites that must attach to a host fish to develop into juvenile mussels. The Central Texas mussels use a variety of host fish, many of which are widely distributed throughout their ranges. The presence of these fish species, either singly or in combination, supports the life-history needs of the Central Texas mussels:

- *False spike:* Blacktail shiner (*Cyprinella venusta*) and red shiner (*C. lutrensis*);
- *Texas fawnsfoot:* Freshwater drum (*Aplodinotus grunniens*);
- *Texas pimpleback and Guadalupe orb:* Channel catfish (*Ictalurus punctatus*), flathead catfish (*Pylodictus olivaris*), and tadpole madtom (*Noturus gyrinus*);
- *Texas fatmucket and Guadalupe fatmucket:* Green sunfish (*Lepomis cyanellus*), bluegill (*L. macrochirus*), largemouth bass (*Micropterus salmoides*), and Guadalupe bass (*M. treculii*).

Summary of Essential Physical or Biological Features

In summary, we derive the specific PBFs essential to the conservation of Central Texas mussels from studies of these species' habitat, ecology, and life history as described above. Additional information can be found in the SSA report available on *http://www.regulations.gov* under Docket No. FWS–R2–ES–2019–0061. We have determined that the following PBFs are essential to the conservation of the Central Texas mussels:

(1) Suitable substrates and connected instream habitats, characterized by geomorphically stable stream channels and banks (*i.e.,* channels that maintain lateral dimensions, longitudinal profiles, and sinuosity patterns over time without an aggrading or degrading bed elevation) with habitats that support a diversity of freshwater mussel and native fish (such as stable riffle-run-pool habitats that provide flow refuges consisting of silt-free gravel and coarse sand substrates).

(2) Adequate flows, or a hydrologic flow regime (which includes the severity, frequency, duration, and seasonality of discharge over time), necessary to maintain benthic habitats where the species are found and to maintain connectivity of streams with the floodplain, allowing the exchange of nutrients and sediment for maintenance of the mussels' and fish hosts' habitat, food availability, spawning habitat for native fishes, and the ability for newly transformed juveniles to settle and become established in their habitats.

(3) Water and sediment quality (including, but not limited to, dissolved oxygen, conductivity, hardness, turbidity, temperature, pH, ammonia, heavy metals, and chemical constituents) necessary to sustain natural physiological processes for normal behavior, growth, and viability of all life stages.

(4) The presence and abundance of fish hosts necessary for recruitment of the Central Texas mussels.

Special Management Considerations or Protection

When designating critical habitat, we assess whether the specific areas within the geographical area occupied by the species at the time of listing contain features which are essential to the conservation of the species and which may require special management considerations or protection. The features essential to the conservation of the Central Texas mussels may require special management considerations or protections to reduce the following threats: Increased fine sediment, changes in water quality impairment, altered hydrology from both inundation and flow loss/scour, predation and collection, and barriers to fish movement.

Management activities that could ameliorate these threats include, but are not limited to: Use of best management practices (BMPs) designed to reduce sedimentation, erosion, and bank side destruction; protection of riparian corridors and leaving sufficient canopy cover along banks; exclusion of livestock and nuisance wildlife (feral hogs, exotic ungulates); moderation of surface and ground water withdrawals to maintain natural flow regimes; increased use of stormwater management and reduction of stormwater flows into the systems; use of highest water quality standards for wastewater and other return flows, and reduction of other watershed and floodplain disturbances that release sediments, pollutants, or nutrients into the water.

In summary, we find that the occupied areas we are proposing to designate as critical habitat contain the PBFs that are essential to the conservation of the species and that may require special management considerations or protection. Special management considerations or protection may be required of the Federal action agency to eliminate, or to reduce to negligible levels, the threats affecting the PBFs of each unit.

Criteria Used To Identify Critical Habitat

As required by section 4(b)(2) of the Act, we use the best scientific data available to designate critical habitat. In accordance with the Act and our implementing regulations at 50 CFR 424.12(b), we review available information pertaining to the habitat requirements of the species and identify specific areas within the geographical area occupied by the species at the time of listing and any specific areas outside the geographical area occupied by the species to be considered for designation as critical habitat.

We are proposing to designate critical habitat in areas within the geographical area that was occupied by the species at the time of listing. We also are proposing to designate specific areas outside the geographical area occupied by the species at the time of listing because we have determined that a designation limited to occupied areas would be inadequate to ensure the conservation of the species. The current distributions of all six of the Central Texas mussels are much reduced from their historical distributions. We anticipate that recovery will require continued protection of existing populations and habitat, as well as ensuring that there are adequate numbers of mussels in stable populations that occur over a wide geographic area. This strategy will help to ensure that catastrophic events, such as the effects of hurricanes (which can lead to flooding that causes excessive sedimentation, nutrients, and debris to disrupt stream ecology, etc.) and drought, cannot simultaneously affect all known populations. Rangewide recovery considerations, such as maintaining existing genetic diversity and striving for representation of all major portions of the species' current ranges, were considered in formulating this proposed critical habitat. The unoccupied areas included in this designation all contain at least one PBF, fall within the regulatory definition of ''habitat'' (50 CFR 424.02), and are reasonably certain to contribute to the conservation of the species, as discussed in the below unit descriptions.

Sources of data for this proposed critical habitat include multiple databases maintained by universities and State agencies, scientific and agency reports, and numerous survey reports on streams throughout the species' ranges (see SSA report).

Areas Occupied at the Time of Listing

The proposed critical habitat designations do not include all streams known to have been occupied by the species historically; instead, they focus on streams occupied at the time of listing that have retained the necessary PBFs that will allow for the maintenance and expansion of existing populations. A stream reach may not have all of the PBFs to be included as proposed critical habitat; in such reaches, our goal is to recover the species by restoring the missing PBFs. We defined ''occupied'' units as stream channels with observations of one or more live individuals. Specific habitat areas were delineated based on reports of live individuals and recently dead shells. We include ''recent dead shell material'' to delineate the boundaries of a unit because recently dead shell material at a site indicates the species is present in that area. Recently dead shells have tissue remaining on the shells or have retained a shiny nacre, indicating the animal died within days or weeks of finding the shell. It is highly unlikely that a dead individual represents the last remaining individual of the population, and recently dead shells are an accepted indicator of species' presence (*e.g.,* Howells 1996; Randklev *et al.* 2012). We are relying on evidence of occupancy from data collected in 2000 to the present. This is because freshwater mussels may be difficult to detect and some sites are not visited multiple times. Additionally, these species live at least 15—20 years. Because adults are less sensitive to habitat changes than juveniles, changes in population sizes usually occur over decades rather than years. As a result, areas where individuals were collected within the last 20 years are expected to remain occupied now. Additionally, any areas that were surveyed around 20 years ago and do not have subsequent surveys were reviewed for any large-scale habitat changes (*i.e.,* major flood or scour event, drought) to confirm that general habitat characteristics remained constant over this time. None of the relatively few areas without more recent survey information had experienced changes to general habitat characteristics. Therefore, data from around 2000 would be considered a strong indicator a species remains extant at a site if general habitat characteristics have remained constant over that time.

For occupied areas proposed as critical habitat, we delineated critical habitat unit boundaries using the following criterion: Evaluate habitat suitability of stream segments within the geographic area occupied at the time of listing, and retain those segments that contain some or all of the PBFs to support life-history functions essential for conservation of the species.

As a final step, we evaluated those occupied stream segments retained through the above analysis and refined the starting and ending points by evaluating the presence or absence of appropriate PBFs. We selected upstream and downstream cutoff points to reference existing easily recognizable geopolitical features including confluences, highway crossings, and county lines. Using these features as end points allows the public to clearly understand the boundaries of critical habitat. Unless otherwise specified, any stream beds located directly beneath bridge crossings or other landmark features used to describe critical habitat spatially, such as stream confluences, are considered to be wholly included within the critical habitat unit. Critical habitat stream segments were then mapped using ArcMap version 10 (ESRI, Inc.), a Geographic Information Systems program.

We consider the following streams to be occupied by the Guadalupe fatmucket at the time of proposed listing: Guadalupe River, North Fork Guadalupe River, and Johnson Creek (see *Unit Descriptions,* below).

We consider the following streams to be occupied by the Texas fatmucket at the time of proposed listing: Bluff Creek, Elm Creek, San Saba River, Cherokee Creek, North Llano River, South Llano River, Llano River, James River, Threadgill Creek, Beaver Creek, Pedernales River, Live Oak Creek, and Onion Creek (see *Unit Descriptions,* below).

We consider the following streams to be occupied by the Texas fawnsfoot at the time of proposed listing: Clear Fork of the Brazos River, Upper Brazos River, Lower Brazos River, Navasota River, Little River, Lower San Saba River, Upper Colorado River, Lower Colorado River, East Fork of the Trinity River, and Middle Trinity River (see *Unit Descriptions,* below).

We consider the following streams to be occupied by the Guadalupe orb at the time of proposed listing: Upper Guadalupe River, South Fork Guadalupe River, Lower Guadalupe River, and San Marcos River (see *Unit Descriptions,* below).

We consider the following streams to be occupied by the Texas pimpleback at the time of proposed listing: Concho River, Upper Colorado River, Lower San Saba River, Upper San Saba River, Llano River, and Lower Colorado River (see *Unit Descriptions,* below).

We consider the following streams to be occupied by false spike at the time of proposed listing: Little River, San Gabriel River, Brushy Creek, San Saba River, Llano River, San Marcos River, and Guadalupe River (see *Unit Descriptions,* below).

Areas Outside the Geographic Area Occupied at the Time of Listing

We are not proposing to designate any areas outside the geographical area currently occupied by the false spike, Guadalupe orb, and Guadalupe fatmucket because we did not find any unoccupied areas that contained the necessary PBFs and were essential for the conservation of the species. However, each species needs the establishment and protection of additional resilient populations across their historical ranges to reduce their risk of extinction. While the species need these areas, we do not currently have adequate information to identify where these populations could be located at this time.

We have determined that a designation limited to the occupied units would be inadequate to ensure the conservation of the Texas fatmucket, Texas fawnsfoot, and Texas pimpleback. Of the five remaining fragmented and isolated populations of Texas fatmucket, two are small in abundance and occupied stream length and have low to no resiliency (*i.e.,* are unhealthy), and one population is functionally extirpated. The other two current populations have moderate resiliency and remain at risk of extirpation. For Texas fawnsfoot, seven populations remain. Four populations have moderate resiliency, and three are unhealthy or are functionally extirpated. The populations with moderate resiliency are all in the mainstem of large rivers, subject to decreased water quality as urbanization increases. Increasing the size of populations in the upper portions of the watersheds will increase the redundancy and representation of the Texas fawnsfoot in areas that are not subject to similar water quality declines. Finally, of the five remaining Texas pimpleback populations, three are unhealthy and are not reproducing, and two have moderate resiliency. This species needs expanded populations across its range to increase the populations' resiliency and the species' redundancy and representation.

In the SSA report, we defined 50 miles (80 km) as a stream length long enough to sustain a highly resilient population of the Central Texas mussels because a single event is unlikely to affect the entire population, and the affected section may be repopulated by mussel beds up- or downstream. Where available, we identified areas outside the geographical area currently occupied by Texas fatmucket, Texas pimpleback, and Texas fawnsfoot as critical habitat in order to increase the occupied stream length of existing small populations. Not all small (less than 50 miles) occupied stream reaches may have adjacent unoccupied reaches that are reasonably certain to contribute to the conservation of the species, and while these smaller reaches will inherently have a higher risk of extirpation, these smaller areas contribute to the conservation of the species through maintaining redundancy and representation. Special management within smaller occupied units can reduce the risk of extirpation.

We are proposing to designate some areas outside the geographical area currently occupied by Texas fatmucket, Texas pimpleback, and Texas fawnsfoot we found to be essential for the conservation of each species. The proposed unoccupied subunits are essential to the conservation of the species because each provides for the growth and expansion of the species within portions of their historical ranges. The longer the reach occupied by a species, the more likely it is that the population can withstand stochastic events such as extreme flooding, dewatering, or water contamination. Therefore, the unoccupied subunits are each essential for the conservation of the species. These proposed areas are located immediately adjacent to currently occupied stream reaches, include one or more of the necessary PBFs, and would allow for expansion of existing populations necessary to improve population resiliency, extend physiographic representation, and reduce the risk of extinction for the species. The establishment of additional moderately healthy to healthy populations across the range of these species would sufficiently reduce their risk of extinction. Improving the resiliency of populations in the currently occupied streams, and into identified unoccupied areas, will increase species viability to the point that the protections of the Act are no longer necessary. The unoccupied reaches we are proposing for critical habitat designation are Elm Creek and Onion Creek for the Texas fatmucket; the Clear Fork Brazos River for the Texas fawnsfoot; and the Llano River and Concho River for the Texas pimpleback.

General Information on the Maps of the Proposed Critical Habitat Designations

When determining proposed critical habitat boundaries, we made every effort to avoid including developed areas such as lands covered by buildings, pavement, and other structures because such lands lack physical or biological features necessary for the Central Texas mussels. The scale of the maps we prepared under the parameters for publication within the Code of Federal Regulations may not reflect the exclusion of such developed lands. Any such lands inadvertently left inside critical habitat boundaries shown on the maps of this proposed rule have been excluded by text in the proposed rule and are not proposed for designation as critical habitat. Therefore, if the critical habitat is finalized as proposed, a Federal action involving these lands would not trigger section 7 consultation under the Act with respect to critical habitat and the requirement of no adverse modification unless the specific action would affect the physical or biological features in the adjacent critical habitat.

We propose to designate as critical habitat lands that we have determined are occupied at the time of listing (*i.e.,* currently occupied) and that contain one or more of the physical or biological features that are essential to support life-history processes of the species. We have determined that occupied areas are inadequate to ensure the conservation of the species. Therefore, we have also identified, and propose for designation as critical habitat, unoccupied areas that are essential for the conservation of the species.

The proposed critical habitat designations are defined by the map or maps, as modified by any accompanying regulatory text, presented at the end of this document under Proposed Regulation Promulgation. We include more detailed information on the boundaries of the proposed critical habitat designations in the discussion of individual units below. We will make the coordinates or plot points or both on which each map is based available to the public on *http://www.regulations.gov* under Docket No. FWS–R2–ES–2019–0061.

Proposed Critical Habitat Designation

In total, we are proposing to designate approximately 1,944 river mi (3,129 river km), accounting for overlapping units, in 27 units (total of 50 subunits; Table 8) as critical habitat for one or more Central Texas mussel species: The false spike, Texas fatmucket, Guadalupe fatmucket, Texas pimpleback, Guadalupe orb, and Texas fawnsfoot. All but five of the subunits are currently occupied by one or more of the species, and each of the 50 subunits contains the physical and biological features essential to the conservation of each species. These proposed critical habitat areas, described below, constitute our current best assessment of areas that meet the definition of critical habitat for the six Central Texas mussel species. Each species historically occurred in a different subset of watersheds in Central Texas; therefore, there are large differences in the amount of critical habitat proposed for each species. For example, the Guadalupe fatmucket only occurred in the upper reaches of the Guadalupe River basin. As such, we have not proposed to designate areas outside of the very small historical range. In contrast, Texas fawnsfoot was historically widespread in three basins; therefore, to maintain the adaptive capacity of this species, we are proposing to designate a larger area for Texas fawnsfoot. Texas surface water is owned by the State, as are the beds of navigable streams; thus the actual critical habitat units (occupied waters and streambeds up to the ordinary high-water mark) are owned by the State of Texas (Texas Water Code Section 11.021, 11.0235). Adjacent riparian areas are in most cases, privately owned, and are what is reported in the discussion that follows. In many cases, activities on adjacent private land would not trigger section 7 consultation under the Act if those activities do not affect instream habitat.

TABLE 8—OVERALL PROPOSED CRITICAL HABITAT FOR THE CENTRAL TEXAS MUSSELS

[Note: Stream lengths will not sum due to overlapping units.]

Species	Basin/unit name	Occupied	Proposed critical habitat river mi (km)
Guadalupe fatmucket	*Guadalupe River:*	Yes.	
	GUFM–1a: North Fork Guadalupe River		7.5 (12.1)
	GUFM–1b: Johnson Creek		10.4 (16.7)
	GUFM–1c: Guadalupe River		36.2 (58.3)
			Total: 54.1 (87.1)
Texas fatmucket	*Colorado River:*	Yes.	
	TXFM–1a: Bluff Creek		11.8 (19.0)
	TXFM–1b: Lower Elm Creek		12.5 (20.2)
	TXFM–2: San Saba River		93.4 (150.3)
	TXFM–3: Cherokee Creek		18.1 (29.2)
	TXFM–4a: North Llano River		31.2 (50.1)
	TXFM–4b: South Llano River		22.9 (36.8)
	TXFM–4c: Llano River		90.4 (145.6)
	TXFM–4d: James River		18.6 (30.1)
	TXFM–4e: Threadgill Creek		8.3 (13.4)
	TXFM–4f: Beaver Creek		12.9 (20.8)
	TXFM–5a: Pedernales River		80.1 (128.9)
	TXFM–5b: Live Oak Creek		2.6 (4.2)
	TXFM–6a: Lower Onion Creek		5.2 (8.3)
			Total: 408.2 (656.8)
	Colorado River:	No.	
	TXFM–1c: Upper Elm Creek		9.1 (14.7)
	TXFM–6b: Upper Onion Creek		18.9 (30.4)
			Total: 28 (45.1)
Texas fawnsfoot	*Brazos River:*	Yes.	
	TXFF–1a: Upper Clear Fork Brazos River		27.9 (44.9)
	TXFF–2: Upper Brazos River		79.9 (128.6)
	TXFF–3a: Lower Brazos River		348.0 (560.0)
	TXFF–3b: Navasota River		39.3 (63.2)
	Colorado River:		
	TXFF–4: Little River		35.6 (57.3)
	TXFF–5a: San Saba River		50.4 (81.1)
	TXFF–5b: Upper Colorado River		10.5 (16.9)
	TXFF–6: Lower Colorado River		124.4 (200.2)
	Trinity River:		
	TXFF–7: East Fork Trinity River		15.6 (25.1)
	TXFF–8: Trinity River		157.0 (252.7)
			Total: 888.6 (1,430.1)

TABLE 8—OVERALL PROPOSED CRITICAL HABITAT FOR THE CENTRAL TEXAS MUSSELS—Continued

[Note: Stream lengths will not sum due to overlapping units.]

Species	Basin/unit name	Occupied	Proposed critical habitat river mi (km)
	Brazos River:	No.	
	TXFF–1b: Lower Clear Fork Brazos River		28.6 (46.0)
Guadalupe orb	*Guadalupe River:*	Yes.	
	GORB–1a: South Fork Guadalupe River		5.1 (8.3)
	GORB–1b: Upper Guadalupe River		99.4 (159.9)
	GORB–2a: San Marcos River		65.3 (105.1)
	GORB–2b: Lower Guadalupe River		124.7 (200.7)
			294.5 (474.0)
Texas pimpleback	*Colorado River:*	Yes.	
	TXPB–1a: Bluff Creek		11.8 (19.0)
	TXPB–1b: Lower Elm Creek		12.5 (20.2)
	TXPB–2a: Lower Concho River		35.6 (57.2)
	TXPB–3a: Upper Colorado River		153.8 (247.6)
	TXPB–3b: Lower San Saba River		50.4 (81.1)
	TXPB–4: Upper San Saba River		52.8 (85.0)
	TXPB–5a: Upper Llano River		38.3 (61.6)
	TXPB–6: Lower Colorado River		111.3 (179.1)
			Total: 466.5 (750.8)
	Colorado River:	No.	
	TXPB–2b: Upper Concho River		16.0 (25.7)
	TXPB–5b: Lower Llano River		12.2 (19.7)
			Total: 28.2 (45.4)
False spike	*Brazos River:*	Yes.	
	FASP–1a: Little River		35.6 (57.3)
	FASP–1b: San Gabriel River		31.4 (50.5)
	FASP–1c: Brushy Creek		14.0 (22.5)
	Colorado River:		
	FASP–2: San Saba River		50.4 (81.1)
	FASP–3: Llano River		50.5 (81.3)
	Guadalupe River:		
	FASP–4a: San Marcos River		21.6 (34.8)
	FASP–4b: Guadalupe River		124.7 (200.7)
			Total: 328.2 (528.2)

Guadalupe Fatmucket

We are proposing to designate approximately 54.1 river mi (87.1 river km) in a single unit (three subunits) as critical habitat for Guadalupe fatmucket. The critical habitat areas we describe below constitute our current best assessment of areas that meet the definition of critical habitat for Guadalupe fatmucket. The unit we propose as critical habitat is GUFM–1: Guadalupe River Unit. Table 9 shows the occupancy of the unit, the riparian ownership, and approximate length of the proposed designated areas for the Texas fatmucket. We present a brief description of the proposed unit, and reasons why it meets the definition of critical habitat for Guadalupe fatmucket, below.

TABLE 9—PROPOSED CRITICAL HABITAT UNITS FOR THE GUADALUPE FATMUCKET

[Note: Lengths may not sum due to rounding.]

Unit	Subunit	Riparian ownership	Occupancy	River miles (kilometers)
GUFM–1: Guadalupe River	GUFM–1a: North Fork Guadalupe River	Private	Occupied	7.5 (12.1)
	GUFM–1b: Johnson Creek	Private	Occupied	10.4 (16.7)
	GUFM–1c: Guadalupe River	Private	Occupied	36.2 (58.3)
Total				54.1 (87.1)

Guadalupe River Basin

Unit GUFM–1: Guadalupe River

Subunit GUFM–1a: North Fork Guadalupe River. The North Fork Guadalupe River subunit consists of 7.5 river mi (12.1 river km) in Kerr County, Texas. The adjacent riparian areas of the subunit are privately owned. The entire subunit is currently occupied by the species. The North Fork Guadalupe River subunit extends from the FM 1340 bridge crossing (just upstream of the Bear Creek Boy Scout camp) downstream to the confluence with the Guadalupe River. This subunit contains all of the PBFs essential to the conservation of the Guadalupe fatmucket. The North Fork Guadalupe River subunit is in a mostly rural setting; is influenced by drought, low flows, and flooding (leading to scour); and is being affected by ongoing agricultural activities and development resulting in excessive sedimentation, water quality degradation, and ground water withdrawals and surface water diversions. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. Special management may be necessary to ensure adequate instream flow and water quality.

Subunit GUFM–1b: Johnson Creek. The Johnson Creek subunit consists of 10.4 river mi (16.7 river km) within Kerr County, Texas. The Johnson Creek subunit begins at the Byas Springs Road crossing downstream to the confluence with the Guadalupe River. The adjacent riparian area is privately owned. The subunit is occupied by the Guadalupe fatmucket. This site contains the majority of the PBFs essential to the conservation of the species. Certain PBFs, such as sufficient water flow, dissolved oxygen levels, and water temperature, may be missing or degraded during times of drought. The Johnson Creek subunit is in a mostly rural but urbanizing setting, is influenced by drought, low flows, and flooding (leading to scour), and is being affected by ongoing agricultural activities and development resulting in excessive sedimentation, water quality degradation, and groundwater withdrawals and surface water diversions. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity.

Subunit GUFM–1c: Guadalupe River. This unit consists of approximately 36.2 river mi (58.3 river km) in Kerr and Kendall Counties, Texas. The Guadalupe River Subunit extends from the confluence of the North and South Fork Guadalupe Rivers downstream to the Interstate Highway 10 bridge crossing near Comfort, Texas. The adjacent riparian areas of this subunit are privately owned. The subunit is occupied by the Guadalupe fatmucket. This portion of the Guadalupe River basin is largely agricultural with several municipalities and multiple low-head dams originally built for a variety of purposes and now largely used for recreation (kayaking, fishing, camping, swimming, etc.). This subunit provides all of the PBFs essential to the conservation of the species. The Guadalupe River subunit is experiencing some urbanization and is influenced by drought, low flows, and flooding (leading to scour), and is being affected by ongoing agricultural activities and development resulting in excessive sedimentation, water quality degradation, ground water withdrawals and surface water diversions, and wastewater inputs. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. This subunit is also occupied by Guadalupe orb.

Texas Fatmucket

We are proposing to designate approximately 436.0 river mi (701.7 km) in 6 units (15 subunits) as critical habitat for Texas fatmucket. The critical habitat areas we describe below constitute our current best assessment of areas that meet the definition of critical habitat for Texas fatmucket. The six areas we propose as critical habitat are: TXFM–1: Elm Creek Unit; TXFM–2: San Saba River Unit; TXFM–3: Cherokee Creek Unit; TXFM–4: Llano River Unit; TXFM–5: Pedernales River Unit; and TXFM–6: Onion Creek Unit. Table 10 shows the occupancy of the units, the riparian ownership, and approximate length of the proposed designated areas for the Texas fatmucket. We present brief descriptions of all proposed units, and reasons why they meet the definition of critical habitat for Texas fatmucket, below.

TABLE 10—PROPOSED CRITICAL HABITAT UNITS FOR TEXAS FATMUCKET

[Note: Lengths may not sum due to rounding.]

Unit	Subunit	Riparian ownership	Occupancy	River miles (kilometers)
TXFM–1: Elm Creek	TXFM–1a: Bluff Creek	Private	Occupied	11.8 (19.0)
	TXFM–1b: Lower Elm Creek	Private	Occupied	12.5 (20.2)
	TXFM–1c: Upper Elm Creek	Private	Unoccupied	9.1 (14.7)
TXFM–2: San Saba River		Private	Occupied	93.4 (150.3)
TXFM–3: Cherokee Creek		Private	Occupied	18.1 (29.2)
TXFM–4: Llano River	TXFM–4a: North Llano River	Private	Occupied	31.2 (50.1)
	TXFM–4b: South Llano River	Private	Occupied	22.9 (36.8)
	TXFM–4c: Llano River	Private	Occupied	90.4 (145.6)
	TXFM–4d: James River	Private	Occupied	18.6 (30.1)
	TXFM–4e: Threadgill Creek	Private	Occupied	8.3 (13.4)
	TXFM–4f: Beaver Creek	Private	Occupied	12.9 (20.8)
TXFM–5: Pedernales River	TXFM–5a: Pedernales River	Private, Federal.	Occupied	80.1 (128.9)
	TXFM–5b: Live Oak Creek	Private	Occupied	2.6 (4.2)
TXFM–6: Onion Creek	TXFM–6a: Lower Onion Creek	Private	Occupied	5.2 (8.3)
	TXFM–6b: Upper Onion Creek	Private	Unoccupied	18.9 (30.4)
Total				436.0 (701.7)

Colorado River Basin

Unit TXFM–1: Elm Creek

Subunit TXFM–1a: Bluff Creek. This occupied critical habitat subunit consists of 11.8 river mi (19.0 km) of Bluff Creek, a tributary to Elm Creek, in Runnels County, Texas. The subunit extends from the County Road 153 bridge crossing, near the town of Winters, Texas, downstream to the confluence of Bluff and Elm creeks. The riparian area of this subunit is privately owned. This subunit is currently occupied by Texas fatmucket. The Bluff Creek subunit is in a rural setting, is influenced by drought, low flows, and elevated chlorides, and is being affected by ongoing agricultural activities and development resulting in excessive sedimentation, water quality degradation, and ground water withdrawals and surface water diversions. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. This subunit is also occupied by Texas pimpleback.

Subunit TXFM–1b: Lower Elm Creek. This subunit consists of 12.5 river mi (20.2 km) of Elm Creek beginning at the confluence of Bluff Creek and continuing downstream to Elm Creek's confluence with the Colorado River in Runnels County, Texas. The riparian lands adjacent to this subunit are privately owned. The Elm Creek watershed is relatively small and remains largely rural and dominated by agricultural practices. This stream regularly has extremely low or no flow during times of drought. Moreover, this stream has elevated chloride concentrations and sedimentation resulting in reduced habitat quality and availability, and decreased water quality. Lower Elm Creek is occupied by Texas fatmucket and contains some of the PBFs essential to the conservation of the species such as presence of host fish; others are in degraded condition and would benefit from management actions such as improving water quality and substrate. The Lower Elm Creek subunit is influenced by drought, low flows, and elevated chlorides, and is being affected by ongoing agricultural activities and development resulting in excessive sedimentation, water quality degradation, and ground water withdrawals and surface water diversions. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. This unit is also occupied by Texas pimpleback.

Subunit TXFM–1c: Upper Elm Creek. Because we have determined occupied areas are not adequate for the conservation of the species, we evaluated whether any unoccupied areas are essential for the conservation of Texas fatmucket and identified this area as essential for the conservation of the species. This subunit consists of 9.1 river mi (14.7 km) from the County Road 153 crossing, near the town of Winters, Texas, downstream to the confluence of Bluff and Elm creeks. The riparian area surrounding this subunit is privately owned. The entire Elm Creek watershed is dominated by agriculture and remains rural. Upper Elm Creek is not currently occupied by Texas fatmucket, but it is essential for the conservation of the species because it provides for the growth and expansion of the Texas fatmucket within a portion of its historical range on Elm Creek; the occupied segment of Elm Creek is too small to ensure conservation of the Texas fatmucket over the long term. This unit is important to the conservation of Texas fatmucket because it is the furthest upstream population; its loss would shrink the overall range of Texas fatmucket to the lower, larger tributaries of the Colorado River. Additionally, this population of Texas fatmucket is substantially far from the other population of the species, such that if a catastrophic event such as drought or extreme flooding were to occur it is likely that this population would be affected differently, increasing the chance of the species surviving such an event.

The Upper Elm Creek subunit is in a rural setting, is influenced by drought, low flows, and elevated chlorides, and is being affected by ongoing agricultural activities. Although it is considered unoccupied, portions of this subunit contain some or all of the physical or biological features essential for the conservation of the species. As previously mentioned, flow rates in this subunit are typically not within the range required by the Texas fatmucket (PBF 1). This subunit is often characterized by small, isolated pools separated by short riffles over bedrock during low flow and when dam releases are minimal. During the last decade, lower Elm Creek has experienced both the lowest and highest flow rates on record (see SSA report for more information). This subunit will require management actions that address flow rate and associated stream habitat quality.

Suitable stream habitat and hydrological connectivity (PBF 2) are unsupported throughout the entirety of this subunit. Specifically, low flows during times of drought punctuated by high flows are either scouring the stream habitat, or depositing stream sediments downstream. Because mussels are sedentary organisms, transportation of individuals during flooding events is often lethal.

The Texas fatmucket uses predatory fish (*e.g.,* bass and sunfishes) for its host infestation period of its lifecycle. These host fishes (PBF 3) are presumed to be common throughout the state of Texas and within the Upper Elm Creek subunit. While ongoing research may be necessary to confirm current abundance of host fishes are at suitable levels, we currently believe they are adequate.

This subunit is not included in Texas Commission on Environmental Quality classified stream segments; therefore, we have no specific water quality information. During times of normal flow this subunit likely supports healthy water quality parameters (PBF 4) for Texas fatmucket, but water quality is likely compromised during low flows, when water temperatures rise and dissolved oxygen drops. The Upper Elm Creek subunit will require additional management practices to ensure sufficient water quality standards are being met and maintained for Texas fatmucket.

Because this reach of Elm Creek periodically contains the flowing water conditions and host fish species used by Texas fatmucket, it qualifies as habitat according to our regulatory definition (50 CFR 424.02).

If the Texas fatmucket can be reestablished in this reach, it will expand the occupied reach length in Elm Creek to a length that will be more resilient to the stressors that the species is facing. The longer the reach occupied by a species, the more likely it is that the population can withstand stochastic events such as extreme flooding, dewatering, or water contamination. In the SSA report, we identified 50 miles (80.5 km) as a reach long enough for a population to be able to withstand stochastic events, and the addition of this 10.9-mile reach, as well as the adjacent tributary of Bluff Creek, would expand the existing Texas fatmucket population downstream in Lower Elm Creek and in Bluff Creek closer to 50 miles. The addition of multiple tributaries increases the value of the overall critical habitat unit, providing protection for the population should a stochastic event occur in one tributary. If Texas fatmucket were to become reestablished throughout this unit, it would likely be a moderately to highly resilient population due to longer stream length and would increase the species' future redundancy. This unit is essential for the conservation of the species because it will provide habitat for range expansion in portions of known historical habitat that is necessary to increase viability of the species by increasing its resiliency, redundancy, and representation.

We are reasonably certain that this unit will contribute to the conservation of the species, because the need for conservation efforts is recognized and is being discussed by our conservation partners, and methods for restoring and reintroducing the species into unoccupied habitat are being developed. The Texas fatmucket is listed as threatened by the State of Texas, and the Texas Comptroller of Public Accounts has funded research, surveys, propagation, and reintroduction studies for this species. State and Federal partners have shown interest in propagation and reintroduction efforts for the Texas fatmucket. As previously mentioned, efforts are underway regarding a captive propagation program for Texas fatmucket at the San Marcos Aquatic Resource Center and Inks Dam National Fish Hatchery. The State of Texas, San Marcos Aquatic Resource Center, Inks Dam National Fish Hatchery, and the Service's Austin and Texas Coastal Field Offices collaborate regularly on conservation actions. Therefore, this unoccupied critical habitat subunit is essential for the conservation of the Texas fatmucket and is reasonably certain to contribute to such conservation.

Unit TXFM–2: San Saba River

This unit consists of 93.4 river mi (150.3 km) of the San Saba River in Menard, Mason, McCulloch, and San Saba Counties, Texas. This unit of the San Saba River extends from the Schleicher and Menard County line, near Fort McKavett, Texas, downstream to the San Saba River confluence with the Colorado River. The adjacent riparian areas are privately owned. This basin is largely rural and is dominated by mostly agricultural activities including cattle grazing and hay and pecan farming. This unit is affected by very low flows and drought during the summer, which is exacerbated by pumping. This unit contains all of the PBFs essential to the conservation of the Texas fatmucket and is currently occupied by the species. The San Saba River unit is influenced by drought, low flows, underlying geology resulting in a losing reach and is being affected by ongoing agricultural activities and development resulting in excessive sedimentation, water quality degradation, groundwater withdrawals and surface water diversions, and collection. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, improve habitat connectivity, and manage collection. Special management will be necessary to ensure adequate flow and prevent water quality degradation. This subunit is also occupied by Texas fawnsfoot, Texas pimpleback, and false spike.

Unit TXFM–3: Cherokee Creek

This unit consists of 18.1 river mi (29.2 km) of Cherokee Creek in San Saba County, Texas. The adjacent riparian lands are privately owned. The Cherokee Creek unit extends from the County Road 409 bridge crossing downstream to the confluence with the Colorado River. This unit is occupied by the Texas fatmucket and contains all of the PBFs essential to the conservation of the species. Even though this unit is smaller than 50 miles, which we had determined was the reach length long enough to withstand stochastic events, this population increases the species' redundancy, making it more likely to withstand catastrophic events that may eliminate one or more of the other populations. The Cherokee Creek unit is in a rural setting, is influenced by drought and low flows, and is being affected by ongoing agricultural activities and development resulting in excessive sedimentation, water quality degradation, and groundwater withdrawals and surface water diversions. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. Special management may be necessary to limit the effect of low flow and drought conditions. With this special management, the threats to the population may be reduced, increasing the resiliency of the population, and providing additional redundancy and representation for the species.

Unit TXFM–4: Llano River

Subunit TXFM–4a: North Llano River. This subunit consists of 31.2 river mi (50.1 km) in Sutton and Kimble Counties, Texas. The North Llano River subunit extends from the most upstream County Road 307 bridge crossing in Sutton County downstream for 31.2 river mi (50.1 river km) into Kimble County at the confluence with the South Llano River near the city of Junction, Texas. The North Llano River is occupied by the Texas fatmucket and contains all of the PBFs essential to the conservation of the species. Riparian areas adjacent to this subunit are privately owned and largely dominated by rural agricultural operations. This subunit is not heavily influenced by spring inputs like some other tributaries to the Llano River, such as the South Llano River. During summertime low flows and extended periods of drought, this subunit often becomes a series of isolated pools separated by shallow flowing riffles over bedrock. These reduced flows can leave mussels stranded and dessicated in dry beds or isolated in shallow pools. Decreased flows can also result in decreased water quality, specifically in the form of reduced dissolved oxygen and increased temperature. Special management may be required to address ongoing concerns of low flows and subsequent water quality degradation.

Subunit TXFM–4b: South Llano River. The South Llano River subunit extends from the Edwards and Kimble County line downstream 22.9 river mi (36.8 river km) to the confluence with the North Llano River in Kimble County, Texas. Riparian areas adjacent to this subunit are privately owned. Major activities in this basin are farming, ranching, and other agricultural uses, as the watershed remains largely rural. The South Llano River subunit is occupied by the Texas fatmucket and contains all of the PBFs essential to the conservation of the species. The South Llano River subunit is influenced by flooding (leading to scour), drought, and low flows and is being affected by ongoing agricultural activities and development resulting in excessive sedimentation, water quality degradation, and groundwater withdrawals and surface water diversions. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. Special management will be required to address episodic low flows during summer drought and associated with reduced spring flow.

Subunit TXFM–4c: Llano River. This subunit consists of 90.4 river mi (145.6 km) in Kimble, Mason, and Llano Counties, Texas. The Llano River subunit begins at the confluence of the North and South Fork Llano River and continues downstream to the State Highway 16 bridge crossing in Llano County. The riparian land adjacent to the subunit is privately owned, and the watershed remains largely rural. The Llano River subunit is occupied by the Texas fatmucket and contains all of the PBFs essential to the conservation of the species. The Llano River subunit is in a rural setting; is influenced by flooding (leading to scour), drought, and low flows; and is being affected by ongoing agricultural activities and development resulting in excessive sedimentation, water quality degradation, and groundwater withdrawals and surface water diversions. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. Special management may be necessary to prevent low-flow conditions due to drought and agricultural water use. This subunit is also occupied by Texas pimpleback and false spike.

Subunit TXFM–4d: James River. The James River subunit consists of 18.6 river mi (30.1 km) of the James River and begins at the Kimble and Mason county line and continues downstream to the Llano River confluence. Adjacent riparian areas are privately owned. The James River subunit is occupied by the Texas fatmucket and contains all of the PBFs essential to the conservation of the species. The James River subunit is in a rural setting; is influenced by flooding (leading to scour), drought, and low flows; and is being affected by ongoing agricultural activities and development resulting in excessive sedimentation, water quality degradation, and groundwater withdrawals and surface water diversions. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity.

Subunit TXFM–4e: Threadgill Creek. The Threadgill Creek subunit consists of 8.3 river mi (13.4 river km) extending from the Ranch Road 783 bridge crossing downstream to the confluence with Beaver Creek. Riparian lands adjacent to this subunit are privately owned. Threadgill Creek is occupied by the Texas fatmucket and contains all of the PBFs essential to the conservation of the species. The Threadgill Creek subunit is in a rural setting; is influenced by flooding (leading to scour), drought, and low flows; and is being affected by ongoing agricultural activities and development resulting in excessive sedimentation, water quality degradation, and ground water withdrawals and surface water diversions. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity.

Subunit TXFM–4f: Beaver Creek. The Beaver Creek Subunit consists of 12.9 river mi (20.8 river km) and begins at the confluence with Threadgill Creek and continues downstream to the confluence with the Llano River. Adjacent riparian habitats are privately owned. This subunit contains all of the PBFs essential to the conservation of Texas fatmucket. The Beaver Creek subunit is in a rural setting; is influenced by flooding (leading to scour), drought, and low flows; and is being affected by ongoing agricultural activities and development resulting in excessive sedimentation, water quality degradation, and ground water withdrawals and surface water diversions. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity.

This subunit is connected to known populations of Texas fatmucket in Subunits TXFM–4c and TXFM–4e, but there are no recent surveys of Beaver Creek itself. There are no instream structures in subunits TXFM–4c and TXFM–4e that would impede water flow; the flow regime is the same as in those subunits; and the host fish may move between the subunits freely. Based on this information, it is reasonable to conclude that the populations in subunits TXFM–4c and TXFM–4e are unlikely to stop at the most up- or downstream survey location; therefore, we conclude that this subunit is occupied.

However, due to the lack of recent surveys, we are analyzing this subunit against the second prong of the definition of critical habitat for unoccupied habitat out of an abundance of caution. If subunit TXFM–4f is not, in fact, occupied, it is essential to the conservation of the species because it provides for needed growth and expansion of the species in this portion of its historical range and connectivity between documented occupied reaches. Connecting occupied reaches increases the resiliency of the occupied reaches by allowing for gene flow and repopulation after stochastic events. The longer the occupied reach, the more likely it is that the Texas fatmucket population can rebound after stochastic events such as extreme flooding, dewatering, or water contamination. Therefore, subunit TXFM–4e is essential for the conservation of the species.

Unit TXFM–5: Pedernales River

Subunit TXFM–5a: Pedernales River. The Pedernales River subunit consists of 80.1 river mi (128.9 river km) in Gillespie, Blanco, Hays, and Travis Counties, Texas. The Pedernales River subunit extends from the origination of the Pedernales River at the confluence of Bear and Wolf creeks in Gillespie County downstream to the FM 3238 (Hamilton Pool Road) bridge crossing in Travis County. The riparian area of this subunit is primarily privately owned, although 1.5 river mi (2.4 river km) within Lyndon B. Johnson National Historical Park owned and managed by the National Park Service (NPS) in Gillespie County, Texas. The subunit is currently occupied by the Texas fatmucket and supports all of the PBFs essential to the conservation of the species. The watershed of the Pedernales River is characterized by agricultural uses including irrigated orchards and vineyards. Excess nutrients, sediment, and pollutants enter the Pedernales River from wastewater, agricultural runoff, and urban stormwater runoff, all of which reduces instream water quality. The Pedernales River geology, like many central Texas rivers, is predominately limestone outcroppings; therefore, this system is subject to flashy, episodic flooding during rain events that mobilize large amounts of sediment and wood materials. Special management may be required in this subunit to address low water levels as a result of water withdrawals and drought. Additionally, implementation of the highest levels of treatment of wastewater practicable would improve water quality in this subunit, and maintenance of riparian habitat and upland buffers would maintain or improve substrate quality.

Subunit TXFM–5b: Live Oak Creek. The Live Oak Creek subunit consists of 2.6 river mi (4.2 river km) in Gillespie County, Texas. Riparian ownership of lands adjacent to this subunit is private. The Live Oak Creek subunit originates at the FM 2093 bridge crossing downstream to its confluence with the Pedernales River. This subunit is currently occupied by Texas fatmucket and contains all of the PBFs essential to the conservation of the species. The Live Oak Creek subunit is in a mostly rural setting with some urbanization; is influenced by drought, low flows, and flooding (leading to scour); and is being affected by ongoing development and agricultural activities resulting in excessive sedimentation, water quality degradation, and groundwater withdrawals and surface water diversions. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. Special management considerations may be required to address periods of low flow, increased sedimentation, and water quality degradation.

Unit TXFM–6: Onion Creek

Subunit TXFM–6a: Lower Onion Creek. The Lower Onion Creek subunit consists of 5.2 river mi (8.3 river km) in

Travis County, Texas. This subunit extends from the State Highway 130 bridge crossing downstream to the confluence with the Colorado River. This subunit is in close proximity to the rapidly urbanizing city of Austin, Texas, and contains substantial municipal developments. The effects of such rapid and widespread urbanization have contributed to significantly altered flows in Onion Creek that have led to bank destabilization, increased sedimentation and streambed mobilization, and loss of stable substrate. Further, urban runoff pollutants are responsible for degraded water quality conditions. Even though this unit is smaller than 50 miles, which we had determined was the reach length long enough to withstand stochastic events, the population increases the species' redundancy, making it more likely to withstand catastrophic events that may eliminate one or more of the other populations. Further, it is the easternmost population of Texas fatmucket and its loss would lessen the species' distribution considerably. The Lower Onion Creek subunit is occupied by Texas fatmucket. The subunit occurs within private land and contains some of the PBFs essential to the conservation of Texas fatmucket, including host fishes. Several PBFs, such as water quality, sufficient flow rates, and sedimentation, are either missing in this subunit or minimally acceptable for the species. Special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity.

Subunit TXFM–6b: Upper Onion Creek. Because we have determined occupied areas are not adequate for the conservation of the species, we have evaluated whether any unoccupied areas are essential for the conservation of Texas fatmucket and identified this area as essential for the conservation of the species. The Upper Onion Creek subunit consists of 18.9 river mi (30.4 river km) of stream habitat with private riparian ownership. The subunit begins at the Interstate Highway 35 bridge crossing and extends downstream to the State Highway 130 bridge, where it is adjacent to subunit TXFM–6a. The Upper Onion Creek subunit is in a rural but urbanizing setting and is influenced by drought, low flows, and flooding (leading to scour). Riparian lands adjacent to this subunit are privately owned.

This unit is essential to the conservation of Texas fatmucket because it would expand the easternmost population; its loss would diminish the distribution of Texas fatmucket. Additionally, this population of Texas fatmucket is substantially far from the other population of the species, such that if a catastrophic event such as drought or extreme flooding were to occur it is likely that this population would be affected differently, increasing the chance of the species surviving such an event. The subunit is being affected by ongoing agricultural and development activities resulting in excessive sedimentation, water quality degradation, ground water withdrawals and surface water diversions, and wastewater inputs.

Although it is considered unoccupied, portions of this subunit contain some or all of the physical or biological features essential for the conservation of the species. Water quantity (PBF 1) is likely present only during portions of the year. This subunit is subjected to extreme high and extreme low flows during periods of flash flooding and prolonged drought. This subunit requires management actions that address these hydrological alterations leading to extreme high and low flow events.

Suitable substrate and connected instream habitats (PBF 2) are not present through the majority of this reach. The Upper Onion Creek subunit's watershed is highly urbanized and even minor precipitation events frequently result in elevated flows, which scour, mobilize, and redeposit stream bed materials. Management actions addressing overland flows and the frequency of elevated flows in this subunit are required.

Access to host fishes (PBF 3) is the only physical or biological factor currently supported by this subunit because Texas fatmucket utilize common basses and sunfishes (see the SSA report for more details). Future management actions could focus on determining if the abundance and distribution of host fish are sufficient to support a robust Texas fatmucket population.

Urban runoff and resulting inflows from tributary streams contributes to elevated levels of salts and decreased dissolved oxygen levels in Onion Creek. While these parameters may be present during periods of normal flows, we believe they are degraded overall. Management actions that contribute to increased quality of key water parameters (PBF 4) would benefit this stream subunit and allow for the reestablishment of Texas fatmucket. This subunit occurs within the Barton Springs segment of the Edwards Aquifer recharge zone, and the continued management of this aquifer may indirectly benefit Texas fatmucket through water quality improvements.

Because this reach of Onion Creek periodically contains the flowing water conditions and host fish species used by Texas fatmucket, it qualifies as habitat according to our regulatory definition (50 CFR 424.02).

If the Texas fatmucket becomes reestablished in this reach, it will expand the occupied reach length in Onion Creek to a length that will be more resilient to the stressors that the species is facing. The longer the reach occupied by a species, the more likely it is that the population can withstand stochastic events such as extreme flooding, dewatering, or water contamination. The addition of this 18.9-mile reach to the 5.2-mile occupied section of Onion Creek would expand the existing Texas fatmucket population in Onion Creek to 25.1 miles. While this reach length is still less than 50 miles, (the stream length identified in the SSA report as a reach long enough for a population to be able to withstand stochastic events) the additional stream miles would substantially increase the resiliency of this population and dramatically reduce the likelihood of its extirpation. If this unit were established, it would likely be a moderately resilient population due to longer stream length and would increase the species' future redundancy This unit is essential for the conservation of the species because it will provide habitat for range expansion in portions of known historical habitat that is necessary to increase viability of the species by increasing its resiliency, redundancy, and representation.

We are reasonably certain that this unit will contribute to the conservation of the species because it is an extension of a currently occupied unit and it supports the host fish of the species (PBF 2), as well as the appropriate flowing water conditions (PBF 1) periodically. Additionally, the need for conservation efforts is recognized and is being discussed by our conservation partners, and methods for restoring and reintroducing the species into unoccupied habitat are being worked on. The Texas fatmucket is listed as threatened by the State of Texas, and the Texas Comptroller of Public Accounts has funded research, surveys, propagation, and reintroduction studies for this species. State and Federal partners have shown interest in propagation and reintroduction efforts for the Texas fatmucket. As previously mentioned, efforts are underway regarding a captive propagation program for Texas fatmucket at the San Marcos Aquatic Resource Center and Inks Dam National Fish Hatchery. The State of Texas, San Marcos Aquatic Resource Center, Inks Dam National Fish

Hatchery, and the Service's Austin and Texas Coastal Field Offices collaborate regularly on conservation actions. Therefore, this unoccupied critical habitat subunit is essential for the conservation of the Texas fatmucket and is reasonably certain to contribute to such conservation.

Texas Fawnsfoot

We are proposing to designate approximately 917.2 river mi (1,476.1 km) in eight units (11 subunits) as critical habitat for Texas fawnsfoot. The critical habitat areas we describe below constitute our current best assessment of areas that meet the definition of critical habitat for Texas fawnsfoot. The eight areas we propose as critical habitat are: TXFF–1: Clear Fork Brazos River Unit; TXFF–2: Upper Brazos River Unit; TXFF–3: Lower Brazos River Unit; TXFF–4: Little River; TXFF–5: Lower San Saba and Upper Colorado River Unit; TXFF–6: Lower Colorado River Unit; TXFF–7: East Fork Trinity River Unit; and TXFF–8: Trinity River Unit. Table 11 shows the occupancy of the units, the riparian ownership, and approximate length of the proposed designated areas for the Texas fawnsfoot. We present brief descriptions of all proposed units, and reasons why they meet the definition of critical habitat for Texas fawnsfoot, below.

TABLE 11—PROPOSED CRITICAL HABITAT UNITS FOR THE TEXAS FAWNSFOOT (*Truncilla macrodon*)

[Note: Lengths may not sum due to rounding.]

Unit	Subunit	Riparian ownership	Occupancy	River miles (kilometers)
TXFF–1: Clear Fork Brazos River	TXFF–1a: Upper Clear Fork Brazos River	Private	Occupied	27.9 (44.9)
	TXFF–1b: Lower Clear Fork Brazos River	Private	Unoccupied	28.6 (46.0)
TXFF–2: Upper Brazos River		Private	Occupied	79.9 (128.6)
TXFF–3: Lower Brazos River	TXFF–3a: Lower Brazos River	Private	Occupied	348.0 (560.0)
	TXFF–3b: Navasota River	Private	Occupied	39.3 (63.2)
TXFF–4: Little River		Private	Occupied	35.6 (57.3)
TXFF–5: Lower San Saba and Upper Colorado River.	TXFF–5a. Lower San Saba River	Private	Occupied	50.4 (81.1)
	TXFF–5b. Upper Colorado River	Private	Occupied	10.5 (16.9)
TXFF–6: Lower Colorado River		Private	Occupied	124.4 (200.2)
TXFF–7: East Fork Trinity River		Private	Occupied	15.6 (25.1)
TXFF–8: Trinity River		Private	Occupied	157.0 (252.7)
Total				917.2 (1,476.1)

Brazos River Basin

Unit TXFF–1: Clear Fork of the Brazos River

Subunit TXFF–1a: Upper Clear Fork of the Brazos River. The Upper Clear Fork of the Brazos River Subunit consists of approximately 27.9 river mi (44.9 river km) in Throckmorton and Shackelford Counties, Texas. The subunit begins at the confluence of Paint Creek and extends downstream to the US Highway 283 bridge, near Fort Griffin, Texas. Adjacent riparian lands are privately owned. This subunit is occupied by Texas fawnsfoot and contains some of the PBFs essential to the conservation of the species, such as appropriate fish hosts and appropriate flows during portions of the year. The Upper Clear Fork of the Brazos River does not currently have sufficient flow, and water quality is often inadequate for the Texas fawnsfoot in this subunit, largely due to ongoing low-flow conditions from summertime drought and continued pressure on already strained water resources for municipal and agricultural uses.

The Upper Clear Fork Brazos River subunit is in a rural setting and is influenced by drought, low flows, and chlorides. The subunit is being affected by ongoing agricultural activities and development, resulting in excessive sedimentation, water quality degradation, ground water withdrawals and surface water diversions, and wastewater inputs. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity.

Subunit TXFF–1b: Lower Clear Fork of the Brazos River. Because we have determined occupied areas are not adequate for the conservation of the species, we have evaluated whether any unoccupied areas are essential for the conservation of Texas fawnsfoot and identified this area as essential for the conservation of the species. The Lower Clear Fork of the Brazos River Subunit consists of 28.6 river mi (46.0 river km) in Shackelford and Stephens Counties, Texas. This subunit begins at the US Highway 283 bridge and continues downstream to the US Highway 183 bridge in Stephens County, Texas. Adjacent riparian lands are privately owned.

This unit is essential to the conservation of Texas fawnsfoot because it would expand the most northern population; its loss would reduce the distribution of Texas fawnsfoot to only mainstem, higher order streams. Additionally, this population of Texas fawnsfoot is geographically distant from the other populations of the species, such that if a catastrophic event were to occur within the range of Texas fawnsfoot, such as extreme flooding or drought, it is likely that this population would not be affected in the same way, increasing the chance of the species surviving such an event. The Lower Clear Fork Brazos River Subunit is in a rural setting; is influenced by drought, low flows, and chlorides; and is being affected by ongoing agricultural activities and development, resulting in excessive sedimentation, water quality degradation, ground water withdrawals and surface water diversions, and wastewater inputs.

Although it is considered unoccupied, portions of this subunit contain some or all of the physical or biological features essential for the conservation of the species. Flowing water at rates needed by Texas fawnsfoot (PBF 1) is not adequate in this subunit throughout most of the year due to low precipitation, surface diversions, and groundwater withdrawals. In the SSA report, we noted that the Lower Clear Fork of the Brazos River experienced both the lowest flow rate (0 cfs) during the 2011 drought and the highest flow rate (approaching 4,000 cfs) during the 2015 floods. This altered hydrological regime also degrades stream habitat (PBF 2) by either scouring out available substrate or depositing large amounts of sediment on top of otherwise suitable areas. Appropriate substrates are found only in isolated reaches. Management actions that allow for improvement of degraded habitat areas within this subunit would allow Texas fawnsfoot populations to expand and increase the subunit's resiliency.

Freshwater drum, the Texas fawnsfoot's host fish (PBF 3), is expected to be present in the Lower Clear Fork of the Brazos River. However, it remains unclear if the abundance of host fish for the Texas fawnsfoot is currently sufficient. Thus, management actions may be necessary to ensure appropriate populations of host fish are co-occurring with Texas fawnsfoot.

Water quality (PBF 4) may not be sufficient in the Lower Clear Fork of the Brazos River. Elevated chloride levels from naturally occurring underground salt formations are exacerbated by reduced water flow. In order for Texas fawnsfoot populations to expand and occupy the Lower Clear Fork of the Brazos River subunit, management actions would be necessary to reduce chloride levels.

Because this reach of the Clear Fork Brazos River periodically contains the flowing water conditions and host fish species used by Texas fawnsfoot, it qualifies as habitat according to our regulatory definition (50 CFR 424.02).

If the Texas fawnsfoot can be reestablished in this reach, it will expand the occupied reach length in the Clear Fork Brazos River to a length that will be more resilient to the stressors that the species is experiencing. The longer the reach occupied by a species, the more likely it is that the population can withstand stochastic events such as extreme flooding, dewatering, or water contamination. In the SSA report, we identified 50 miles (80.5 km) as a reach long enough for a population to be able to withstand stochastic events, and the addition of this 28.6-mile reach to the 27.9-mile occupied section of the Clear Fork Brazos River would expand the existing Texas fawnsfoot population in the Clear Fork Brazos River to 56.5 miles, achieving a length that would allow for a highly resilient population to be reestablished, increasing the species' future redundancy. This unit is essential for the conservation of the species because it will provide habitat for range expansion in portions of known historical habitat that is necessary to increase viability of the species by increasing its resiliency, redundancy, and representation.

We are reasonably certain that this unit will contribute to the conservation of the species, because the need for conservation efforts is recognized and is being discussed by our conservation partners, and methods for restoring and reintroducing the species into unoccupied habitat are being developed. The Texas fawnsfoot is listed as threatened by the State of Texas, and the Texas Comptroller of Public Accounts has funded research, surveys, propagation, and reintroduction studies for this species. State and Federal partners have shown interest in propagation and reintroduction efforts for the Texas fawnsfoot. As previously mentioned, efforts are underway regarding a captive propagation program for Texas fawnsfoot at the San Marcos Aquatic Resource Center and Inks Dam National Fish Hatchery. The State of Texas, San Marcos Aquatic Resource Center, Inks Dam National Fish Hatchery, and the Service's Austin, Arlington and Texas Coastal Field Offices collaborate regularly on conservation actions for Texas fawnsfoot. Therefore, this unoccupied critical habitat subunit is essential for the conservation of the Texas fawnsfoot and is reasonably certain to contribute to such conservation.

Unit TXFF–2: Upper Brazos River

The Upper Brazos River Unit consists of approximately 79.9 river mi (128.6 km) of the Brazos River in Palo Pinto and Parker Counties, Texas. The Upper Brazos River Unit extends from the FM 4 bridge crossing in Palo Pinto County, Texas, downstream to the FM 1189 bridge in Parker County, Texas. The unit is currently occupied by the species, and adjacent riparian lands are privately owned. This unit currently supports some of the PBFs essential to the conservation of Texas fawnsfoot, such as presence of appropriate fish hosts and suitable flow conditions during portions of the year, but becomes unsuitable during times of drought. The PBFs for water quality and sufficient flow are degraded in this unit, as excessive chloride concentrations and persistent low flows diminish habitat quality in this unit. Elevated chloride concentrations in this portion of Central Texas are often a result of natural causes, such as saline water inputs from spring releases flowing through subterranean salt deposits. However, while the Texas fawnsfoot may be able to tolerate some minor increases in salinity, low-flow rates in this unit exacerbate the concentrations of chlorides.

The Upper Brazos River Unit is in a rural setting with some urbanization; is influenced by drought, low flows, chlorides, and reservoir operations; and is being affected by rock, sand and gravel mining, ongoing agricultural activities and development, resulting in excessive sedimentation, water quality degradation, ground water withdrawals and surface water diversions, and wastewater inputs. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. Special management may be required to improve the water quantity, water quality, and habitat connectivity in this unit.

Unit TXFF–3: Lower Brazos River

Subunit TXFF–3a: Lower Brazos River. The Lower Brazos River Subunit consists of approximately 348.0 river mi (560.0 km) in McLennan, Falls, Robertson, Milam, Burleson, Brazos, Washington, Grimes, Waller, Austin, and Fort Bend Counties, Texas. This subunit begins at the Texas State Highway 6 bridge crossing, downstream of Waco, Texas, to the Fort Bend and Brazoria county line. This subunit is occupied by Texas fawnsfoot and supports all of the PBFs essential to the conservation of the Texas fawnsfoot. Adjacent riparian lands are privately owned and include rural agricultural operations such as cattle grazing and row-crop agriculture. Because much of the historically forested floodplain has been deforested, bank sloughing and sedimentation is ongoing in this segment.

The Lower Brazos River Subunit is in a rural setting with some urbanization; is influenced by drought, low flows, and reservoir operations; and is being affected by rock, sand and gravel mining, channel incision, ongoing agricultural activities and development, resulting in excessive sedimentation, water quality degradation, groundwater withdrawals and surface water diversions, and wastewater inputs. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, restore riparian vegetation, and improve habitat connectivity. The Brazos River Authority (BRA) owns and manages surface water rights throughout the Brazos River basin, and, through operations of the BRA system of reservoirs, the BRA is able to manage flows in this subunit to some degree.

Subunit TXFF–3b: Navasota River. The Navasota River Subunit consists of 39.3 river mi (63.2 river km) of the Navasota River in Brazos and Grimes Counties, Texas. This subunit extends from the State Highway 30 bridge downstream to the Brazos River confluence. Adjacent riparian lands to this subunit are primarily privately owned. The subunit is largely rural with agricultural practices dominating the surrounding landscape. This subunit is occupied by the Texas fawnsfoot and supports the PBFs essential to the conservation of the species. The Navasota River has experienced water quality degradation (low dissolved oxygen and elevated bacteria) from adjacent land use practices, flow alterations associated with drought, and operation of the Lake Limestone reservoir. Additionally, this subunit has elevated levels of nitrate and phosphorus presumably from agricultural runoff. The Navasota River Subunit is in a rural setting with some urbanization; is influenced by drought, low flows, and reservoir operations; and is being affected by ongoing agricultural activities and development, resulting in excessive sedimentation, water quality degradation, ground water withdrawals and surface water diversions, and wastewater inputs. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, restore riparian vegetation, and improve habitat connectivity.

Colorado River Basin

Unit TXFF–4: Little River

The Little River Unit consists of 35.6 river miles (57.3 km) of the Little River in Milam County, Texas. This subunit begins at the Bell and Milam county line and continues downstream to the confluence of the Little and San Gabriel rivers. The lands adjacent to the critical habitat unit are privately owned. The unit is currently occupied by the species and supports all of the PBFs essential to the conservation of the species. The Little River subunit is in a mostly rural setting, is influenced by ongoing development in the upper reaches associated with the Austin-Round Rock metropolitan area, and is being affected by ongoing agricultural activities and development resulting in excessive sedimentation, water quality degradation, and groundwater withdrawals and surface water diversions. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. The Little River Unit is also occupied by false spike.

Unit TXFF–5: Lower San Saba River and Upper Colorado River

Subunit TXFF–5a: Lower San Saba River. The Lower San Saba River Subunit consists of approximately 50.4 river mi (81.1 river km) in San Saba County, Texas. This subunit begins at the Brady Creek confluence and extends to the Colorado River confluence. Adjacent riparian lands are owned and are primarily in agricultural use. The river experiences periods of low flow due to drought and water withdrawals, and water withdrawals are expected to increase in the future. The subunit is occupied by Texas fawnsfoot and contains all of the PBFs essential to the conservation of the species. The Lower San Saba River Subunit is experiencing some urbanization and is influenced by drought, low flows, and wastewater discharges. The watershed is being affected by ongoing agricultural activities and development, resulting in excessive sedimentation, water quality degradation, ground water withdrawals and surface water diversions, and wastewater inputs. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. This subunit is also occupied by Texas pimpleback and false spike.

Subunit TXFF–5b: Upper Colorado River. The Upper Colorado River Subunit consists of 10.5 river mi (16.9 river km) of the Colorado River near its confluence with the San Saba River in San Saba, Mills, and Lampasas Counties, Texas. This subunit extends from the County Road 124 bridge and continues downstream to the US highway 190 bridge. Activities in the watershed are mostly agricultural. The river experiences periodic low flows from drought and upstream water withdrawals. The average daily flow rate of the upper Colorado River in this segment has been declining since the early 1920s. This subunit is currently occupied, and adjacent riparian lands are privately owned. All PBFs essential to the conservation of Texas fawnsfoot are present in this subunit, with the exception of appropriate flows throughout the year.

The Upper Colorado River Subunit is influenced by reservoir operations and chlorides and is being affected by ongoing agricultural activities and development, resulting in excessive sedimentation, water quality degradation, ground water withdrawals and surface water diversions, and wastewater inputs. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. This subunit is also occupied by the Texas pimpleback.

Unit TXFF–6: Lower Colorado River

The Lower Colorado River Unit consists of approximately 124.4 river mi (200.2 river km) of the Colorado River in Colorado, Wharton, and Matagorda Counties, Texas. This unit begins at the Fayette and Colorado county line and continues downstream to the Texas State Highway 35 bridge near Bay City, Texas. Adjacent riparian habitats are privately owned. This unit is currently occupied by Texas fawnsfoot, and all PBFs essential to the conservation of the species are present in the unit. Upstream reservoir operation and urbanization in the Austin, Texas, metropolitan area contribute to altered flows and degraded water quality downstream.

The Lower Colorado River Unit is in a mostly rural setting with some urbanization downstream from an urban area; is influenced by reservoir operations, drought, low flows, flooding (leading to scour), and wastewater discharges; and is being affected by ongoing agricultural activities and development, resulting in excessive sedimentation, water quality degradation, ground water withdrawals and surface water diversions, wastewater inputs, and rock, sand and gravel mining. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. This subunit is also occupied by the Texas pimpleback.

Trinity River Basin

Unit TXFF–7: East Fork of the Trinity River

This unit consists of approximately 15.6 river mi (25.1 km) of the East Fork of the Trinity River in Kaufman County, Texas. The East Fork of the Trinity River Unit extends from the Dallas and Kaufman county line downstream to the Trinity River confluence. This unit is currently occupied, and adjacent riparian lands are privately owned. Even though this unit is smaller than 50 miles, which we had determined was the reach length long enough to withstand stochastic events, the population increases the species' redundancy, making it more likely to withstand catastrophic events that may eliminate one or more of the other populations.

Some of the PBFs essential to the conservation of Texas fawnsfoot are present, such as host fishes and appropriate substrate. The East Fork Trinity River Unit is in an urban setting; is influenced by drought, low flows, wastewater discharges, and flooding (leading to scour); and is being affected by ongoing development activities, resulting in excessive sedimentation, water quality degradation, ground water withdrawals and surface water diversions, and wastewater inputs. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity, which would reduce the threats to the population, increasing the resiliency of the population.

Unit TXFF–8: Middle Trinity River

The Middle Trinity River Unit consists of approximately 157.0 river mi (252.7 km) of the Trinity River in Navarro, Henderson, Freestone, Anderson, Leon, Houston, and Madison Counties, Texas. This unit extends from the State Highway 31 bridge, west of Trinidad, Texas, to the State Highway 21 bridge in Madison County. This unit is occupied, and adjacent riparian lands are privately owned. This unit provides all of the PBFs essential to the conservation of Texas fawnsfoot, although flows in this portion of the Trinity River are elevated above natural levels due to altered hydrology within the basin and daily high mean discharge approaching 80,000 cubic feet per second. Runoff and wastewater effluent release in the Dallas-Fort Worth metropolitan area result in daily pulses of high and low flow moving through the Trinity basin.

The Middle Trinity River Unit is in a rural setting with some urbanization; is influenced by drought, low flows, wastewater discharges, reservoir operations, and flooding (leading to scour); and is being affected by channel incision, ongoing agricultural activities and development, resulting in excessive sedimentation, water quality degradation, ground water withdrawals and surface water diversions, and wastewater inputs. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, restore riparian vegetation, and improve habitat connectivity.

Guadalupe Orb

We are proposing to designate approximately 294.5 river mi (474.0 river km) in two units (four subunits) as critical habitat for Guadalupe orb. The critical habitat areas we describe below constitute our current best assessment of areas that meet the definition of critical habitat for Guadalupe orb. The two areas we propose as critical habitat are: GORB–1: Upper Guadalupe River Unit and GORB–2: Lower Guadalupe River Unit. Table 12 shows the occupancy of the units, the riparian ownership, and approximate length of the proposed designated areas for the Guadalupe orb. We present brief descriptions of all proposed units, and reasons why they meet the definition of critical habitat for Guadalupe orb, below.

TABLE 12—PROPOSED CRITICAL HABITAT UNITS FOR THE GUADALUPE ORB

[Note: Lengths may not sum due to rounding.]

Unit	Subunit	Riparian ownership	Occupancy	River miles (kilometers)
GORB–1: Upper Guadalupe River	GORB–1a: South Fork Guadalupe River	Private	Occupied	5.1 (8.3)
	GORB–1b: Upper Guadalupe River	Private	Occupied	99.4 (159.9)
GORB–2: Lower Guadalupe River	GORB–2a: San Marcos River	Private	Occupied	65.3 (105.1)
	GORB–2b: Lower Guadalupe River	Private	Occupied	124.7 (200.7)
Total				294.5 (474.0)

Guadalupe River Basin

Unit GORB–1: Upper Guadalupe River

Subunit GORB–1a: South Fork Guadalupe River. The South Fork Guadalupe River Subunit consists of 5.1 river mi (8.3 river km) of the South Fork Guadalupe River in Kerr County, Texas. This subunit extends from Griffin Road crossing just downstream of the Texas Highway 39 crossing in Kerr County, to its confluence with the North Fork Guadalupe River. This subunit is occupied by the Guadalupe orb, and the riparian area is privately owned. This subunit is mostly rural and agricultural, with organized recreational camps. These camps often operate very low dams that form small impoundments along the subunit. The South Fork Guadalupe River Subunit contains all of the PBFs essential to the conservation of the species. This subunit, combined with the Upper Guadalupe River subunit, results in a highly resilient population with presence in several tributaries, protecting the population from a single stochastic event eliminating the entire population.

The South Fork Guadalupe River Subunit is in a mostly rural setting; is influenced by drought, low flows, and flooding (leading to scour); and is being affected by ongoing agricultural activities and development, resulting in excessive sedimentation, water quality degradation, and ground water withdrawals and surface water diversions. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity.

Subunit GORB–1b: Upper Guadalupe River. The Upper Guadalupe River Subunit consists of 99.4 river mi (159.9 river km) of the Guadalupe River in Kerr, Kendall, and Comal Counties, Texas. This subunit extends from the confluence of the North and South Forks of the Guadalupe River downstream to the US Highway 311 bridge in Comal County, Texas. The Upper Guadalupe River is occupied by the Guadalupe orb, and adjacent riparian areas are privately owned. The subunit contains the PBFs essential to the conservation of the Guadalupe orb. In recent years, the Guadalupe orb in this reach have experienced some of the highest and lowest flows on record, as well as water quality degradation (high temperature and low dissolved oxygen). Extreme high flows removed needed gravel and cobble, while low flows caused suspended sediment to settle out, reducing substrate quality for the Guadalupe orb.

The Upper Guadalupe River subunit is in a mostly rural setting with some urbanization; is influenced by drought, low flows, and flooding (leading to scour); and is being affected by ongoing agricultural activities and development, resulting in excessive sedimentation, water quality degradation, ground water withdrawals and surface water diversions, and wastewater inputs. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. This subunit is also occupied by Guadalupe fatmucket.

Unit GORB–2: Lower Guadalupe River

Subunit GORB–2a: San Marcos River. The San Marcos River Subunit consists of approximately 65.3 river miles (105.1 river km) in Caldwell, Guadalupe, and Gonzales Counties, Texas. The subunit extends from the FM 1977 bridge crossing in Caldwell County to the

Guadalupe River confluence. The subunit is currently occupied by the Guadalupe orb, and adjacent riparian areas are privately owned. The San Marcos River drains the City of San Marcos, including the campus of Texas State University, leading to impacts of urban runoff, waste water inputs, and altered hydrology. The large San Marcos springs complex, the second largest in Texas, contributes significantly to the flows in this river and the lower Guadalupe River. This segment contains all of the PBFs essential to the conservation of the species.

The San Marcos River Subunit is in a mostly rural setting with some urbanization and downstream from an urban area; is influenced by drought, low flows, flooding (leading to scour), and wastewater discharges; and is being affected by ongoing agricultural activities and development, resulting in excessive sedimentation, water quality degradation, ground water withdrawals and surface water diversions, and wastewater inputs. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. This subunit is also occupied by the false spike.

Subunit GORB–2b: Lower Guadalupe River. The Lower Guadalupe River Subunit consists of approximately 124.7 river mi (200.7 river km) in Gonzales, DeWitt, and Victoria Counties, Texas. This subunit extends from the San Marcos River confluence downstream to the US Highway 59 bridge crossing near Victoria, Texas. The Lower Guadalupe River Subunit is currently occupied by the Guadalupe orb, and adjacent riparian areas are privately owned. This subunit contains all of the PBFs necessary for the Guadalupe orb and is the most resilient population known. Existing protections for the San Marcos and Comal Springs from the Edwards Aquifer Authority Habitat Conservation Plan provide some protection to spring flows and help ensure flow rates and water quality are generally believed to be suitable for downstream mussel beds during times of drought and low flows.

The Lower Guadalupe River subunit is in a mostly rural setting with some urbanization downstream from some urban areas; is influenced by reservoir operations, drought, low flows, flooding (leading to scour), and wastewater discharges; and is being affected by ongoing agricultural activities and development, resulting in excessive sedimentation, water quality degradation, ground water withdrawals and surface water diversions, and wastewater inputs. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. This subunit is also occupied by the false spike.

Texas Pimpleback

We are proposing to designate approximately 494.7 river mi (796.1 km) in six units (10 subunits) as critical habitat for Texas pimpleback. The critical habitat areas we describe below constitute our current best assessment of areas that meet the definition of critical habitat for Texas pimpleback. The five areas we propose as critical habitat are: TXPB–1: Elm Creek Unit; TXPB–2: Concho River Unit; TXPB–3: Upper Colorado River/Lower San Saba River Unit; TXPB–4: Upper San Saba River Unit; TXPB–5: Llano River Unit; and TXPB–6: Lower Colorado River Unit. Table 13 shows the occupancy of the units, the riparian ownership, and approximate length of the proposed designated areas for the Texas pimpleback. We present brief descriptions of all proposed units, and reasons why they meet the definition of critical habitat for Texas pimpleback, below.

TABLE 13—PROPOSED CRITICAL HABITAT UNITS FOR THE TEXAS PIMPLEBACK

[Note: Lengths may not sum due to rounding.]

Unit	Subunit	Riparian ownership	Occupancy	River miles (kilometers)
TXPB–1: Elm Creek	TXPB–1a: Bluff Creek	Private	Occupied	11.8 (19.0)
	TXPB–1b: Lower Elm Creek	Private	Occupied	12.5 (20.2)
TXPB–2: Concho River	TXPB–2a: Lower Concho River	Private	Occupied	35.6 (57.2)
	TXPB–2b. Upper Concho River	Private	Unoccupied	16.0 (25.7)
TXPB–3. Upper Colorado River/Lower San Saba River.	TXPB–3a. Upper Colorado River	Private	Occupied	153.8 (247.6)
	TXPB–3b. Lower San Saba River	Private	Occupied	50.4 (81.1)
TXPB–4: Upper San Saba River		Private	Occupied	52.8 (85.0)
TXPB–5: Llano River	TXPB–5a: Upper Llano River	Private	Occupied	38.3 (61.6)
	TXPB–5b: Lower Llano River	Private	Unoccupied	12.2 (19.7)
TXPB–6. Lower Colorado River		Private	Occupied	111.3 (179.1)
Total				494.7 (796.1)

Colorado River Basin

Unit TXPB–1: Elm Creek

Subunit TXPB–1a: Bluff Creek. This occupied critical habitat subunit consists of 11.8 river mi (19.0 km) of Bluff Creek, a tributary to Elm Creek, in Runnels County, Texas. The subunit extends from the County Road 153 bridge crossing, near the town of Winters, Texas, downstream to the confluences of Bluff and Elm creeks. The riparian area of this subunit is privately owned. This subunit is currently occupied by Texas pimpleback. The Bluff Creek subunit is in a rural setting, is influenced by drought, low flows, and elevated chlorides, and is being affected by ongoing agricultural activities and development resulting in excessive sedimentation, water quality degradation, and ground water withdrawals and surface water diversions. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. This subunit is also occupied by Texas fatmucket.

Subunit TXPB–1b: Lower Elm Creek. This subunit consists of 12.5 river mi (20.2 km) of Elm Creek beginning at the County Road 344 crossing downstream to Elm Creek's confluence with the Colorado River in Runnels County, Texas. The riparian lands adjacent to this subunit are privately owned. The Elm Creek watershed is relatively small and remains largely rural and dominated by agricultural practices. This stream regularly has extremely low or no flow during times of drought. Moreover, this stream has elevated chloride concentrations and sedimentation resulting in reduced habitat quality and availability, and decreased water quality. Lower Elm Creek is occupied by Texas pimpleback and contains some of the PBFs essential to the conservation of the species such as presence of host fish; others are in degraded condition and would benefit from management actions. The Lower Elm Creek subunit is influenced by drought, low flows, and elevated chlorides, and is being affected by ongoing agricultural activities and development resulting in excessive sedimentation, water quality degradation, and groundwater withdrawals and surface water diversions. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. This unit is also occupied by Texas fatmucket.

Unit TXPB–2: Concho River

Subunit TXPB–2a: Lower Concho River. The Lower Concho River Subunit consists of approximately 35.6 river mi (57.2 river km) in Tom Green and Concho Counties, Texas. The Concho River subunit extends from the FM 1692 bridge crossing downstream to the FM 1929 crossing. This subunit is occupied, and its riparian area is privately owned. The Lower Concho River Subunit does not currently contain all of the PBFs essential to the conservation of the Texas pimpleback, as it does not currently have sufficient water quality (*e.g.,* water temperature is high and dissolved oxygen is low) and instream flow is too low at certain times of the year. Upstream reservoirs, built for flood control and municipal water storage, have contributed to a downward trend in normal river base-flows in recent years. The Lower Concho River subunit is in a mostly rural setting downstream from an urban area, is influenced by reservoir operations and chlorides, and is being affected by ongoing agricultural activities and development resulting in excessive sedimentation, water quality degradation, ground water withdrawals and surface water diversions, and wastewater inputs. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity.

Subunit TXPB–2b: Upper Concho River. Because we have determined occupied areas are not adequate for the conservation of the species, we have evaluated whether any unoccupied areas are essential for the conservation of Texas pimpleback and identified this area as essential for the conservation of the species. The Upper Concho River subunit consists of 16.0 river mi (25.7 river km) of the Concho River in Tom Green County, Texas, from the FM 380 bridge crossing, downstream of San Angelo, Texas, to the FM 1692 bridge where it adjoins subunit TXPB–2a. The riparian lands adjacent to this subunit are privately owned.

This subunit is essential to the conservation of Texas pimpleback because it would expand one of the smaller populations to a length that would be highly resilient to stochastic events; its loss would shrink the distribution of Texas pimpleback and reduce redundancy of the species, limiting its viability. The Upper Concho River subunit is in a mostly rural setting with some urbanization downstream from an urban area; is influenced by reservoir operations, wastewater discharges, and chlorides; and is being affected by ongoing agricultural activities and development resulting in excessive sedimentation, water quality degradation, groundwater withdrawals and surface water diversions, and wastewater inputs.

Although it is considered unoccupied, portions of this subunit contain some or all of the physical or biological features essential for the conservation of the species. Flowing water (PBF 1) is not at levels appropriate for Texas pimpleback in this subunit. Several upstream reservoirs divert the already limited flows, and reduced precipitation has resulted in an overall decrease in river flow rates. Management actions to increase stream flows in this subunit would be required for the Texas pimpleback population to be reestablished.

Currently, appropriate substrates (PBF 2) exist in isolated areas throughout this subunit. These isolated pockets of suitable habitat could allow for expansion and recolonization of Texas pimpleback. However, future management actions that focus on habitat restoration in this reach to improve connectivity between habitat patches would improve the resiliency of this population, once restored.

Recent research on the closely related Guadalupe orb indicated that several species of catfishes are likely suitable host fishes for Texas pimpleback, as well. Currently, we believe appropriate host fishes (PBF 3) are occurring throughout the subunit and would allow for reproduction of Texas pimpleback when the species is reestablished. Management actions could address any deficit in the abundance and distribution of fish hosts in this area allowing for expansion and future reestablishment of this subunit from the adjacent occupied subunit TXPB–2a.

Water quality (PBF 4) is degraded in this subunit. The Upper Concho River subunit, due in part to low flows and high water temperature, experiences decreased levels of dissolved oxygen at such a level that could preclude mussel occupancy. We believe these periods of low dissolved oxygen primarily occur during hot summer months when droughts are common. Therefore, management actions that increase flow rates would also improve water quality in this reach.

Because this reach of the Concho River periodically contains the appropriate substrate conditions and host fish species used by Texas pimpleback, it qualifies as habitat according to our regulatory definition (50 CFR 424.02).

If the Texas pimpleback can be reestablished in this reach, it will expand the occupied reach length in the Concho River to a length that will be more resilient to the stressors that the species is facing. The longer the reach occupied by a species, the more likely it is that the population can withstand stochastic events such as extreme flooding, dewatering, or water contamination. In the SSA report, we identified 50 miles (80.5 km) as a reach long enough for a population to be able to withstand stochastic events, and the addition of this 16.0-mile reach to the 35.6-mile occupied section of the Concho River would expand the existing Texas fawnsfoot population in the Concho River to 51.6 miles, achieving a length that would allow for a highly resilient population to be reestablished, increasing the species' future redundancy. This unit is essential for the conservation of the species because it will provide habitat for range expansion in portions of known historical habitat that is necessary to increase viability of the species by increasing its resiliency, redundancy, and representation.

We are reasonably certain that this unit will contribute to the conservation of the species, because the need for conservation efforts is recognized and is being discussed by our conservation partners, and methods for restoring and reintroducing the species into unoccupied habitat are being worked on. The Texas pimpleback is listed as threatened by the State of Texas, and the Texas Comptroller of Public Accounts has funded research, surveys, propagation, and reintroduction studies for this species. State and Federal partners have shown interest in propagation and reintroduction efforts for the Texas pimpleback. As previously mentioned, efforts are underway regarding a captive propagation program for Texas pimpleback at the San Marcos Aquatic Resource Center and Inks Dam National Fish Hatchery. The State of Texas, San Marcos Aquatic Resource Center, Inks Dam National Fish Hatchery, and the Service's Austin and Texas Coastal Field Offices collaborate regularly on conservation actions. Therefore, this unoccupied critical habitat subunit is essential for the conservation of the Texas pimpleback and is reasonably certain to contribute to such conservation.

Unit TXPB–3: Upper Colorado River and Lower San Saba River

Subunit TXPB–3a: Upper Colorado River. The Upper Colorado River Subunit consists of approximately 153.8 river mi (247.6 river km) in Coleman, McCulloch, Brown, San Saba, Mills, and Lampasas Counties, Texas. The subunit extends from the Coleman and McCulloch county line downstream to the confluence of the Colorado River and Cherokee Creek. The riparian area of this subunit is privately owned. The Upper Colorado River is occupied by Texas pimpleback and contains some of the PBFs essential to the conservation of the species, including host fishes in appropriate abundance and small areas of suitable substrate habitat, but not several PBFs, such as sufficient flow rate and sufficient water quality (dissolved oxygen is often low, and temperature reaches unsuitably high levels during summer drought). The Upper Colorado River subunit is in a mostly rural setting, is influenced by reservoir operations and chlorides, and is being affected by ongoing agricultural activities and development resulting in excessive sedimentation, water quality degradation, groundwater withdrawals and surface water diversions, and wastewater inputs. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. This subunit is also occupied by Texas fawnsfoot.

Subunit TXPB–3b: Lower San Saba River. The Lower San Saba River Subunit consists of 50.4 river mi (81.1 river km) of the San Saba River. This subunit is currently occupied by the species, and adjacent riparian areas are privately owned. The Lower San Saba Subunit extends from the Brady Creek confluence in San Saba County, Texas, downstream to the Colorado River confluence where it adjoins the Upper Colorado River subunit (TXPB–3a). This subunit contains all the PBFs essential to the conservation of the Texas pimpleback most of the year. This population contains evidence of recent Texas pimpleback reproduction, which is largely absent from the rest of the species' range.

This subunit is primarily rural, with cattle grazing and irrigated orchards. Summer drought and water withdrawals cause occasional periods of low flow, which results in water quality degradation as water temperatures are high and dissolved oxygen is low. Additionally, high-flow events during flooding can result in habitat scour and sedimentation. The Lower San Saba River Subunit is experiencing some urbanization; is influenced by drought, low flows, and wastewater discharges; and is being affected by ongoing agricultural activities and development, resulting in excessive sedimentation, water quality degradation, ground water withdrawals and surface water diversions, and wastewater inputs. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. This subunit is also occupied by Texas fawnsfoot and false spike.

Unit TXPB–4: Upper San Saba River

The Upper San Saba River Unit consists of approximately 52.8 river mi (85.0 river km) of the San Saba River in Menard County, Texas. Adjacent riparian habitats are privately owned. The Upper San Saba River Unit extends from the Schleicher County line near Fort McKavett, Texas, downstream to the FM 1311 bridge crossing in Menard, County, Texas. Texas pimpleback occupies the Upper San Saba River Unit in low densities. The Upper San Saba River Unit contains the PBFs essential to the conservation of Texas pimpleback most of the year, although flows decline to low levels during summer drought. The PBFs of sufficient water flow and water quality are lacking during these times, as low-flow conditions lead to high water temperature and low dissolved oxygen. The Upper San Saba River unit is in a rural setting; is influenced by drought, low flows, and underlying geology resulting in a losing reach; and is being affected by ongoing agricultural activities and development resulting in excessive sedimentation, water quality degradation, groundwater withdrawals and surface water diversions, and collection. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. This subunit is also occupied by Texas fatmucket.

Unit TXPB–5: Llano River

Subunit TXPB–5a: Upper Llano River. The Upper Llano River Subunit consists of approximately 38.3 river mi (61.6 river km) in Kimble and Mason Counties, Texas. Adjacent riparian areas are privately owned. This subunit extends from the Ranch Road RR 385 bridge crossing downstream to the US Highway 87 bridge. This reach of the Llano River is largely rural, with much of the land in agricultural use. The Upper Llano River Subunit is occupied by the Texas pimpleback and contains all the necessary PBFs essential to the conservation of the species most of the year. However, drought conditions and flooding in the Llano River can be extreme, causing the species to experience either extreme low-flow conditions with related reduced water quality or extreme high flows that mobilize substrate, eroding habitat or depositing sediment on Texas pimpleback populations. The Upper Llano River Subunit is in a rural setting; is influenced by drought, low flows, and flooding (leading to scour); and is being affected by ongoing agricultural activities and development resulting in excessive sedimentation, water quality degradation, ground water withdrawals and surface water diversions, and collection. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, improve habitat connectivity, and manage collection. This subunit is also occupied by Texas fatmucket.

Subunit TXPB–5b: Lower Llano River. Because we have determined occupied areas are not adequate for the conservation of the species, we have evaluated whether any unoccupied areas are essential for the conservation of Texas pimpleback and identified this area as essential for the conservation of the species. The Lower Llano River Subunit consists of 12.2 river mi (19.7 river km) of the Llano River. This subunit extends from the US Highway 87 bridge in Mason County downstream to the Mason and Llano county line. Adjacent riparian lands are privately owned.

This subunit is essential to the conservation of Texas pimpleback because it would expand one of the smaller populations to a length that would be highly resilient to stochastic events in a separate tributary; its loss would reduce the distribution of Texas pimpleback and reduce redundancy of the species, limiting its viability. The Lower Llano River Subunit is in a rural setting; is influenced by drought, low flows, and flooding (leading to scour);

and is being affected by ongoing agricultural activities and development, resulting in excessive sedimentation, water quality degradation, and ground water withdrawals and surface water diversions.

Although it is considered unoccupied, portions of this subunit contain some or all of the physical or biological features essential for the conservation of the species. Flowing water (PBF 1) is generally sufficient in this subunit during portions of the year. However, in the past decade the Llano River has seen both the highest and lowest flow rates ever recorded, with extremely low water levels and stranding of mussels during low flow, and scour and entrainment of mussels with subsequent deposition over suitable habitat during floods. Spring inputs from the South Llano River help mitigate the effects of drought in the lower portions of the Llano River, although water withdrawals for agricultural operations contribute to decreased flows during drought. Ongoing management actions by resource management agencies and non-profit organizations are contributing to restoring a natural flow regime.

In the Llano River, suitable substrates (PBF 2) exist as isolated riffles between larger pools. Given the hydrology of the Llano River basin, suitable substrates have been degraded in this reach and would need restoration.

The Texas pimpleback uses similar host fishes as the closely related Guadalupe orb, including channel catfish, flathead catfish, and tadpole madtom. Sufficient abundance of host fishes (PBF 3) are present in the lower Llano River subunit to support a population of Texas pimpleback.

Water quality in the lower Llano River subunit (PBF 4) are generally sufficient for the species during portions of the year. However, dissolved oxygen declines and water temperature increases during periods of low flow. Management to ensure sufficient flow rates in this reach will improve water quality as well.

Because this reach of the Llano River periodically contains the flowing water conditions, suitable substrates, and host fish species used by Texas pimpleback, it qualifies as habitat according to our regulatory definition (50 CFR 424.02).

If the Texas pimpleback can be reestablished in this reach, it will expand the occupied reach length in the Llano River to a length that will be more resilient to the stressors that the species is facing. The longer the reach occupied by a species, the more likely it is that the population can withstand stochastic events such as extreme flooding, dewatering, or water contamination. In the SSA report, we identified 50 miles (80.5 km) as a reach long enough for a population to be able to withstand stochastic events, and the addition of this 12.2-mile reach to the 38.3-mile occupied section of the Llano River would expand the existing Texas pimpleback population in the Llano River to 50.5 miles, achieving a length that would allow for a highly resilient population to be reestablished, increasing the species' future redundancy. This unit is essential for the conservation of the species because it will provide habitat for range expansion in portions of known historical habitat that is necessary to increase viability of the species by increasing its resiliency, redundancy, and representation.

We are reasonably certain that this unit will contribute to the conservation of the species, because the need for conservation efforts is recognized and is being discussed by our conservation partners, and methods for restoring and reintroducing the species into unoccupied habitat are being worked on. The Texas pimpleback is listed as threatened by the State of Texas, and the Texas Comptroller of Public Accounts has funded research, surveys, propagation, and reintroduction studies for this species. State and Federal partners have shown interest in propagation and reintroduction efforts for the Texas pimpleback. As previously mentioned, efforts are underway regarding a captive propagation program for Texas pimpleback at the San Marcos Aquatic Resource Center and Inks Dam National Fish Hatchery. The State of Texas, San Marcos Aquatic Resource Center, Inks Dam National Fish Hatchery, and the Service's Austin and Texas Coastal Field Offices collaborate regularly on conservation actions.

Therefore, this unoccupied critical habitat subunit is essential for the conservation of the Texas pimpleback and is reasonably certain to contribute to such conservation. This subunit is also occupied by Texas fatmucket and false spike.

Unit TXPB–6: Lower Colorado River

The Lower Colorado River Unit consists of approximately 111.3 river mi (179.1 river km) of the Colorado River in Colorado and Wharton Counties, Texas. The Lower Colorado River unit extends from the Fayette and Colorado County line downstream to the Wharton and Matagorda County line. The unit is currently occupied, and adjacent riparian lands are privately owned. This unit contains all of the PBFs essential to the conservation of Texas pimpleback. Periodic low flows due to drought and water management activities contribute to diminished and variable flows, dewatering, scour, and water quality decline from urban run-off, agricultural operations, and wastewater treatment effluent. The Lower Colorado River Unit is in a mostly rural setting with some urbanization downstream from an urban area and is influenced by reservoir operations, drought, low flows, flooding (leading to scour), and wastewater discharges. The unit is being affected by ongoing agricultural activities and development, resulting in excessive sedimentation, water quality degradation, ground water withdrawals and surface water diversions, wastewater inputs, and rock, sand and gravel mining. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. This subunit is also occupied by Texas fatmucket.

False Spike

We are proposing to designate approximately 328.2 river mi (528.2 km) in four units (seven subunits) as critical habitat for false spike. Each of the seven subunits is currently occupied by the species and contains all of the PBFs essential to the conservation of the species. The critical habitat areas we describe below constitute our current best assessment of areas that meet the definition of critical habitat for false spike. The four areas we propose as critical habitat are: FASP–1: Little River Unit; FASP–2: San Saba River Unit; FASP–3: Llano River Unit; and FASP–4: Guadalupe River Unit. Table 14 shows the occupancy of the units, the riparian ownership, and approximate length of the proposed designated areas for the false spike. We present brief descriptions of all proposed units, and reasons why they meet the definition of critical habitat for false spike, below.

TABLE 14—PROPOSED CRITICAL HABITAT UNITS FOR FALSE SPIKE

[Note: Lengths may not sum due to rounding]

Unit	Subunit	Riparian ownership	Occupancy	River miles (kilometers)
FASP–1: Little River	FASP–1a: Little River	Private	Occupied	35.6 (57.3)
	FASP–1b: San Gabriel River	Private	Occupied	31.4 (50.5)
	FASP–1c: Brushy Creek	Private	Occupied	14.0 (22.5)
FASP–2: San Saba River		Private	Occupied	50.4 (81.1)
FASP–3: Llano River		Private	Occupied	50.5 (81.3)
FASP–4: Guadalupe River	FASP–4a: San Marcos River	Private	Occupied	21.6 (34.8)
	FASP–4b: Guadalupe River	Private	Occupied	124.7 (200.7)
Total				328.2 (528.2)

Brazos River Basin

Unit FASP–1: Little River

Subunit FASP–1a: Little River. This subunit consists of 35.6 river miles (57.3 km) of the Little River in Milam County, Texas. This subunit begins at the Bell and Milam county line and continues downstream to the confluence of the Little and San Gabriel Rivers. The lands adjacent to the critical habitat unit are privately owned. The unit is currently occupied by the species and supports all of the PBFs essential to the conservation of the species. The Little River subunit is in a mostly rural setting, is influenced by ongoing development in the upper reaches associated with the Austin-Round Rock metropolitan area, and is being affected by ongoing agricultural activities and development resulting in excessive sedimentation, water quality degradation, and ground water withdrawals and surface water diversions. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. This subunit is also occupied by the Texas fawnsfoot.

Subunit FASP–1b: San Gabriel River. This subunit consists of 31.4 river mi (50.5 km) of the San Gabriel River in Williamson and Milam Counties, Texas. The subunit starts downstream of the Granger Lake dam (at the downstream edge of the Pecan Grove State Wildlife Management Area) and continues through Williamson County to the confluence of the San Gabriel and Little Rivers in Milam County. The land adjacent to this subunit is all privately owned. The San Gabriel River subunit is currently occupied by the species and currently supports all of the PBFs essential to the conservation of the species. The San Gabriel River subunit is in a rural setting, is influenced by releases from Granger Reservoir, and is being affected by ongoing agricultural activities and development resulting in excessive sedimentation, water quality degradation, and ground water withdrawals and surface water diversions. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity.

Subunit FASP–1c: Brushy Creek. The subunit consists of 14.0 river mi (22.5 km) of Brushy Creek in Milam County, Texas. The subunit begins at the US Highway 79 bridge crossing and extends downstream to the confluence with Brushy Creek and the San Gabriel River. The unit is currently occupied by the species, and the adjacent riparian areas are privately owned. This stream drains a large portion of the City of Cedar Park, resulting in altered hydrology, altered flow regimes, and increased sedimentation. Brushy Creek contains some of the PBFs essential to the conservation of the false spike, such as adequate fish hosts, but other factors like water flow rates and water quality parameters may not be adequate during summer low-flow periods. The Brushy Creek subunit is in a rural but urbanizing setting, and it is influenced by wastewater discharges and ongoing development in the upper reaches associated with the Austin-Round Rock metropolitan area. It is also being affected by ongoing development and agricultural activities resulting in excessive sedimentation, water quality degradation, ground water withdrawals and surface water diversions, and wastewater inputs. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. Additionally, hydrological alterations in this watershed result in scour and mobilization of sediment during times of high-flow rates, resulting in loss of appropriate mussel habitat. Special management considerations for this area could include the highest level of wastewater treatment, decreased pollutant inputs from surface flows, bank stabilization, and increased flows during low-flow periods.

Colorado River Basin

Unit FASP–2: San Saba River

This unit consists of 50.4 river mi (81.1 km) of the San Saba River in San Saba County, Texas. The unit extends from the San Saba River and Brady Creek confluence and continues downstream to the confluence of the San Saba and Colorado Rivers. The riparian land adjacent to the critical habitat unit is privately owned. The unit is currently occupied by the species and contains all of the PBFs essential to the conservation of false spike. The San Saba River subunit is in a rural setting, is influenced by drought, low flows, and wastewater discharges, and is being affected by ongoing agricultural activities and development resulting in excessive sedimentation, water quality degradation, groundwater withdrawals and surface water diversions, and wastewater inputs. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. Much of the land use in the watershed is agricultural, and special management considerations or protection may be required to address excess nutrients, sediment, and pollutants that enter the San Saba River and reduce instream water quality. Sources of these types of pollution are wastewater, agricultural runoff, and urban stormwater runoff. Additional special management considerations or protection may be required in this unit to address low water levels that result from water withdrawals and drought, as well as excessive erosion. This subunit is also occupied by Texas pimpleback.

Unit FASP–3: Llano River

This unit consists of 50.5 river mi (81.3 km) of the Llano River in Kimble and Mason Counties, Texas. The Llano River unit begins at the Ranch Road 385 bridge crossing in Kimble County and continues downstream to the Mason and Llano County line. The unit is occupied by the species, and surrounding riparian areas are privately owned. The majority of the Llano River basin is rural and composed of agricultural operations that were historically used for sheep and goat ranching. During 2018, the Llano River experienced some of the largest floods and most severe drought within the same year. Extreme floods and drought conditions result in both stream bed mobilization, sedimentation, and dewatering. The Llano River unit contains all the PBFs essential to the conservation of false spike. The Llano River unit is in a rural setting; is influenced by drought, low flows, and flooding (leading to scour); and is being affected by ongoing agricultural activities and development resulting in excessive sedimentation, water quality degradation, ground water withdrawals and surface water diversions, and collection. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, improve habitat connectivity, and manage collection. Additionally, special management may be required to address excess nutrients, sediment, and pollutants, as well as exceptionally low and high flows. This subunit is also occupied by Texas fatmucket, Texas fawnsfoot, and Texas pimpleback.

Guadalupe River Basin

Unit FASP–4: Guadalupe River

Subunit FASP–4a: San Marcos River. This subunit consists of 21.6 river mi (34.8 km) of the San Marcos River in Gonzales County, Texas. The San Marcos River subunit begins at the Farm-to-Market (FM) 2091 bridge crossing within Palmetto State Park (Park Road 11) and continues for 21.7 river miles downstream to the San Marcos River confluence with the Guadalupe River. The riparian lands adjacent to this subunit are primarily privately owned; Texas Parks and Wildlife Department's Palmetto State Park occurs in the upstream reaches. The San Marcos River drains the City of San Marcos, including the campus of Texas State University, which causes the river to be impacted by urban runoff, wastewater inputs, and altered hydrology. The San Marcos springs complex, the second largest in Texas, contributes significantly to the flows in this river and the lower Guadalupe River. The lower San Marcos River watershed is characterized by agricultural land in the lower portion of the San Marcos River. The subunit is occupied by the false spike and contains all of the PBFs essential to the conservation of the species. Because the San Marcos River subunit is downstream from an urban area in a rural but urbanizing setting, it is influenced by wastewater discharges and ongoing development in the upper reaches associated with the Austin-Round Rock metropolitan area. It is also being affected by ongoing development and agricultural activities resulting in excessive sedimentation, water quality degradation, ground water withdrawals and surface water diversions, and wastewater inputs. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. Special management considerations may be required to address riparian bank sloughing, increased sedimentation, and pollutants from upstream urbanization and agricultural practices. This subunit is also occupied by Guadalupe orb.

Subunit FASP–4b: Guadalupe River. This subunit consists of 124.7 river mi (200.7 km) of the Guadalupe River in Gonzales, DeWitt, and Victoria Counties, Texas. The Guadalupe River subunit begins at the confluence of the Guadalupe and San Marcos Rivers and continues downstream for 124.7 river miles to the US highway 59 bridge near Victoria, Texas. Adjacent riparian areas within this subunit are privately owned. This subunit is occupied by the false spike and contains all of the PBFs essential to the conservation of the species. The Guadalupe River subunit is in a mostly rural but urbanizing setting, is influenced by reservoir releases (from Canyon and Guadalupe Valley) and flooding (leading to scour), and is being affected by ongoing development and agricultural activities resulting in excessive sedimentation, water quality degradation, ground water withdrawals and surface water diversions, and wastewater inputs. Therefore, special management is necessary to reduce sedimentation, improve water quality, maintain adequate flows, and improve habitat connectivity. This subunit contains the most resilient known population of false spike. During times of drought, spring water influence from the Comal and San Marcos Rivers can contribute as much as 50 percent of the flows to the lower Guadalupe River. Continued protections for these spring systems are imperative for protecting mussel beds in the lower Guadalupe River. Special management considerations may be required to ensure low flows, sedimentation, and degraded water quality parameters do not worsen and contribute to future population decline. This subunit is also occupied by Guadalupe orb.

Effects of Critical Habitat Designation

Section 7 Consultation

Section 7(a) of the Act requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as an endangered or threatened species and with respect to its critical habitat, if any is designated. Section 7(a)(2) of the Act requires Federal agencies, including the Service, to ensure that any action they fund, authorize, or carry out is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of designated critical habitat of such species. In addition, section 7(a)(4) of the Act requires Federal agencies to confer with the Service on any agency action that is likely to jeopardize the continued existence of any species proposed to be listed under the Act or result in the destruction or adverse modification of proposed critical habitat.

We published a final regulation with a revised definition of destruction or adverse modification on August 27, 2019 (84 FR 44976). Destruction or adverse modification means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.

If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency (action agency) must enter into consultation with us. Examples of actions that are subject to the section 7 consultation process are actions on State, tribal, local, or private lands that require a Federal permit or that involve some other Federal action. Federal agency actions within the species' habitat that may require conference or consultation or both include management and any other landscape-altering activities on Federal lands administered by the U.S. Fish and Wildlife Service, Army National Guard, U.S. Forest Service, and National Park Service; issuance of section 404 Clean Water Act (33 U.S.C. 1251 *et seq.*) permits by the U.S. Army Corps of Engineers; and construction and maintenance of roads or highways by the Federal Highway Administration. Federal actions not affecting listed species or critical habitat, and actions on State, tribal, local, or private lands that are not federally funded, authorized, or carried out by a Federal agency, do not require section 7 consultation.

Compliance with the requirements of section 7(a)(2), is documented through our issuance of:

(1) A concurrence letter for Federal actions that may affect, but are not likely to adversely affect, listed species or critical habitat; or

(2) A biological opinion for Federal actions that may affect, and are likely to adversely affect, listed species or critical habitat.

When we issue a biological opinion concluding that a project is likely to jeopardize the continued existence of a listed species and/or destroy or adversely modify critical habitat, we provide reasonable and prudent alternatives to the project, if any are identifiable, that would avoid the likelihood of jeopardy and/or destruction or adverse modification of critical habitat. We define ''reasonable and prudent alternatives'' (at 50 CFR 402.02) as alternative actions identified during consultation that:

(1) Can be implemented in a manner consistent with the intended purpose of the action,

(2) Can be implemented consistent with the scope of the Federal agency's legal authority and jurisdiction,

(3) Are economically and technologically feasible, and

(4) Would, in the Service Director's opinion, avoid the likelihood of jeopardizing the continued existence of the listed species and/or avoid the likelihood of destroying or adversely modifying critical habitat.

Reasonable and prudent alternatives can vary from slight project modifications to extensive redesign or relocation of the project. Costs associated with implementing a reasonable and prudent alternative are similarly variable.

Regulations at 50 CFR 402.16 set forth requirements for Federal agencies to reinitiate formal consultation on previously reviewed actions. These requirements apply when the Federal agency has retained discretionary involvement or control over the action (or the agency's discretionary involvement or control is authorized by law) and, if subsequent to the previous consultation: (1) If the amount or extent of taking specified in the incidental take statement is exceeded; (2) if new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or (4) if a new species is listed or critical habitat designated that may be affected by the identified action. In such situations, Federal agencies sometimes may need to request reinitiation of consultation with us, but the regulations also specify some exceptions to the requirement to reinitiate consultation on specific land management plans after subsequently listing a new species or designating new critical habitat. See the regulations for a description of those exceptions.

Application of the ''Adverse Modification'' Standard

The key factor related to the destruction or adverse modification determination is whether implementation of the proposed Federal action directly or indirectly alters the designated critical habitat in a way that appreciably diminishes the value of the critical habitat as a whole for the conservation of the listed species. As discussed above, the role of critical habitat is to support physical or biological features essential to the conservation of a listed species and provide for the conservation of the species.

Section 4(b)(8) of the Act requires us to briefly evaluate and describe, in any proposed or final regulation that designates critical habitat, activities involving a Federal action that may violate 7(a)(2) of the Act by destroying or adversely modifying such habitat, or that may be affected by such designation.

Activities that the Service may, during a consultation under section 7(a)(2) of the Act, find are likely to destroy or adversely modify critical habitat include, but are not limited to:

(1) Actions that would alter the minimum flow or the existing flow regime. Such activities could include, but are not limited to, impoundment, channelization, water diversion, water withdrawal, and hydropower generation. These activities could eliminate or reduce the habitat necessary for the growth and reproduction of the Central Texas mussels and its fish host by decreasing or altering flows to levels that would adversely affect their ability to complete their life cycles.

(2) Actions that would significantly alter water chemistry or temperature. Such activities could include, but are not limited to, release of chemicals (including pharmaceuticals, metals, and salts), biological pollutants, or heated effluents into the surface water or connected groundwater at a point source or by dispersed release (non-point source). These activities could alter water conditions to levels that are beyond the tolerances of the mussel or its host fish and result in direct or cumulative adverse effects to these individuals and their life cycles.

(3) Actions that would significantly increase sediment deposition within the stream channel. Such activities could include, but are not limited to, excessive sedimentation from livestock grazing, road construction, channel alteration, timber harvest, off-road vehicle use, agricultural, industrial, and urban development, and other watershed and floodplain disturbances. These activities could eliminate or reduce the habitat necessary for the growth and reproduction of the mussel and its fish host by increasing the sediment deposition to levels that would adversely affect their ability to complete their life cycles.

(4) Actions that would significantly alter channel morphology or geometry. Such activities could include, but are not limited to, channelization, impoundment, road and bridge construction, mining, dredging, and destruction of riparian vegetation. These activities may lead to changes in water flows and levels that would degrade or eliminate the mussel or its fish host and/or their habitats. These actions can also lead to increased sedimentation and degradation in water quality to levels that are beyond the tolerances of the mussel or its fish host.

(5) Actions that result in the introduction, spread, or augmentation of nonnative aquatic species in occupied stream segments, or in stream segments that are hydrologically connected to occupied stream segments, even if those segments are occasionally intermittent, or introduction of other species that compete with or prey on the Central Texas mussels. Possible actions could include, but are not limited to, stocking of nonnative fishes, stocking of sport fish, or other related actions. These activities can introduce parasites or disease for host fish, and can result in direct predation, or affect the growth, reproduction, and survival, of Central Texas mussels.

Exemptions

Application of Section 4(a)(3) of the Act

Section 4(a)(3)(B)(i) of the Act (16 U.S.C. 1533(a)(3)(B)(i)) provides that the Secretary shall not designate as critical habitat any lands or other geographical areas owned or controlled by the Department of Defense, or designated for its use, that are subject to an integrated natural resources management plan (INRMP) prepared under section 101 of the Sikes Act (16 U.S.C. 670a), if the Secretary determines in writing that such plan provides a benefit to the species for which critical habitat is proposed for designation. There are no Department of Defense (DoD) lands with a completed INRMP within the proposed critical habitat designation.

Consideration of Impacts Under Section 4(b)(2) of the Act

Section 4(b)(2) of the Act states that the Secretary shall designate and make revisions to critical habitat on the basis of the best available scientific data after taking into consideration the economic impact, national security impact, and any other relevant impact of specifying any particular area as critical habitat. The Secretary may exclude an area from critical habitat if she determines that the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat, unless she determines, based on the best scientific data available, that the failure to designate such area as critical habitat will result in the extinction of the species. In making that determination, the statute on its face, as well as the legislative history, are clear that the Secretary has broad discretion regarding which factor(s) to use and how much weight to give to any factor.

Under section 4(b)(2) of the Act, we may exclude an area from designated critical habitat based on economic impacts, impacts on national security, or any other relevant impacts. In considering whether to exclude a particular area from the designation, we identify the benefits of including the area in the designation, identify the benefits of excluding the area from the designation, and evaluate whether the benefits of exclusion outweigh the benefits of inclusion. If the analysis indicates that the benefits of exclusion outweigh the benefits of inclusion, the Secretary may exercise the discretion to exclude the area only if such exclusion would not result in the extinction of the species. We describe below the process that we undertook for taking into consideration each category of impacts and our analyses of the relevant impacts.

The Service is aware of efforts currently under way by the Brazos River Authority, Trinity River Authority of Texas, and Lower Colorado River Authority (collectively the River Authorities) to develop comprehensive management plans for one or more species of Central Texas mussels. The Service is currently working with the River Authorities individually to develop Candidate Conservation Agreements with Assurances (CCAAs) that address activities conducted by the River Authorities and conservation measures specifically designed to provide a net conservation benefit to the covered species, including the Central Texas mussels, in the covered area for the term of the CCAA. The Brazos River Authority CCAA would cover the false spike and Texas fawnsfoot. The Trinity River Authority of Texas is developing a CCAA that would cover the Texas fawnsfoot. The Colorado River Authority is developing a CCAA that would cover the Texas fawnsfoot and Texas pimpleback. Finally, the Guadalupe-Blanco River Authority, in partnership with the Upper Guadalupe River Authority, has plans to develop a comprehensive Habitat Conservation Plan (HCP) for the entire Guadalupe River Basin that would cover the false spike, Guadalupe orb, and Guadalupe fatmucket, among other species. None of these plans have been approved or operationalized as of the time this proposal is published. While these agreements are not yet completed, if and when they are, we may consider excluding areas covered by the completed agreements from our critical habitat designations.

Consideration of Economic Impacts

Section 4(b)(2) of the Act and its implementing regulations require that we consider the economic impact that may result from a designation of critical habitat. To assess the probable economic impacts of a designation, we must first evaluate specific land uses or activities and projects that may occur in the area of the critical habitat. We then must evaluate whether a specific critical habitat designation may restrict or modify specific land uses or activities for the benefit of the species and its habitat within the areas proposed. We then identify which conservation efforts may be the result of the species being listed under the Act versus those attributed solely to the designation of critical habitat. The probable economic impact of a proposed critical habitat designation is analyzed by comparing scenarios both ''with critical habitat'' and ''without critical habitat.''

The ''without critical habitat'' scenario represents the baseline for the analysis, which includes the existing regulatory and socioeconomic burden imposed on landowners, managers, or other resource users potentially affected by the designation of critical habitat (*e.g.,* under the Federal listing as well as other Federal, State, and local regulations). The baseline, therefore, represents the costs of all efforts attributable to the listing of the species under the Act (*i.e.,* conservation of the species and its habitat incurred regardless of whether critical habitat is designated). The ''with critical habitat'' scenario describes the incremental impacts associated specifically with the designation of critical habitat for the species. The incremental conservation efforts and associated impacts would not be expected without the designation of critical habitat for the species. In other words, the incremental costs are those attributable solely to the designation of critical habitat, above and beyond the baseline costs. These are the costs we use when evaluating the benefits of inclusion and exclusion of particular areas from the final designation of critical habitat should we choose to conduct a discretionary 4(b)(2) exclusion analysis.

For these proposed designations, we developed an incremental effects memorandum (IEM) considering the probable incremental economic impacts that may result from these proposed designations of critical habitat. The information contained in our IEM was then used to develop a screening analysis of the probable effects of the designations of critical habitat for the Central Texas mussels (Industrial Economics, Inc. (IEc) 2019, entire). We began by conducting a screening analysis of the proposed designation of critical habitat in order to focus our analysis on the key factors that are likely to result in incremental economic impacts. The purpose of the screening analysis is to filter out particular geographic areas of critical habitat that are already subject to such protections and are, therefore, unlikely to incur incremental economic impacts. In particular, the screening analysis considers baseline costs (*i.e.,* absent critical habitat designation) and includes probable incremental economic impacts where land and water use may be subject to conservation plans, land management plans, best management practices, or regulations that protect the habitat area as a result of the Federal listing status of the species. Ultimately, the screening analysis allows us to focus our analysis on evaluating the specific areas or sectors that may incur probable incremental economic impacts as a result of the designation. The screening analysis also assesses whether units are unoccupied by the species and thus may require additional management or conservation efforts as a result of the critical habitat designation for the species; these additional efforts may incur incremental economic impacts. This screening analysis, combined with the information contained in our IEM, constitute our draft economic analysis (DEA) of the proposed critical habitat designations for the Central Texas mussels, and is summarized in the narrative below.

Executive Orders (E.O.s) 12866 and 13563 direct Federal agencies to assess the costs and benefits of available regulatory alternatives in quantitative (to the extent feasible) and qualitative terms. Consistent with the E.O. regulatory analysis requirements, our effects analysis under the Act may take into consideration impacts to both directly and indirectly affected entities, where practicable and reasonable. If sufficient data are available, we assess to the extent practicable the probable impacts to both directly and indirectly affected entities. As part of our screening analysis, we considered the types of economic activities that are likely to occur within the areas likely affected by the proposed critical habitat designations. In our December 4, 2019, IEM describing probable incremental economic impacts that may result from the proposed designations, we first identified probable incremental economic impacts associated with each of the following categories of activities: (1) Federal lands management (National Park Service, U.S. Forest Service, Department of Defense); (2) agriculture; (3) forest management/silviculture/timber; (4) development; (5) recreation; (6) restoration activities; and (7) transportation. We considered each industry or category individually. Additionally, we considered whether the activities have any Federal involvement. Critical habitat designation generally will not affect activities that do not have any Federal involvement; under the Act, designation of critical habitat only affects activities conducted, funded, permitted, or authorized by Federal agencies. If we list any of the species, as proposed in this document, in areas where the Central Texas mussels are present, under section 7 of the Act, Federal agencies would be required to consult with the Service on activities they fund, permit, or implement that may affect the species. If we finalize this proposed critical habitat designation, consultations to avoid the destruction or adverse modification of critical habitat would be incorporated into the existing consultation process.

In our IEM, we attempted to clarify the distinction between the effects that would result from the species being listed and those attributable to the critical habitat designations (*i.e.,* difference between the jeopardy and adverse modification standards) for the Central Texas mussels. Because the designation of critical habitat is being proposed concurrently with the listing, it has been our experience that it is more difficult to discern which conservation efforts are attributable to the species being listed and those which would result solely from the designation of critical habitat. However, the following specific circumstances in this case help to inform our evaluation: (1) The essential physical or biological features identified for critical habitat are the same features essential for the life requisites of the species, and (2) any actions that would result in sufficient harm or harassment to constitute jeopardy to the Central Texas mussels would also likely adversely affect the essential physical or biological features of critical habitat. The IEM outlines our rationale concerning this limited distinction between baseline conservation efforts and incremental impacts of the designations of critical habitat for these species. This evaluation of the incremental effects has been used as the basis to evaluate the probable incremental economic impacts of these proposed designations of critical habitat.

The proposed critical habitat designations for the Central Texas mussels totals approximately 1,944 river mi (3,129 river km) in 27 units with a combination of occupied and unoccupied areas. In occupied areas, any actions that may affect the species or their habitat would likely also affect proposed critical habitat, and it is unlikely that any additional conservation efforts would be required to address the adverse modification standard over and above those recommended as necessary to avoid jeopardizing the continued existence of the species. Therefore, the only additional costs that are expected in the occupied proposed critical habitat designations are administrative costs, due to the fact that this additional analysis will require time and resources by both the Federal action agency and the Service. However, it is believed that, in most circumstances, these costs would not reach the threshold of ''significant'' under E.O. 12866. We anticipate incremental costs of section 7 consultations in occupied critical habitat to total less than $75,000 per year.

In unoccupied critical habitat, any costs of section 7 consultations would not be incurred due to the listing of the species. We are proposing to designate six subunits that are currently unoccupied by the Central Texas mussels. We anticipate approximately five new formal section 7 consultations to occur in the next 10 years in these subunits. Considering the costs of formal consultation as well as project modifications that arise from consultation, we project consultations in unoccupied critical habitat to cost approximately $15,000 per consultation.

In total, in both occupied and unoccupied critical habitat, we expect the total cost of critical habitat designations not to exceed $82,500 per year.

We are soliciting data and comments from the public on the DEA discussed above, as well as on all aspects of this proposed rule and our required determinations. During the development of a final designation, we will consider the information presented in the DEA and any additional information on economic impacts received during the public comment period to determine whether any specific areas should be excluded from the final critical habitat designation under authority of section 4(b)(2) and our implementing regulations at 50 CFR 17.90. If we receive credible information regarding the existence of a meaningful economic or other relevant impact supporting a benefit of exclusion, we will conduct an exclusion analysis for the relevant area or areas. We may also exercise the discretion to evaluate any other particular areas for possible exclusion. Furthermore, when we conduct an exclusion analysis based on impacts identified by experts in, or sources with firsthand knowledge about, impacts that are outside the scope of the Service's expertise, we will give weight to those impacts consistent with the expert or firsthand information unless we have rebutting information. We may exclude an area from critical habitat if we determine that the benefits of excluding the area outweigh the benefits of including the area, provided the exclusion will not result in the extinction of this species.

Exclusions

Exclusions Based on Economic Impacts

The first sentence of section 4(b)(2) of the Act requires the Service to consider the economic impacts (as well as the impacts on national security and any other relevant impacts) of designating critical habitat. In addition, economic impacts may, for some particular areas, play an important role in the discretionary section 4(b)(2) exclusion analysis under the second sentence of section 4(b)(2). In both contexts, the Service will consider the probable incremental economic impacts of the designation. When the Service undertakes a discretionary section 4(b)(2) exclusion analysis with respect to a particular area, we will weigh the economic benefits of exclusion (and any other benefits of exclusion) against any benefits of inclusion (primarily the conservation value of designating the area). The conservation value may be influenced by the level of effort needed to manage degraded habitat to the point where it could support the listed species.

The Service will use its discretion in determining how to weigh probable incremental economic impacts against conservation value. The nature of the probable incremental economic impacts and not necessarily a particular threshold level triggers considerations of exclusions based on probable incremental economic impacts. For example, if an economic analysis indicates high probable incremental impacts of designating a particular critical habitat unit of low conservation value (relative to the remainder of the designation), the Service may consider exclusion of that particular unit.

Exclusions Based on National Security Impacts or Homeland Security Impacts

Under section 4(b)(2) of the Act, we consider whether there are lands where a national security impact might exist. In preparing this proposal, we have determined that there are no lands within the proposed designations of critical habitat for the Central Texas mussels owned or managed by the Department of Defense or Department of Homeland Security. We anticipate no impact on national security because there are no lands owned or managed by the Department of Defense within this proposal, and we have not identified any national security or homeland security activities that would be affected by the proposed designations. However, if through the public comment period we receive credible information regarding impacts on national security or homeland security from designating particular areas as critical habitat, then as part of developing the final designation of critical habitat, we will conduct a discretionary exclusion analysis to determine whether to exclude those areas under authority of section 4(b)(2) and our implementing regulations at 50 CFR 17.90.

Exclusions Based on Other Relevant Impacts

Under section 4(b)(2) of the Act, we consider any other relevant impacts, in addition to economic impacts and impacts on national security. We consider a number of factors including whether there are permitted conservation plans covering the species in the area such as HCPs, safe harbor agreements, or candidate conservation agreements with assurances (CCAAs), or whether there are non-permitted conservation agreements and partnerships that would be encouraged by designation of, or exclusion from, critical habitat. In addition, we look whether there are Tribal conservation plans or parnerships, Tribal resources, or government-to-government relationships of the United States with Tribal entities that may be affected by the designation. We also consider any State, local, public health, community interest, environmental, or social impacts that might occur because of the designations.

In preparing this proposal, we have determined that there are currently no HCPs or other management plans for the Central Texas mussels, and the proposed designations do not include any tribal lands or trust resources. We anticipate no impact on tribal lands, partnerships, or HCPs from these proposed critical habitat designations. We are aware of efforts currently under way by the River Authorities to develop CCAAs for the Central Texas mussels, as discussed above, and will take those efforts into account in a final designation. During the development of a final designation, we will consider any additional information received through the public comment period regarding other relevant impacts to determine whether any specific areas should be excluded from the final critical habitat designation under authority of section 4(b)(2) and our implementing regulations at 50 CFR 17.90.

Required Determinations

Clarity of the Rule

We are required by Executive Orders 12866 and 12988 and by the Presidential Memorandum of June 1, 1998, to write all rules in plain language. This means that each rule we publish must:

(1) Be logically organized;

(2) Use the active voice to address readers directly;

(3) Use clear language rather than jargon;

(4) Be divided into short sections and sentences; and

(5) Use lists and tables wherever possible.

If you feel that we have not met these requirements, send us comments by one of the methods listed in **ADDRESSES**. To better help us revise the rule, your comments should be as specific as possible. For example, you should tell us the numbers of the sections or paragraphs that are unclearly written, which sections or sentences are too long, the sections where you feel lists or tables would be useful, etc.

Regulatory Planning and Review (Executive Orders 12866 and 13563)

Executive Order 12866 provides that the Office of Information and Regulatory Affairs (OIRA) in the Office of Management and Budget will review all significant rules. OIRA has determined that this rule is not significant.

Executive Order 13563 reaffirms the principles of E.O. 12866 while calling for improvements in the Nation's regulatory system to promote predictability, to reduce uncertainty, and to use the best, most innovative, and least burdensome tools for achieving regulatory ends. The Executive order directs agencies to consider regulatory approaches that reduce burdens and maintain flexibility and freedom of choice for the public where these approaches are relevant, feasible, and consistent with regulatory objectives. E.O. 13563 emphasizes further that regulations must be based on the best available science and that the rulemaking process must allow for public participation and an open exchange of ideas. We have developed this rule in a manner consistent with these requirements.

Regulatory Flexibility Act (5 U.S.C. 601 et seq.)

Under the Regulatory Flexibility Act (RFA; 5 U.S.C. 601 *et seq.*), as amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA; 5 U.S.C. 801 *et seq.*), whenever an agency is required to publish a notice of rulemaking for any proposed or final rule, it must prepare and make available for public comment a regulatory flexibility analysis that describes the effects of the rule on small entities (*i.e.,* small businesses, small organizations, and small government jurisdictions). However, no regulatory flexibility analysis is required if the head of the agency certifies the rule will not have a significant economic impact on a substantial number of small entities. The SBREFA amended the RFA to require Federal agencies to provide a certification statement of the factual basis for certifying that the rule will not have a significant economic impact on a substantial number of small entities.

According to the Small Business Administration, small entities include small organizations such as independent nonprofit organizations; small governmental jurisdictions, including school boards and city and town governments that serve fewer than 50,000 residents; and small businesses (13 CFR 121.201). Small businesses include manufacturing and mining concerns with fewer than 500 employees, wholesale trade entities with fewer than 100 employees, retail and service businesses with less than $5 million in annual sales, general and heavy construction businesses with less than $27.5 million in annual business, special trade contractors doing less than $11.5 million in annual business, and agricultural businesses with annual sales less than $750,000. To determine if potential economic impacts to these small entities are significant, we considered the types of activities that might trigger regulatory impacts under this designation as well as types of project modifications that may result. In general, the term ''significant economic impact'' is meant to apply to a typical small business firm's business operations.

Under the RFA, as amended, and as understood in the light of recent court decisions, Federal agencies are required to evaluate the potential incremental impacts of rulemaking only on those entities directly regulated by the rulemaking itself and, therefore, are not required to evaluate the potential impacts to indirectly regulated entities. The regulatory mechanism through which critical habitat protections are realized is section 7 of the Act, which requires Federal agencies, in consultation with the Service, to ensure that any action authorized, funded, or carried out by the agency is not likely to destroy or adversely modify critical habitat. Therefore, under section 7, only Federal action agencies are directly subject to the specific regulatory requirement (avoiding destruction and adverse modification) imposed by critical habitat designation. Consequently, it is our position that only Federal action agencies would be directly regulated if we adopt the proposed critical habitat designations. There is no requirement under the RFA to evaluate the potential impacts to entities not directly regulated. Moreover, Federal agencies are not small entities. Therefore, because no small entities would be directly regulated by this rulemaking, the Service certifies that, if promulgated, the proposed critical habitat designations will not have a significant economic impact on a substantial number of small entities.

In summary, we have considered whether the proposed designations would result in a significant economic impact on a substantial number of small entities. For the above reasons and based on currently available information, we certify that, if made final, the proposed critical habitat designations will not have a significant economic impact on a substantial number of small business entities. Therefore, an initial regulatory flexibility analysis is not required.

Energy Supply, Distribution, or Use—Executive Order 13211

Executive Order 13211 (Actions Concerning Regulations That Significantly Affect Energy Supply, Distribution, or Use) requires agencies to prepare Statements of Energy Effects when undertaking certain actions. In our economic analysis, we did not find that the designations of this proposed critical habitat will significantly affect energy supplies, distribution, or use. Therefore, this action is not a significant energy action, and no Statement of Energy Effects is required.

Unfunded Mandates Reform Act (2 U.S.C. 1501 et seq.)

In accordance with the Unfunded Mandates Reform Act (2 U.S.C. 1501 *et seq.*), we make the following findings:

(1) This proposed rule would not produce a Federal mandate. In general, a Federal mandate is a provision in legislation, statute, or regulation that would impose an enforceable duty upon State, local, or tribal governments, or the private sector, and includes both ''Federal intergovernmental mandates'' and ''Federal private sector mandates.'' These terms are defined in 2 U.S.C. 658(5)–(7). ''Federal intergovernmental mandate'' includes a regulation that ''would impose an enforceable duty upon State, local, or tribal governments'' with two exceptions. It excludes ''a condition of Federal assistance.'' It also excludes ''a duty arising from participation in a voluntary Federal program,'' unless the regulation ''relates to a then-existing Federal program under which $500,000,000 or more is provided annually to State, local, and tribal governments under entitlement authority,'' if the provision would ''increase the stringency of conditions of assistance'' or ''place caps upon, or otherwise decrease, the Federal Government's responsibility to provide funding,'' and the State, local, or tribal governments ''lack authority'' to adjust accordingly. At the time of enactment, these entitlement programs were: Medicaid; Aid to Families with Dependent Children work programs; Child Nutrition; Food Stamps; Social Services Block Grants; Vocational Rehabilitation State Grants; Foster Care, Adoption Assistance, and Independent Living; Family Support Welfare Services; and Child Support Enforcement. ''Federal private sector mandate'' includes a regulation that ''would impose an enforceable duty upon the private sector, except (i) a condition of Federal assistance or (ii) a duty arising from participation in a voluntary Federal program.''

The designations of critical habitat do not impose a legally binding duty on non-Federal Government entities or private parties. Under the Act, the only regulatory effect is that Federal agencies must ensure that their actions do not destroy or adversely modify critical habitat under section 7. While non-Federal entities that receive Federal funding, assistance, or permits, or that otherwise require approval or authorization from a Federal agency for an action, may be indirectly impacted by the designation of critical habitat, the legally binding duty to avoid destruction or adverse modification of critical habitat rests squarely on the Federal agency. Furthermore, to the extent that non-Federal entities are indirectly impacted because they receive Federal assistance or participate in a voluntary Federal aid program, the Unfunded Mandates Reform Act would not apply, nor would critical habitat shift the costs of the large entitlement programs listed above onto State governments.

(2) We do not believe that this proposed rule would significantly or uniquely affect small governments because the lands being proposed for critical habitat designation are owned by the State of Texas. This government entity does not fit the definition of ''small governmental jurisdiction.'' Therefore, a Small Government Agency Plan is not required.

Takings—Executive Order 12630

In accordance with E.O. 12630 (Government Actions and Interference with Constitutionally Protected Private Property Rights), we have analyzed the potential takings implications of designating critical habitat for the Central Texas mussels in a takings implications assessment. The Act does not authorize the Service to regulate private actions on private lands or confiscate private property as a result of critical habitat designation. Designation of critical habitat does not affect land ownership, or establish any closures or restrictions on use of or access to the designated areas. Furthermore, the designation of critical habitat does not affect landowner actions that do not require Federal funding or permits, nor does it preclude development of habitat conservation programs or issuance of incidental take permits to permit actions that do require Federal funding or permits to go forward. However, Federal agencies are prohibited from carrying out, funding, or authorizing actions that would destroy or adversely modify critical habitat. A takings implications assessment has been completed and concludes that, if adopted, these designations of critical habitat for the Central Texas mussels does not pose significant takings implications for lands within or affected by the designations.

Federalism—Executive Order 13132

In accordance with E.O. 13132 (Federalism), this proposed rule does not have significant federalism effects. A federalism summary impact statement is not required. In keeping with Department of the Interior and Department of Commerce policy, we requested information from, and coordinated development of these proposed critical habitat designations with, appropriate State resource agencies in Texas. From a federalism perspective, the designation of critical habitat directly affects only the responsibilities of Federal agencies. The Act imposes no other duties with respect to critical habitat, either for States and local governments, or for anyone else. As a result, the proposed rule does not have substantial direct effects either on the States, or on the relationship between the National Government and the States, or on the distribution of powers and responsibilities among the various levels of government. The proposed designations may have some benefit to these governments because the areas that contain the features essential to the conservation of the species are more clearly defined, and the physical or biological features of the habitat necessary to the conservation of the species are specifically identified. This information does not alter where and what federally sponsored activities may occur. However, it may assist these local governments in long-range planning (because these local governments no longer have to wait for case-by-case section 7 consultations to occur).

Where State and local governments require approval or authorization from a Federal agency for actions that may affect critical habitat, consultation under section 7(a)(2) would be required. While non-Federal entities that receive Federal funding, assistance, or permits, or that otherwise require approval or authorization from a Federal agency for an action, may be indirectly impacted by the designation of critical habitat, the legally binding duty to avoid destruction or adverse modification of critical habitat rests squarely on the Federal agency.

Civil Justice Reform—Executive Order 12988

In accordance with Executive Order 12988 (Civil Justice Reform), the Office of the Solicitor has determined that the rule does not unduly burden the judicial system and that it meets the requirements of sections 3(a) and 3(b)(2) of the Order. We have proposed designating critical habitat in accordance with the provisions of the Act. To assist the public in understanding the habitat needs of the species, this proposed rule identifies the elements of physical or biological features essential to the conservation of the species. The proposed areas of designated critical habitat are presented on maps, and the proposed rule provides several options for the interested public to obtain more detailed location information, if desired.

Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.)

This rule does not contain information collection requirements, and a submission to the Office of Management and Budget (OMB) under the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 *et seq.*) is not required. We may not conduct or sponsor and you are not required to respond to a collection of information unless it displays a currently valid OMB control number.

National Environmental Policy Act (42 U.S.C. 4321 et seq.)

It is our position that, outside the jurisdiction of the U.S. Court of Appeals for the Tenth Circuit, we do not need to prepare environmental analyses pursuant to the National Environmental Policy Act (NEPA; 42 U.S.C. 4321 *et seq.*) in connection with designating critical habitat under the Act. We published a notice outlining our reasons for this determination in the **Federal Register** on October 25, 1983 (48 FR 49244). This position was upheld by the U.S. Court of Appeals for the Ninth Circuit (*Douglas County* v. *Babbitt,* 48 F.3d 1495 (9th Cir. 1995), cert. denied 516 U.S. 1042 (1996)).

Government-to-Government Relationship With Tribes

In accordance with the President's memorandum of April 29, 1994 (Government-to-Government Relations with Native American Tribal Governments; 59 FR 22951), Executive Order 13175 (Consultation and Coordination with Indian Tribal Governments), and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes. We have determined that no tribal lands fall within the boundaries of the proposed critical habitat designations for the Central Texas mussels, so no tribal lands would be affected by the proposed designations.

References Cited

A complete list of references cited in this rulemaking is available on the internet at *http://www.regulations.gov* and upon request from the Austin Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Authors

The primary authors of this proposed rule are the staff members of the U.S. Fish and Wildlife Service's Species Assessment Team and the Austin Ecological Services Field Office.

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Proposed Regulation Promulgation

Accordingly, we propose to amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as set forth below:

PART 17—ENDANGERED AND THREATENED WILDLIFE AND PLANTS

■ 1. The authority citation for part 17 continues to read as follows:

Authority: 16 U.S.C. 1361–1407; 1531–1544; and 4201–4245, unless otherwise noted.

■ 2. Amend § 17.11(h) by adding entries for ''Fatmucket, Guadalupe''; ''Fatmucket, Texas''; ''Fawnsfoot, Texas''; ''Orb, Guadalupe''; ''Pimpleback, Texas''; and ''Spike, false'' to the List of Endangered and Threatened Wildlife in alphabetical order under Clams to read as follows:

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Common name	Scientific name	Where listed	Status	Listing citations and applicable rules
* * * * * * *				
CLAMS				
* * * * * * *				
Fatmucket, Guadalupe	*Lampsilis bergmanni*	Wherever found	E	[**Federal Register** citation when published as a final rule]; 50 CFR 17.95(f)^{CH}.
Fatmucket, Texas	*Lampsilis bracteata*	Wherever found	E	[**Federal Register** citation when published as a final rule]; 50 CFR 17.95(f)^{CH}.
Fawnsfoot, Texas	*Truncilla macrodon*	Wherever found	T	[**Federal Register** citation when published as a final rule]; 50 CFR 17.45(c)^{4d}; 50 CFR 17.95(f)^{CH}.
* * * * * * *				
Orb, Guadalupe	*Cyclonaias necki*	Wherever found	E	[**Federal Register** citation when published as a final rule]; 50 CFR 17.95(f)^{CH}.
* * * * * * *				
Pimpleback, Texas	*Cyclonaias petrina*	Wherever found	E	[**Federal Register** citation when published as a final rule]; 50 CFR 17.95(f)^{CH}.
* * * * * * *				
Spike, false	*Fusconaia mitchelli*	Wherever found	E	[**Federal Register** citation when published as a final rule]; 50 CFR 17.95(f)^{CH}.
* * * * * * *				

■ 3. As proposed to be added at 83 FR 51570 (Oct. 11, 2018), and amended at 85 FR 44821 (July 24, 2020) and 85 FR 61384 (Sept. 29, 2020), § 17.45 is further amended by adding paragraph (c) to read as follows:

§ 17.45 Special rules—snails and clams.

* * * * *

(c) Texas fawnsfoot (*Truncilla macrodon*)—(1) *Prohibitions.* The following prohibitions that apply to endangered wildlife also apply to the Texas fawnsfoot. Except as provided at paragraph (c)(2) of this section and §§ 17.4 and 17.5, it is unlawful for any person subject to the jurisdiction of the United States to commit, to attempt to commit, to solicit another to commit, or cause to be committed, any of the following acts in regard to the Texas fawnsfoot:

(i) Import or export, as set forth at § 17.21(b).

(ii) Take, as set forth at § 17.21(c)(1).

(iii) Possession and other acts with unlawfully taken specimens, as set forth at § 17.21(d)(1).

(iv) Interstate or foreign commerce in the course of commercial activity, as set forth at § 17.21(e).

(v) Sale or offer for sale, as set forth at § 17.21(f).

(2) *Exceptions from the prohibitions.* With regard to this species, you may:

(i) Conduct activities as authorized by a permit under § 17.32.

(ii) Take, as set forth at § 17.21(c)(2) through (4) for endangered wildlife.

(iii) Take, as set forth at § 17.31(b).

(iv) Possess and engage in other acts with unlawfully taken Texas fawnsfoot, as set forth at § 17.21(d)(2).

(v) Take incidental to an otherwise lawful activity caused by:

(A) Channel restoration projects that create natural, physically stable, ecologically functioning streams (or stream and wetland systems) that are reconnected with their groundwater aquifers.

(B) Bioengineering methods such as streambank stabilization using live stakes (live, vegetative cuttings inserted or tamped into the ground in a manner that allows the stake to take root and grow), live fascines (live branch cuttings, usually willows, bound together into long, cigar-shaped bundles), or brush layering (cuttings or branches of easily rooted tree species layered between successive lifts of soil fill). These methods would not include the sole use of quarried rock (rip-rap) or the use of rock baskets or gabion structures. In addition, to reduce streambank erosion and sedimentation into the stream, work using these bioengineering methods would be performed at base-flow or low-water conditions and when significant rainfall is not predicted. Further, streambank stabilization projects must keep all equipment out of the stream channels and water.

(C) Soil and water conservation practices and riparian and adjacent upland habitat management activities that restore in-stream habitats for the species, restore adjacent riparian habitats that enhance stream habitats for the species, stabilize degraded and eroding stream banks to limit sedimentation and scour of the species' habitats, and restore or enhance nearby upland habitats to limit sedimentation of the species' habitats and comply with conservation practice standards and specifications, and technical guidelines developed by the Natural Resources Conservation Service.

(D) Presence or abundance surveys for Texas fawnfoot conducted by individuals who successfully complete and show proficiency by passing the end-of-course test with a score equal to or greater than 90 percent, with 100 percent accuracy in identification of mussel species listed under the Endangered Species Act, in an approved freshwater mussel identification and sampling course (specific to the species and basins in which the Texas fawnsfoot is known to occur), such as that administered by the Service, a State wildlife agency, or qualified university experts. Those individuals exercising the exemption in this paragraph (c)(2)(v)(D) should provide reports to the Service annually on number, location, and date of collection. The exemption in this paragraph (c)(2)(v)(D) does not apply if lethal take or collection is anticipated. The exemption in this paragraph (c)(2)(v)(D) only applies for 5 years from the date of successful course completion.

* * * * *

■ 4. Amend § 17.95(f) by:

■ a. Adding critical habitat entries for "Guadalupe Fatmucket (*Lampsilis* *bergmanni*)'', ''Texas Fatmucket (*Lampsilis bracteata*)'', and ''Texas Fawnsfoot (*Truncilla macrodon*)'' immediately following the entry for ''Appalachian Elktoe *(Alasmidonta raveneliana)*'';

■ b. Adding an entry for ''Guadalupe Orb (*Cyclonaias necki*)'' immediately following the entry for ''Carolina Heelsplitter *(Lasmigona decorata)*''; and

■ c. Adding entries for ''Texas Pimpleback (*Cyclonaias petrina*)'' and ''False Spike (*Fusconaia mitchelli*)'' immediately following the entry for ''Georgia Pigtoe *(Pleurobema hanleyianum)*''.

The additions read as follows:

§ 17.95 Critical habitat—fish and wildlife.

* * * * *

(f) * * *

Guadalupe Fatmucket (*Lampsilis bergmanni*)

(1) A critical habitat unit is depicted for Kendall and Kerr Counties, Texas, on the map in this critical habitat entry.

(2) Within this area, the physical or biological features essential to the conservation of Guadalupe fatmucket consist of the following components within waters and streambeds up to the ordinary high-water mark:

(i) Flowing water at moderate to high rates with sufficient depth to remain sufficiently cool and oxygenated during low-flow periods;

(ii) Substrate including bedrock and boulder crevices, point bars, and vegetated run habitat comprising sand, gravel, and larger cobbles;

(iii) Green sunfish (*Lepomis cyanellus*), bluegill (*L. macrochirus*), largemouth bass (*Micropterus salmoides*), and Guadalupe bass (*M. treculii*) present; and

(iv) Water quality parameters within the following ranges:

(A) Dissolved oxygen >2 mg/L;

(B) Salinity <2 ppt;

(C) Total ammonia <0.77 mg/L total ammonia nitrogen;

(D) Water temperature <29 °C (84.2 °F); and

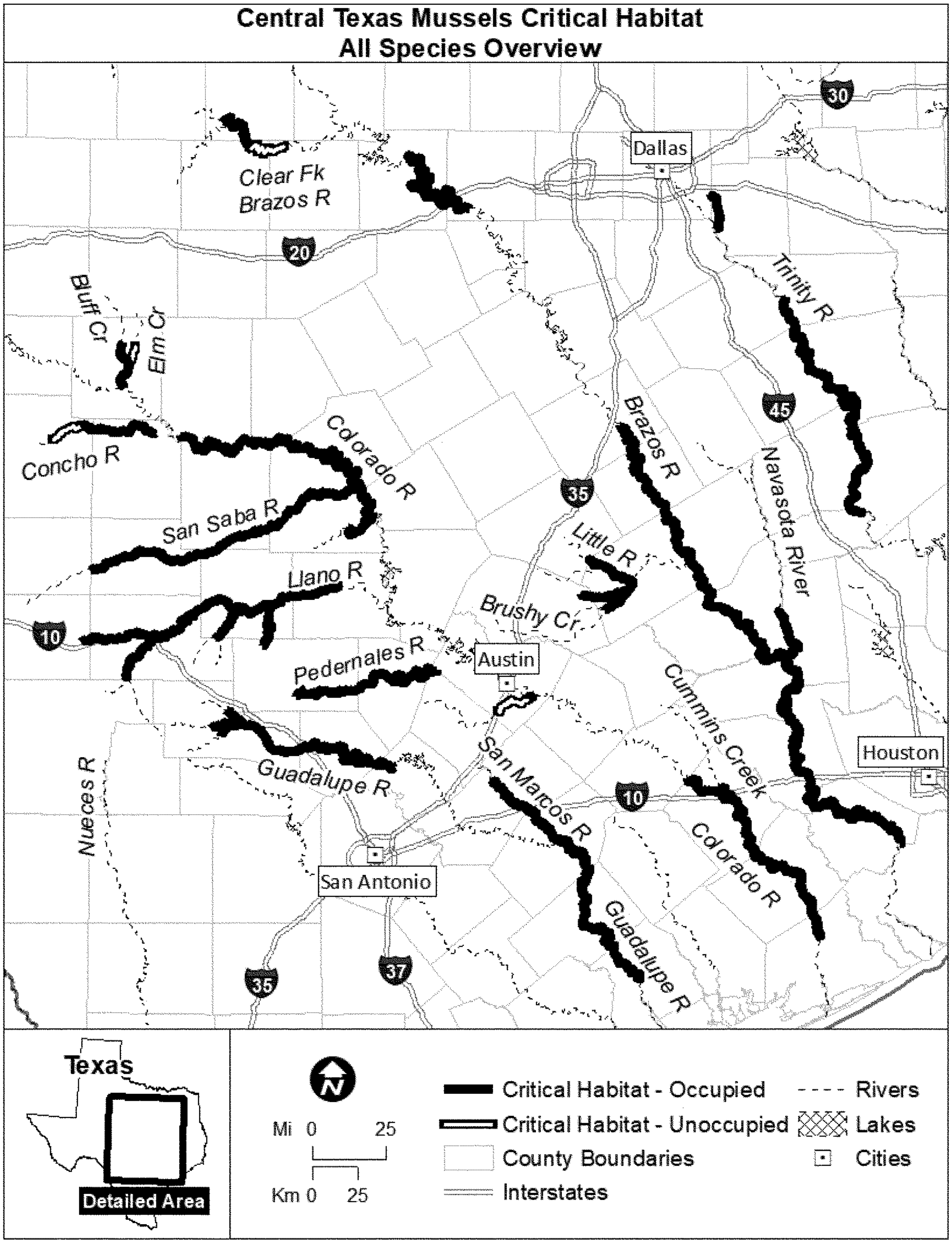
(E) Low levels of contaminants.

(3) Critical habitat does not include manmade structures (such as buildings, aqueducts, runways, roads, and other paved areas) and the land on which they are located existing within the legal boundaries on [EFFECTIVE DATE OF THE FINAL RULE].

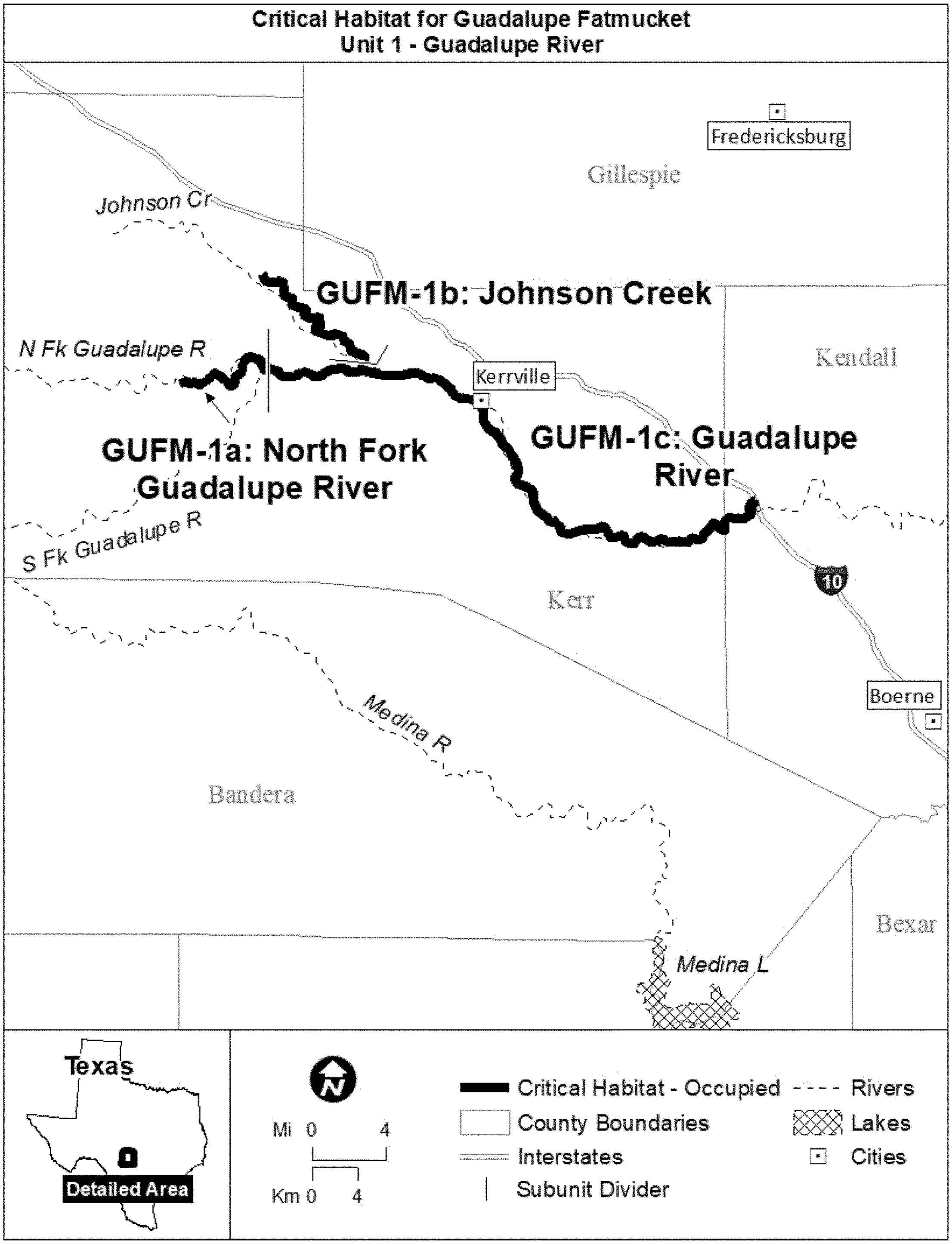
(4) The maps in this entry, as modified by any accompanying regulatory text, establish the boundaries of the critical habitat designation. The coordinates or plot points or both on which each map is based are available to the public at *http://www.regulations.gov* under Docket No. FWS–R2–ES–2019–0061.

(5) Index map of critical habitat for the Central Texas mussels, which includes the Guadalupe fatmucket, follows:

BILLING CODE 4333–15–P



(6) Map of Unit GUFM–1: Guadalupe River follows:



TEXAS FATMUCKET (*LAMPSILIS BRACTEATA*)

Texas Fatmucket (*Lampsilis bracteata*)

(1) Critical habitat units are depicted for Blanco, Gillespie, Hays, Kimble, Llano, Mason, McCulloch, Menard, Runnels, San Saba, and Travis Counties, Texas, on the maps in this critical habitat entry.

(2) Within these areas, the physical or biological features essential to the conservation of Texas fatmucket consist of the following components within waters and streambeds up to the ordinary high-water mark:

(i) Flowing water at moderate to high rates with sufficient depth to remain sufficiently cool and oxygenated during low-flow periods;

(ii) Substrate including bedrock and boulder crevices, point bars, and vegetated run habitat comprising sand, gravel, and larger cobbles;

(iii) Green sunfish (*Lepomis cyanellus*), bluegill (*L. macrochirus*), largemouth bass (*Micropterus salmoides*), and Guadalupe bass (*M. treculii*) present; and

(iv) Water quality parameters within the following ranges:

(A) Dissolved oxygen >2 mg/L;

(B) Salinity <2 ppt;

(C) Total ammonia <0.77 mg/L total ammonia nitrogen;

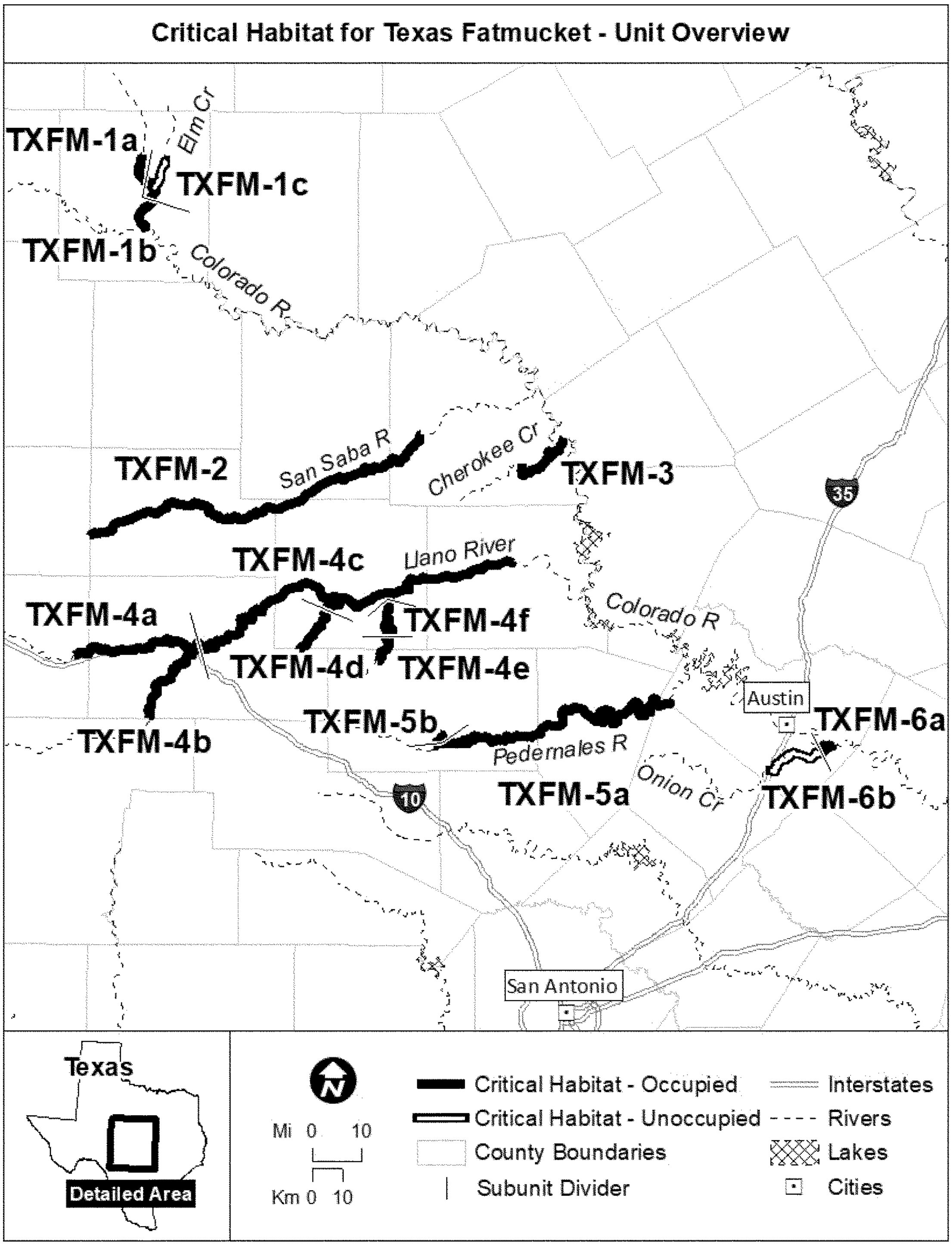
(D) Water temperature <29 °C (84.2 °F); and

(E) Low levels of contaminants.

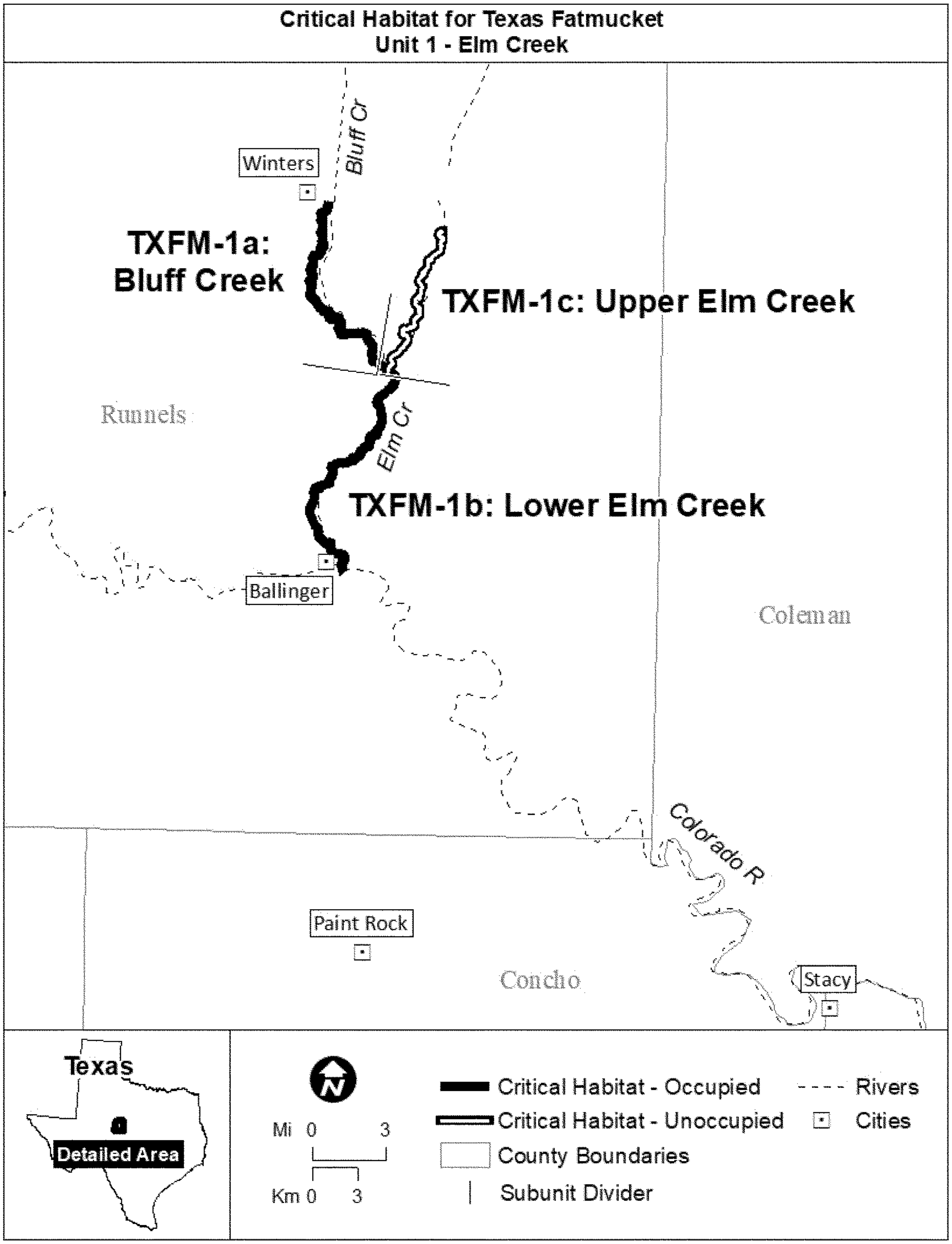
(3) Critical habitat does not include manmade structures (such as buildings, aqueducts, runways, roads, and other paved areas) and the land on which they are located existing within the legal boundaries on [EFFECTIVE DATE OF THE FINAL RULE].

(4) The maps in this entry, as modified by any accompanying regulatory text, establish the boundaries of the critical habitat designation. The coordinates or plot points or both on which each map is based are available to the public at *http://www.regulations.gov* under Docket No. FWS–R2–ES–2019–0061.

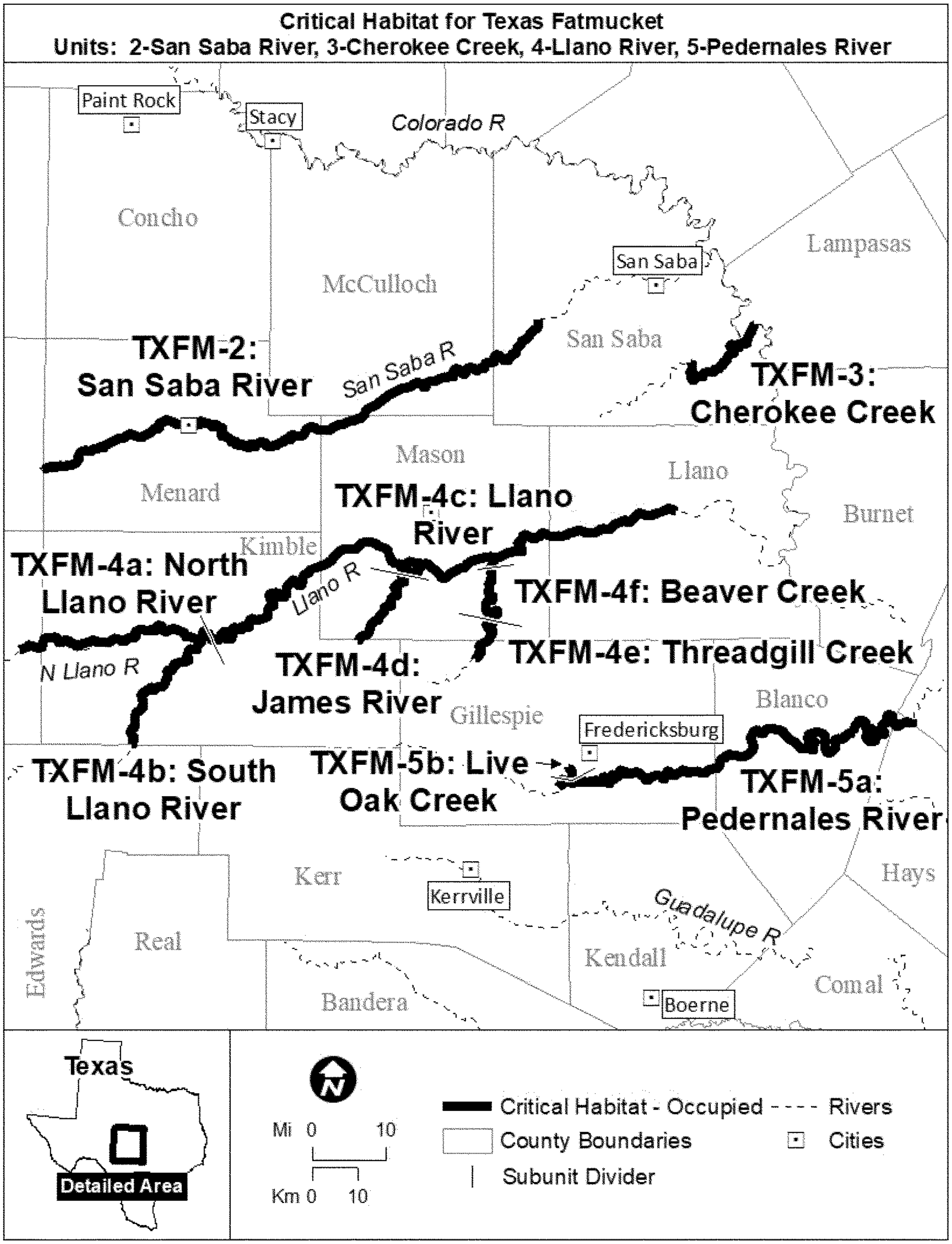
(5) *Note:* An index map of the critical habitat designations for the Central Texas mussels, which includes the Texas fatmucket, can be found in this paragraph (f) at the entry for the Guadalupe fatmucket. An index map of critical habitat units for the Texas fatmucket follows:



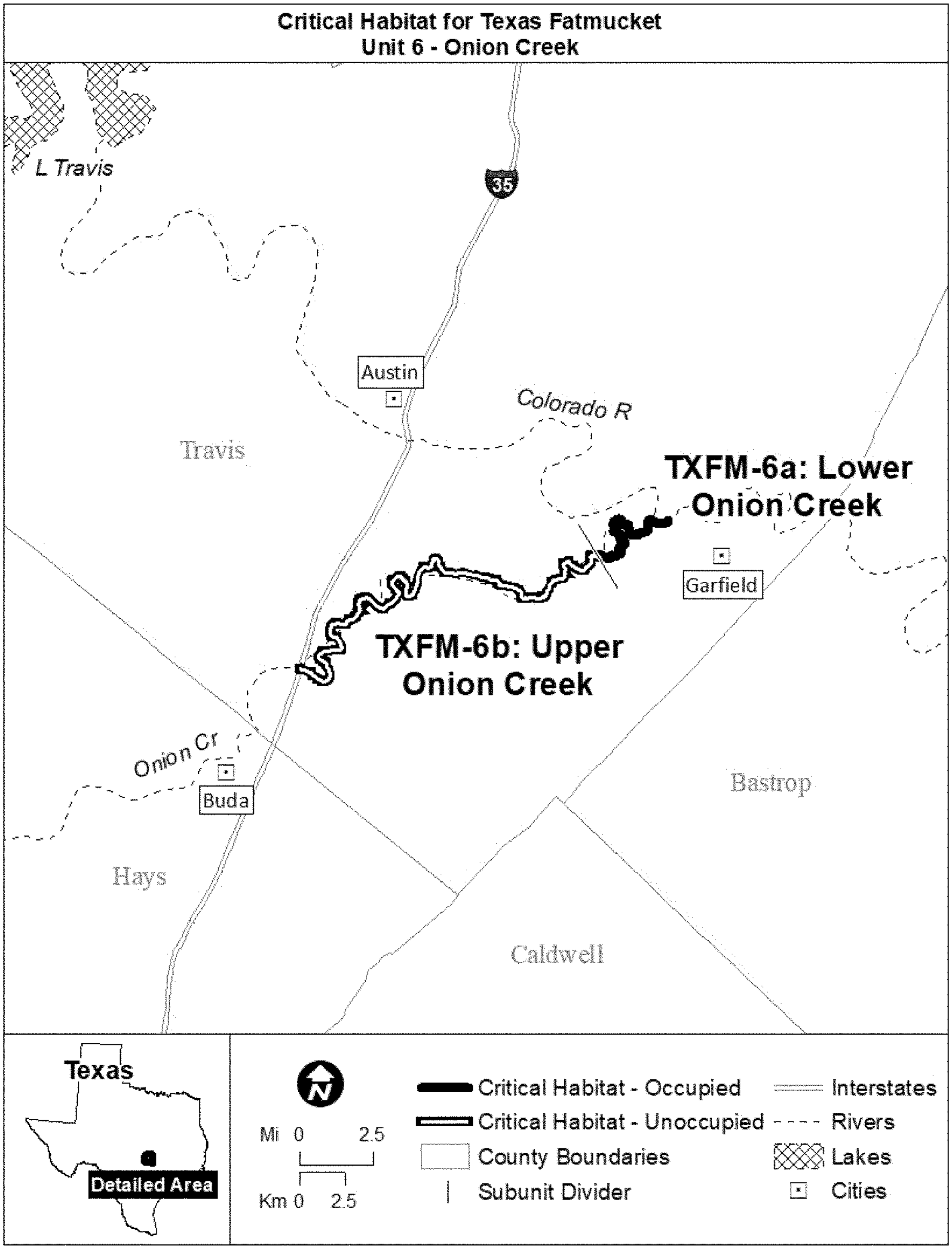
(6) Map of TXFM–1: Elm Creek follows:



(7) Map of Unit TXFM–2: San Saba River, Unit TXFM–3: Cherokee Creek, Unit TXFM–4: Llano River, and Unit TXFM–5: Pedernales River, follows:



(8) Map of Unit TXFM–6: Onion Creek follows:



Texas Fawnsfoot (*Truncilla macrodon*)

(1) Critical habitat units are depicted for Anderson, Austin, Brazos, Burleson, Colorado, Falls, Fort Bend, Freestone, Grimes, Henderson, Houston, Kaufman, Lampasas, Leon, Madison, Matagorda, McLennan, Milam, Mills, Navarro, Palo Pinto, Parker, Robertson, San Saba, Shackelford, Stephens, Throckmorton, Waller, Washington, and Wharton Counties, Texas, on the maps in this critical habitat entry.

(2) Within these areas, the physical or biological features essential to the conservation of Texas fawnsfoot consist of the following components within waters and streambeds up to the ordinary high-water mark:

(i) Flowing water at rates suitable to prevent excess sedimentation but not so high as to dislodge individuals or sediment;

(ii) Stable bank and riffle habitats with gravel, sand, silt, and mud substrates that are clean swept by flushing flows;

(iii) Freshwater drum (*Aplodinotus grunniens*) present; and

(iv) Water quality parameters within the following ranges:

(A) Dissolved oxygen >2 mg/L;

(B) Salinity <2 ppt;

(C) Total ammonia <0.77 mg/L total ammonia nitrogen;

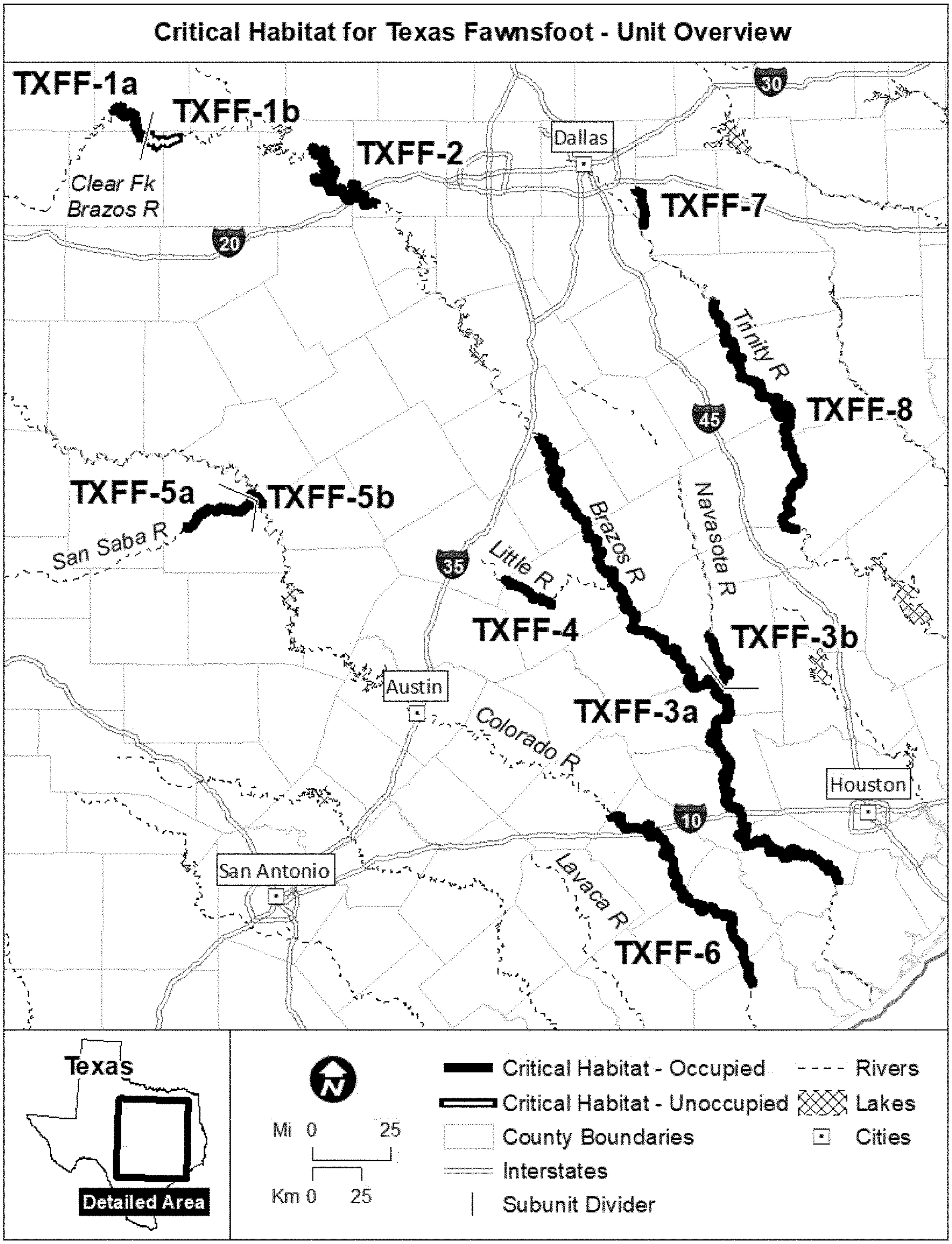
(D) Water temperature <29 °C (84.2 °F); and

(E) Low levels of contaminants.

(3) Critical habitat does not include manmade structures (such as buildings, aqueducts, runways, roads, and other paved areas) and the land on which they are located existing within the legal boundaries on [EFFECTIVE DATE OF THE FINAL RULE].

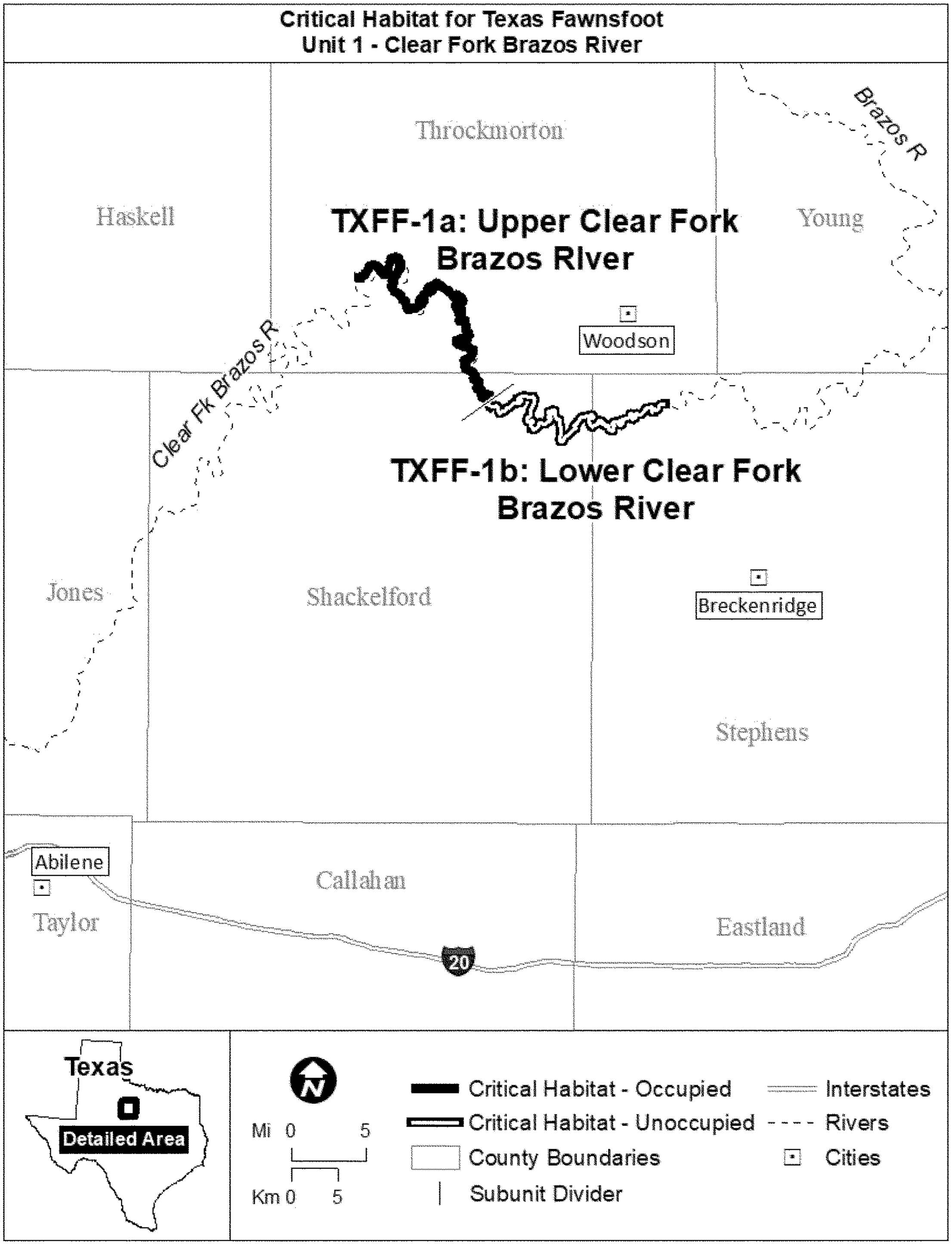
(4) The maps in this entry, as modified by any accompanying regulatory text, establish the boundaries of the critical habitat designation. The coordinates or plot points or both on which each map is based are available to the public at *http://www.regulations.gov* under Docket No. FWS–R2–ES–2019–0061.

(5) *Note:* An index map of the critical habitat designations for the Central Texas mussels, which includes the Texas fawnsfoot, can be found in this paragraph (f) at the entry for the Guadalupe fatmucket. An index map of critical habitat units for the Texas fawnsfoot follows:

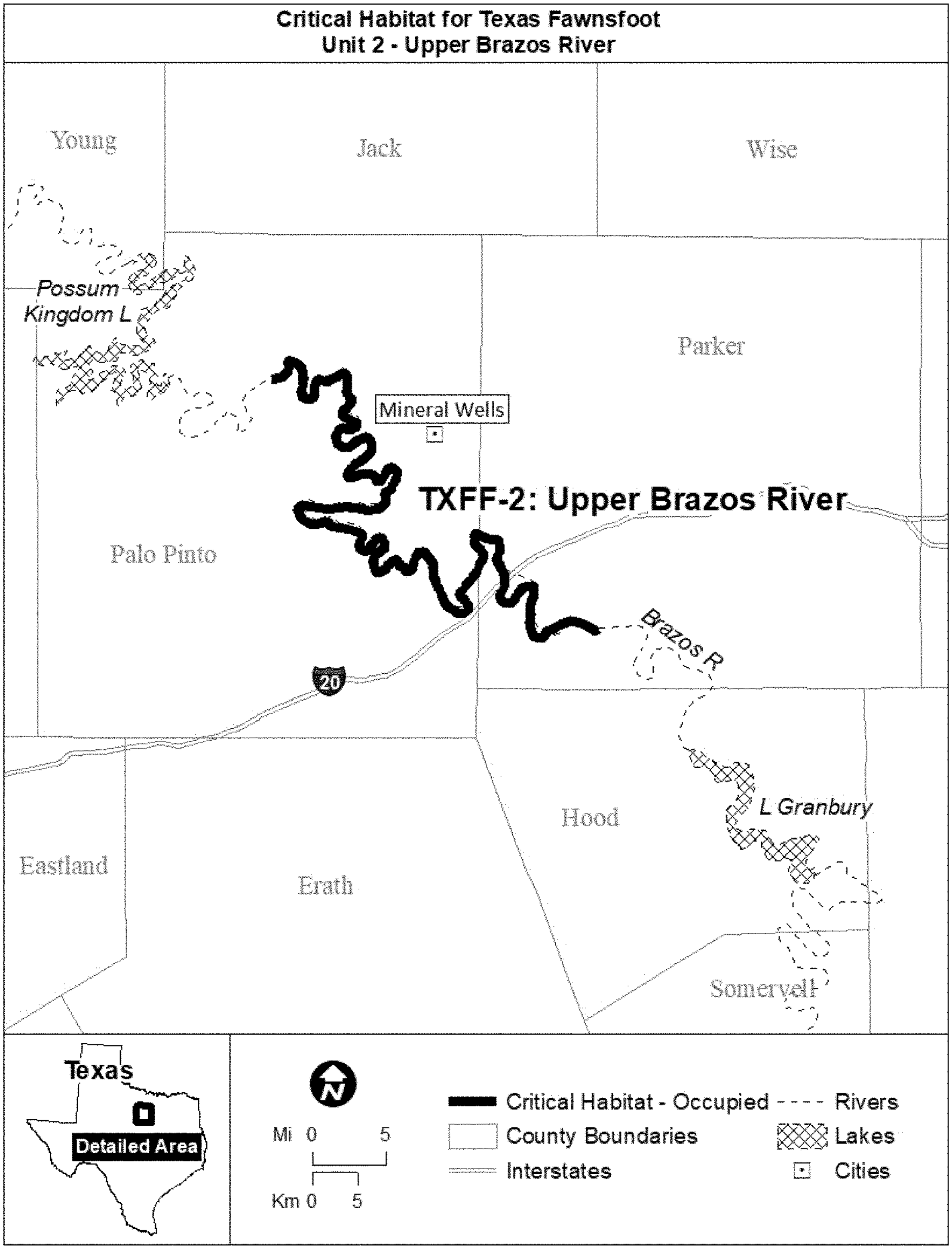


Critical Habitat for Texas Fawnsfoot - Unit Overview
TXFF-1a
TXFF-1b
Clear Fk Brazos R
TXFF-2
Dallas
TXFF-7
30
20
Trinity R
TXFF-8
45
TXFF-5a
TXFF-5b
San Saba R
Brazos R
Navasota R
Little R
35
TXFF-4
TXFF-3b
Austin
TXFF-3a
Colorado R
Houston
10
San Antonio
Lavaca R
TXFF-6
Texas
Detailed Area
Mi 0 25
Km 0 25
Critical Habitat - Occupied
Critical Habitat - Unoccupied
County Boundaries
Interstates
Subunit Divider
Rivers
Lakes
Cities

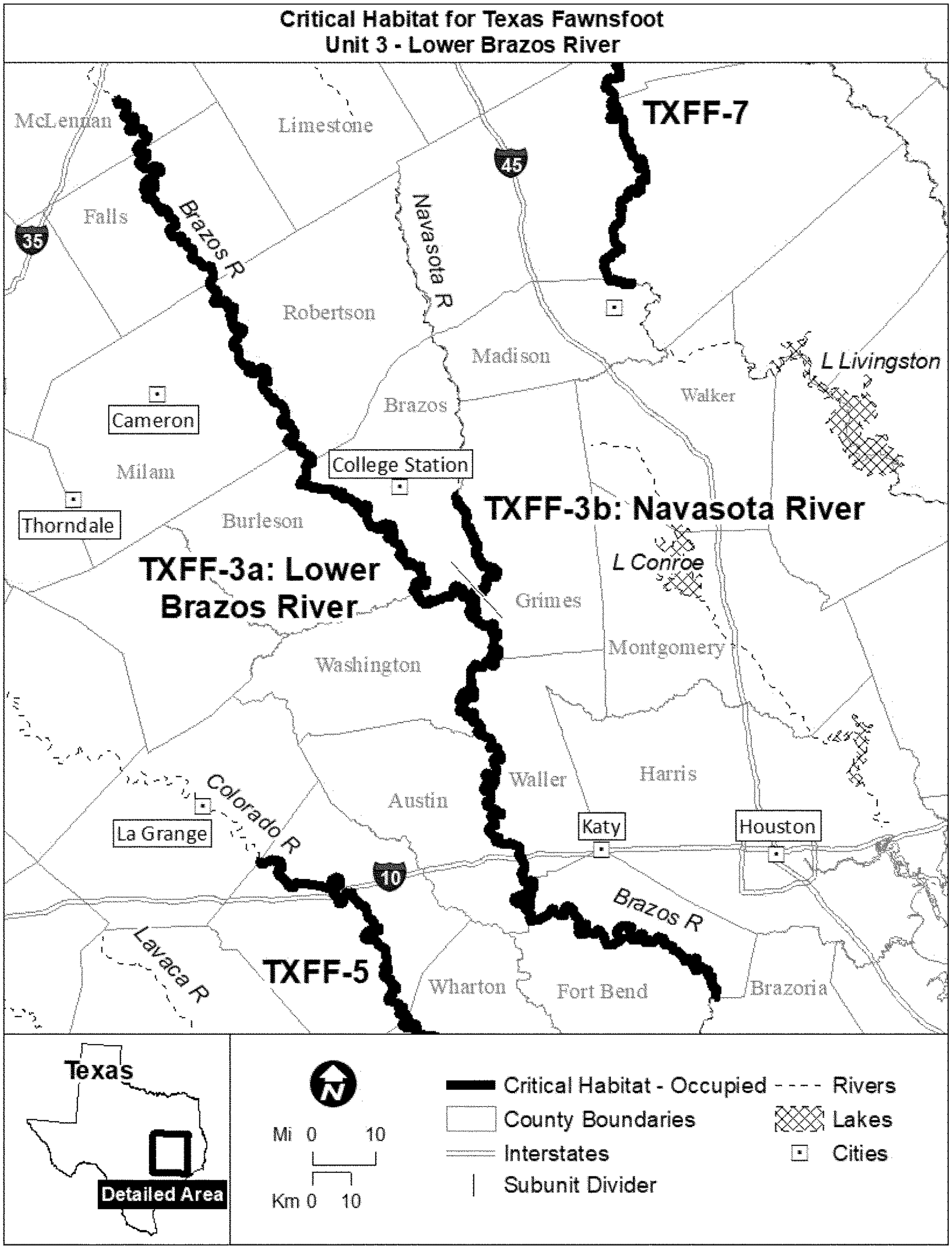
(6) Map of Unit TXFF–1: Clear Fork Brazos River follows:



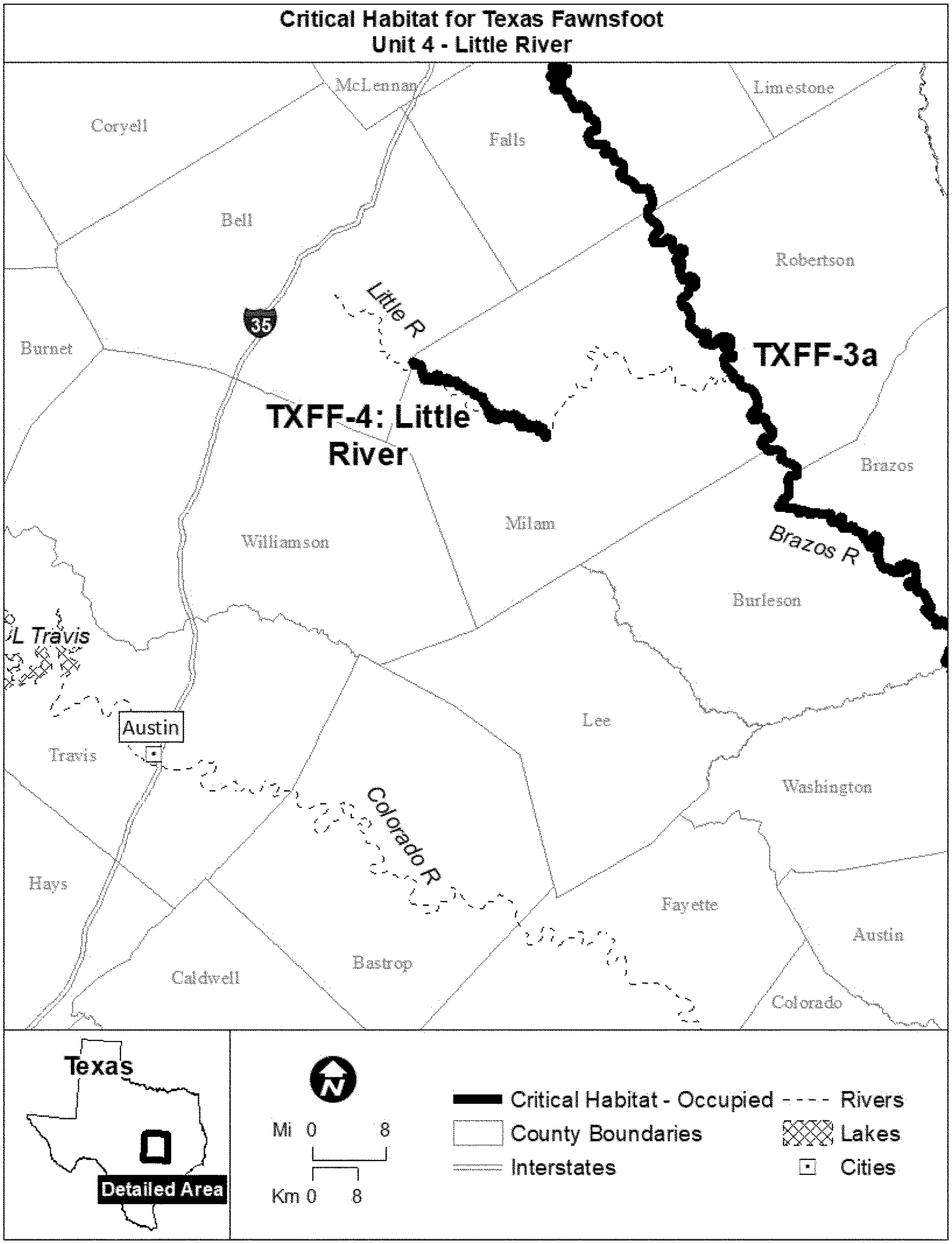
(7) Map of Unit TXFF–2: Upper Brazos River follows:



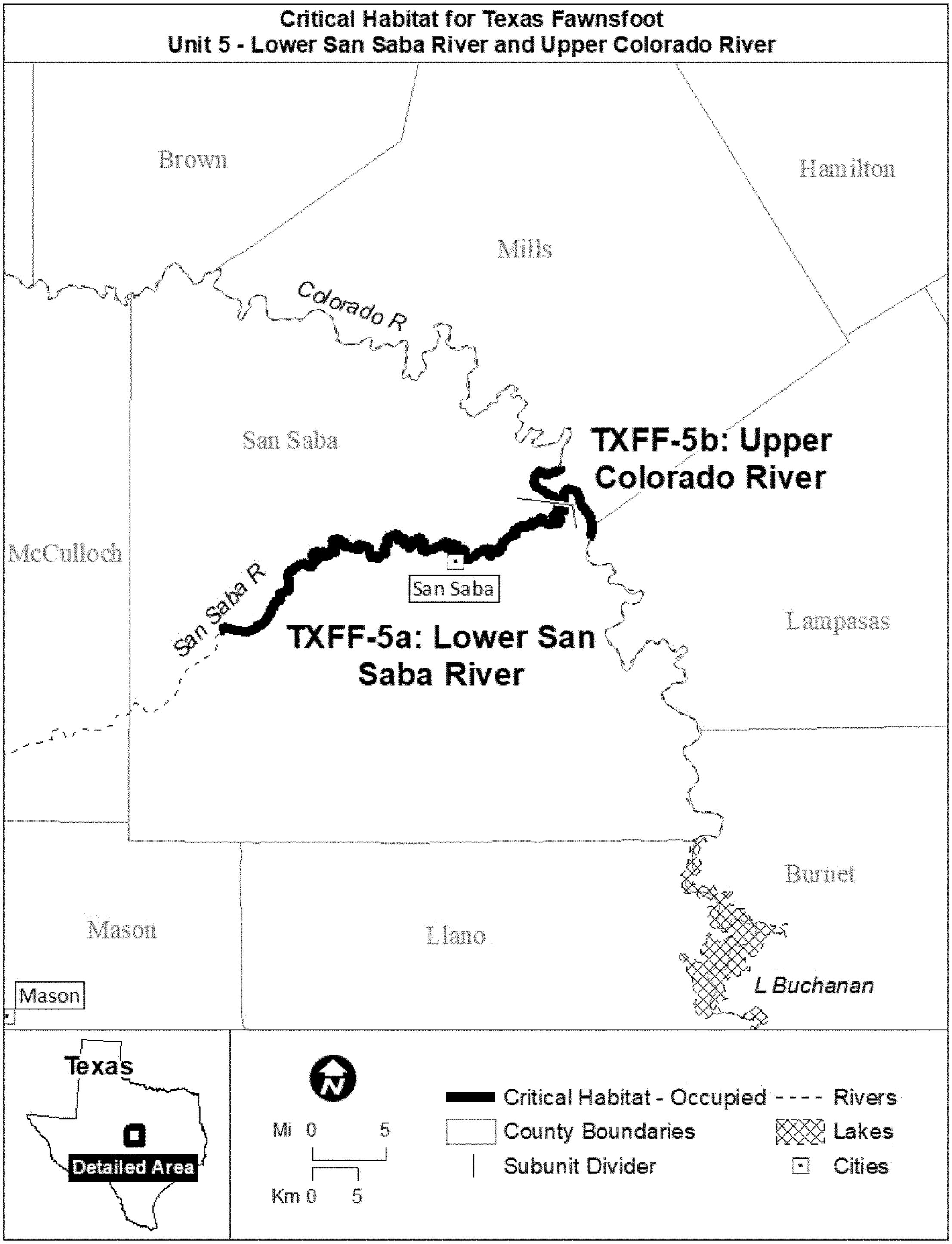
(8) Map of Unit TXFF–3: Lower Brazos River follows:



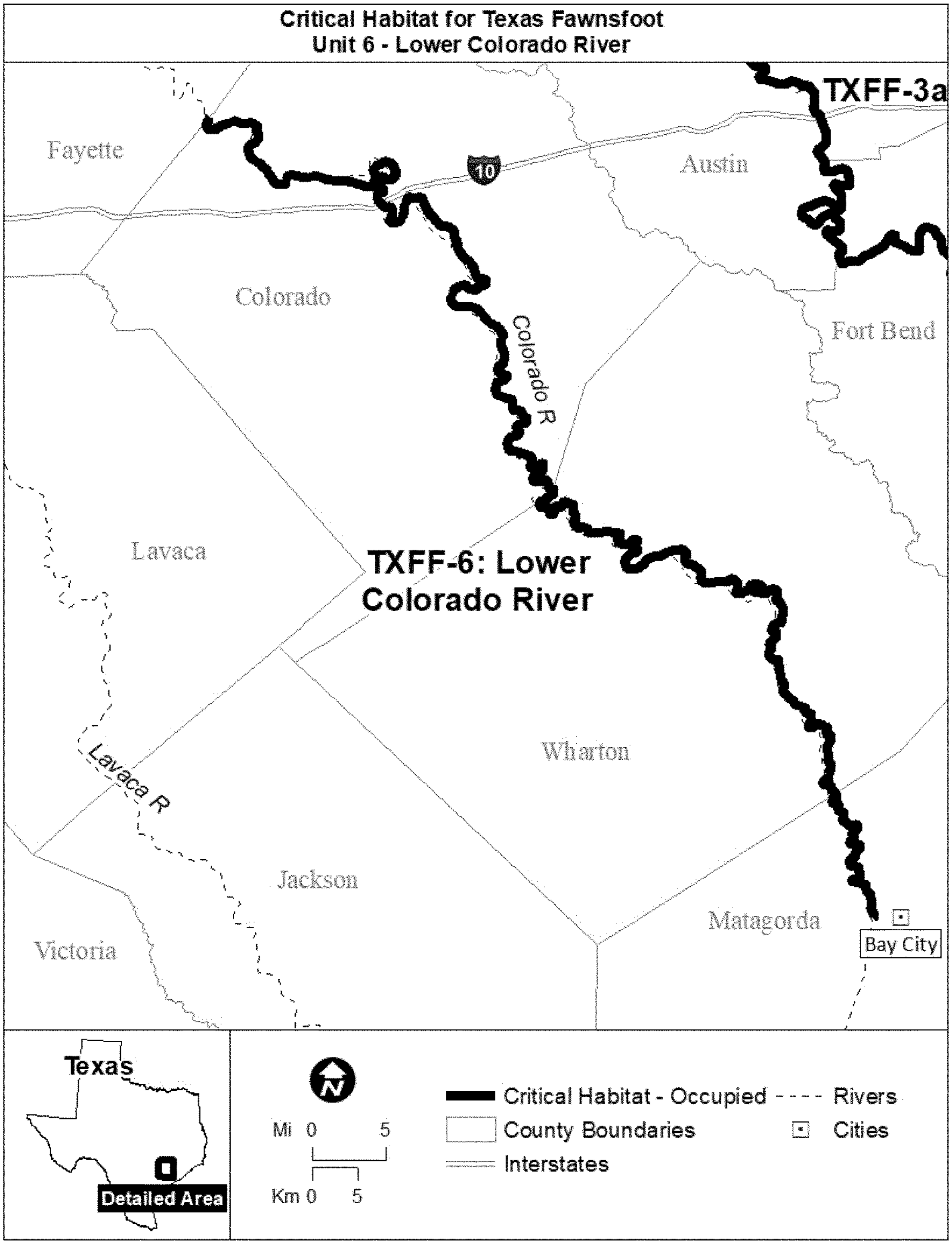
(9) Map of Unit TXFF–4: Little River follows:



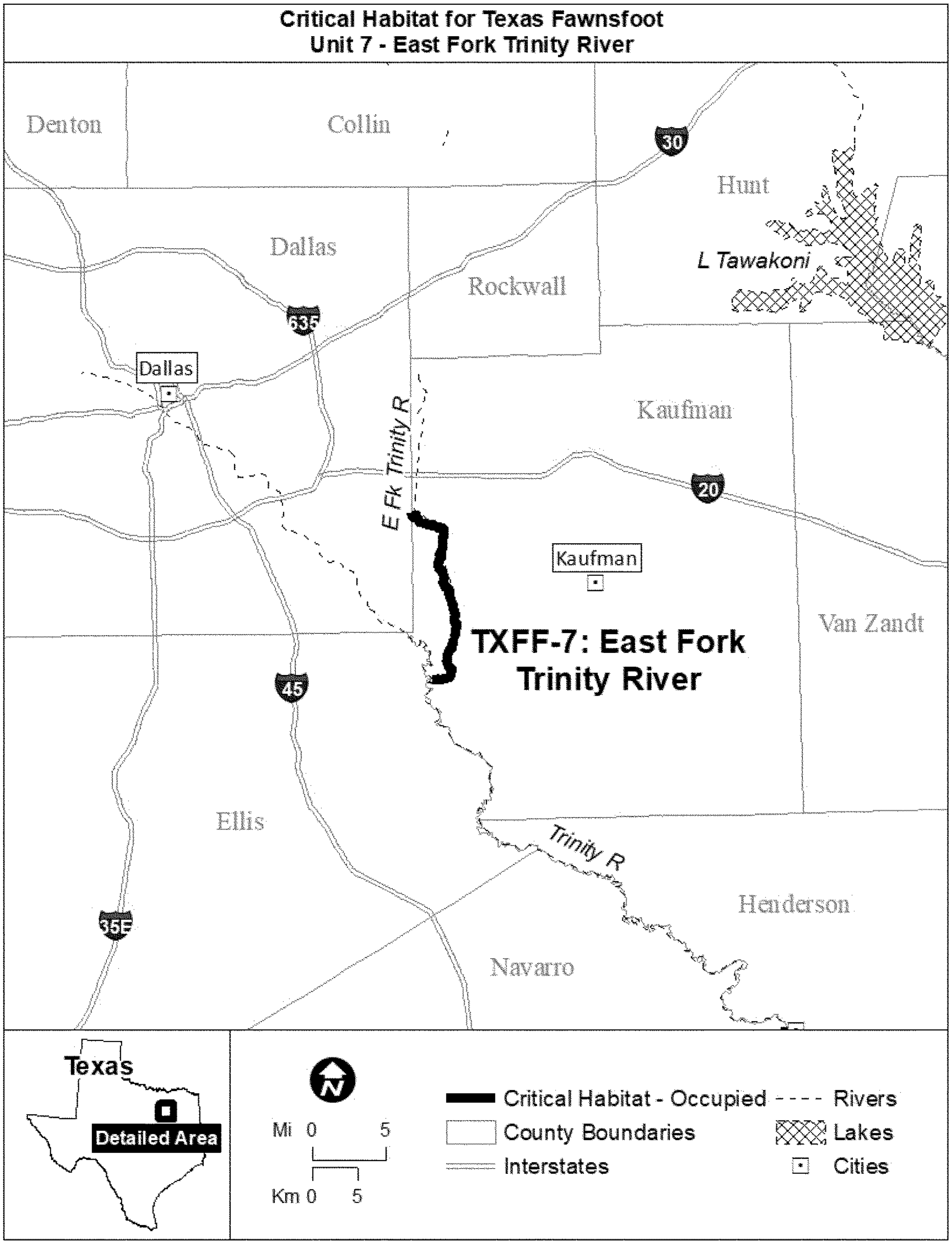
(10) Map of TXFF–5: Lower San Saba and Upper Colorado River follows:



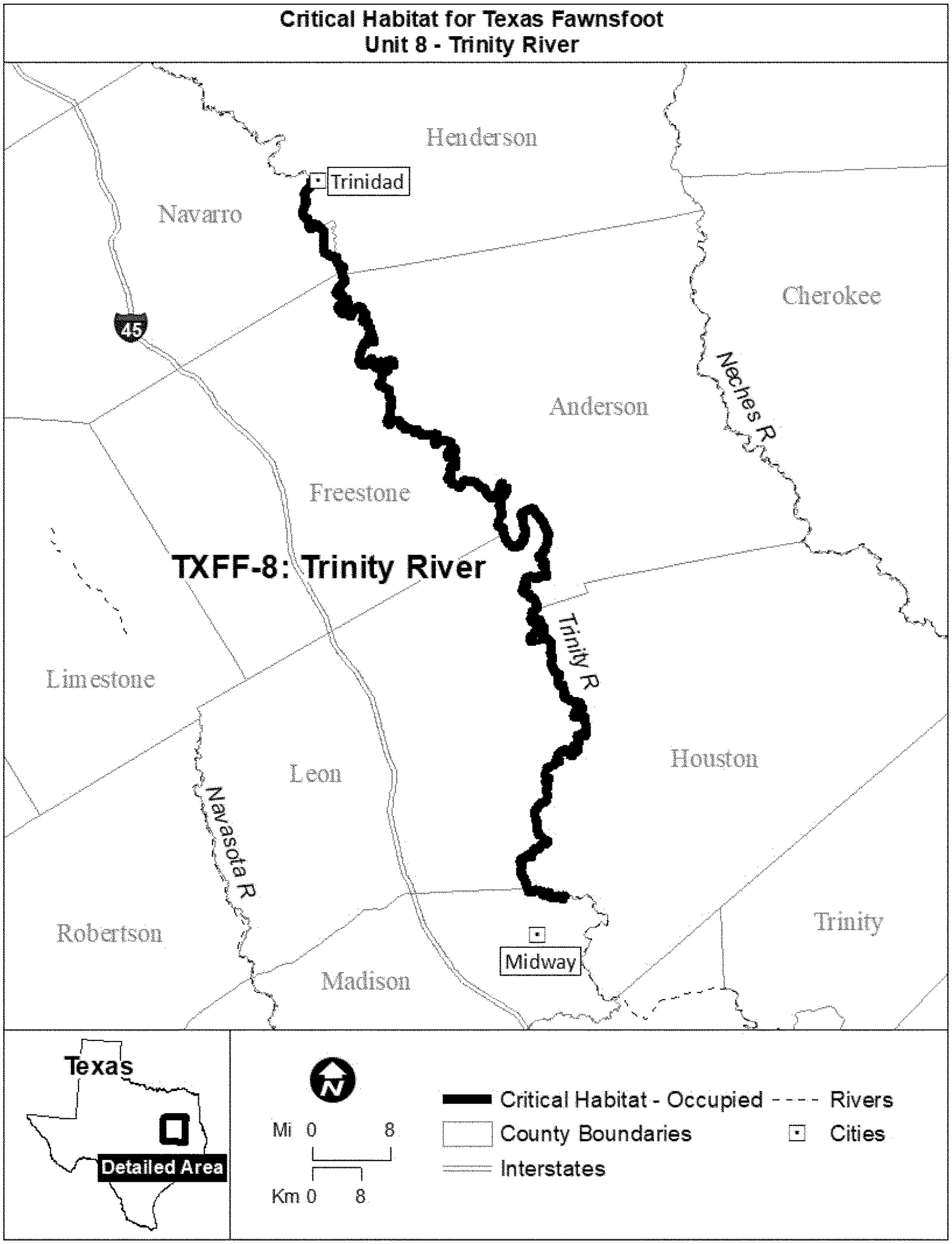
(11) Map of Unit TXFF–6: Lower Colorado River follows:



(12) Map of Unit TXFF–7: East Fork Trinity River follows:



(13) Map of Unit TXFF–8: Trinity River follows:



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Guadalupe Orb (*Cyclonaias necki*)

(1) Critical habitat units are depicted for Caldwell, Comal, DeWitt, Gonzales, Guadalupe, Kendall, Kerr, and Victoria Counties, Texas, on the maps in this critical habitat entry.

(2) Within these areas, the physical or biological features essential to the conservation of Guadalupe orb consist of the following components within waters and streambeds up to the ordinary high-water mark:

(i) Flowing water at rates suitable to keep riffle habitats wetted and well-oxygenated and to prevent excess sedimentation or scour during high-flow events but not so high as to dislodge individuals;

(ii) Stable riffles and runs with substrate composed of cobble, gravel, and fine sediments;

(iii) Channel catfish (*Ictalurus punctatus*), flathead catfish (*Pylodictus olivaris*), and tadpole madtom (*Noturus gyrinus*) present; and

(iv) Water quality parameters within the following ranges:

(A) Dissolved oxygen >2 mg/L;

(B) Salinity <2 ppt;

(C) Total ammonia <0.77 mg/L total ammonia nitrogen;

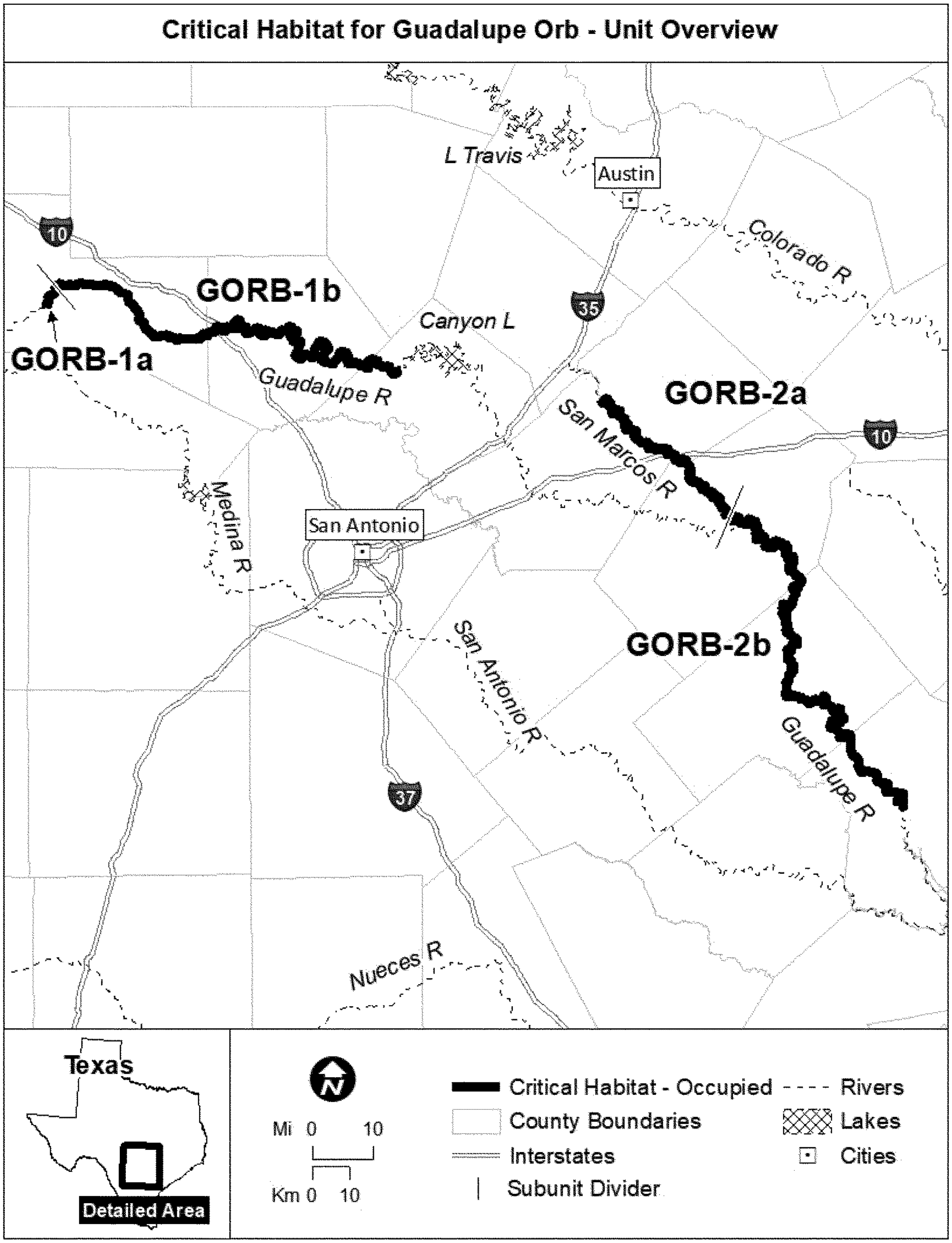
(D) Water temperature <29 °C (84.2 °F); and

(E) Low levels of contaminants.

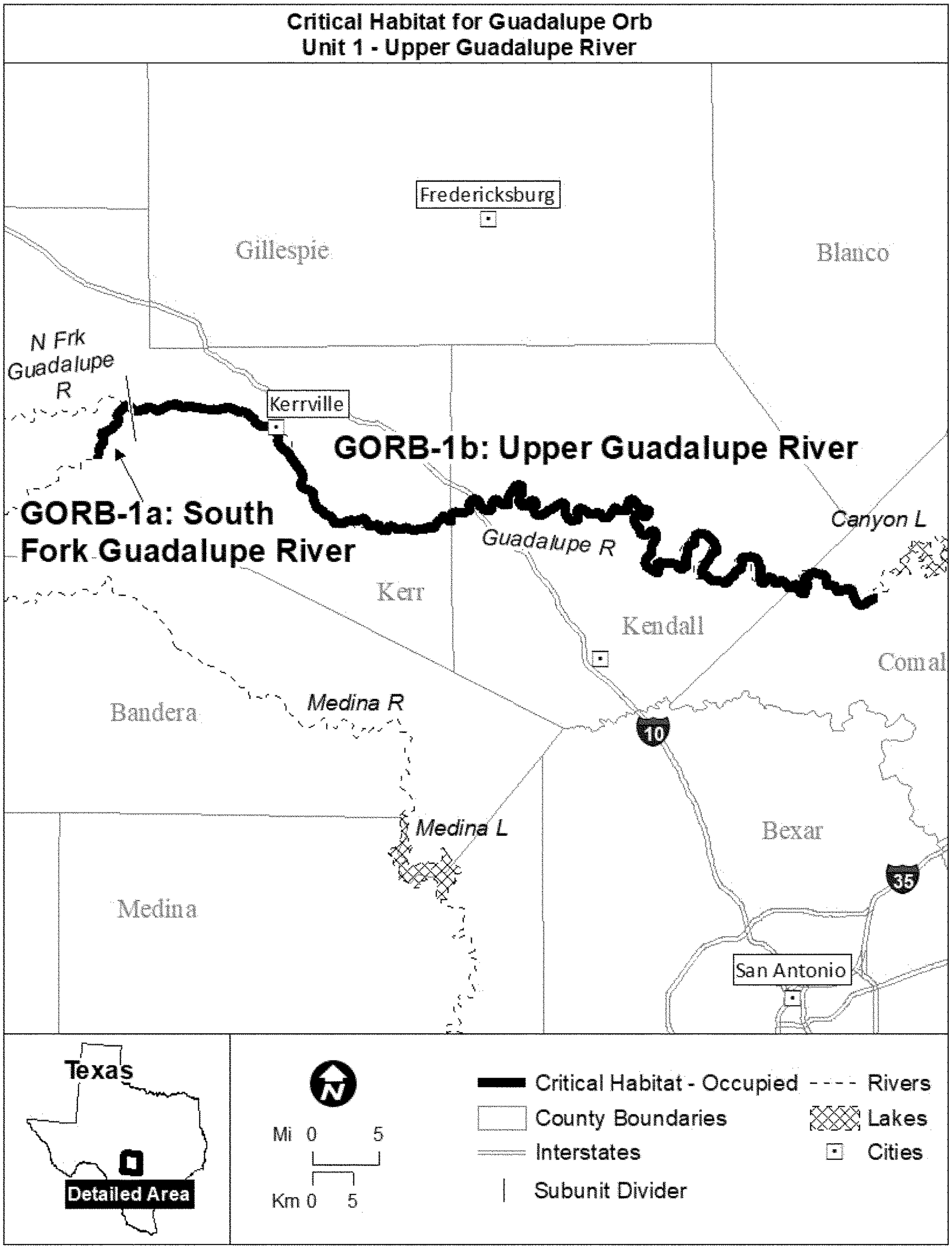
(3) Critical habitat does not include manmade structures (such as buildings, aqueducts, runways, roads, and other paved areas) and the land on which they are located existing within the legal boundaries on [EFFECTIVE DATE OF THE FINAL RULE].

(4) The maps in this entry, as modified by any accompanying regulatory text, establish the boundaries of the critical habitat designation. The coordinates or plot points or both on which each map is based are available to the public at *http://www.regulations.gov* under Docket No. FWS–R2–ES–2019–0061.

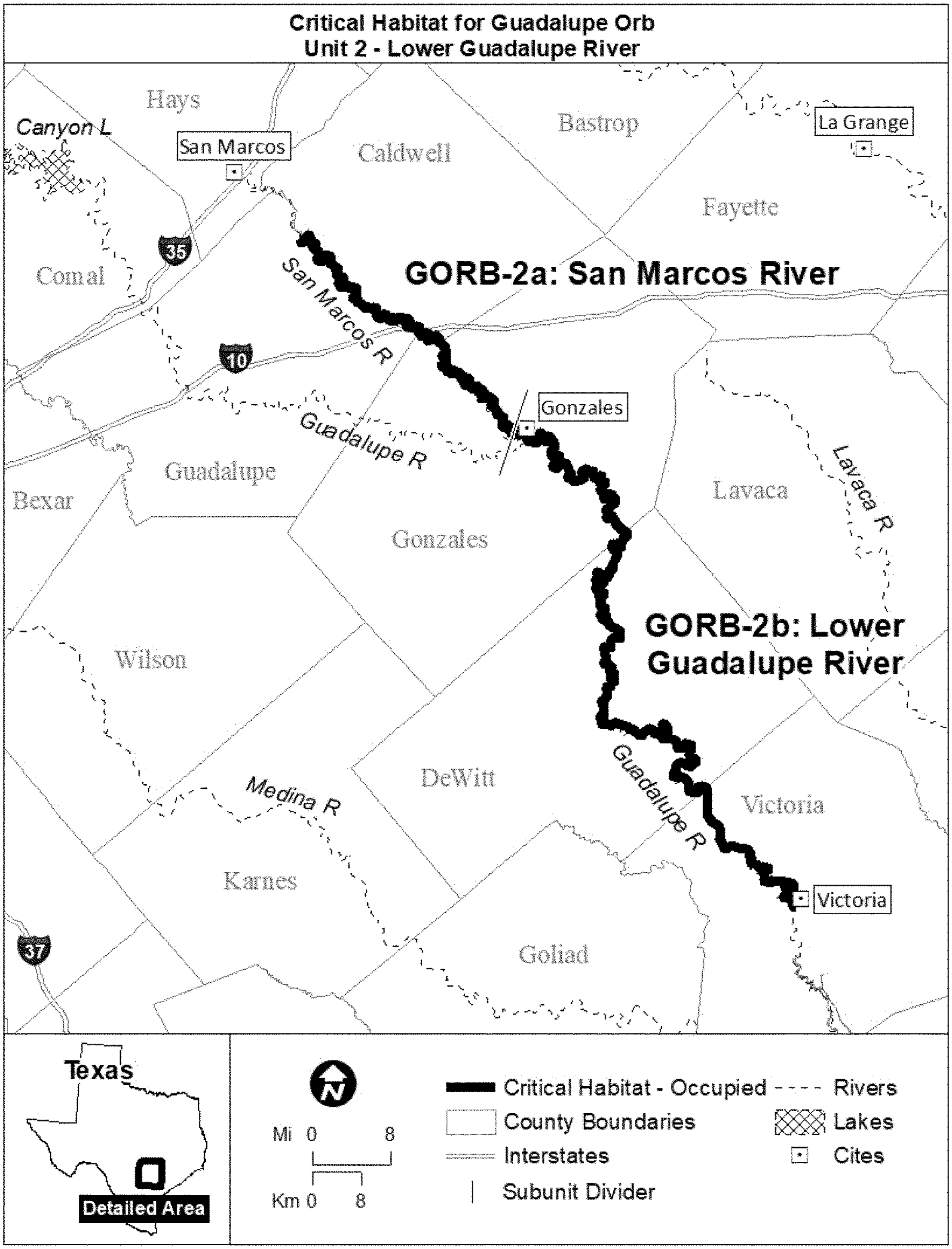
(5) *Note:* An index map of the critical habitat designations for the Central Texas mussels, which includes the Guadalupe orb, can be found in this paragraph (f) at the entry for the Guadalupe fatmucket. An index map of critical habitat units for the Guadalupe orb follows:


Critical Habitat for Guadalupe Orb - Unit Overview
L Travis
Austin
Colorado R
10
35
GORB-1b
GORB-1a
Canyon L
Guadalupe R
GORB-2a
San Marcos R
10
Medina R
San Antonio
San Antonio R
GORB-2b
Guadalupe R
37
Nueces R
Texas
Detailed Area
Mi 0 10
Km 0 10
Critical Habitat - Occupied
County Boundaries
Interstates
Subunit Divider
Rivers
Lakes
Cities

(6) Map of Unit GORB–1: Upper Guadalupe River follows:



(7) Map of Unit GORB–2: Lower Guadalupe River follows:



* * * * *

Texas Pimpleback (*Cyclonaias petrina*)

(1) Critical habitat units are depicted for Brown, Coleman, Colorado, Concho, Kimble, Lampasas, Mason, McCulloch, Menard, Mills, San Saba, Tom Green, and Wharton Counties, Texas, on the maps in this critical habitat entry.

(2) Within these areas, the physical or biological features essential to the conservation of Texas pimpleback consist of the following components within waters and streambeds up to the ordinary high-water mark:

(i) Flowing water at rates suitable to keep riffle habitats wetted and well-oxygenated and to prevent excess sedimentation or scour during high-flow events but not so high as to dislodge individuals;

(ii) Stable riffles and runs with substrate composed of cobble, gravel, and fine sediments;

(iii) Channel catfish (*Ictalurus punctatus*), flathead catfish (*Pylodictus olivaris*), and tadpole madtom (*Noturus gyrinus*) present; and

(iv) Water quality parameters within the following ranges:

(A) Dissolved oxygen >2 mg/L;

(B) Salinity <2 ppt;

(C) Total ammonia <0.77 mg/L total ammonia nitrogen;

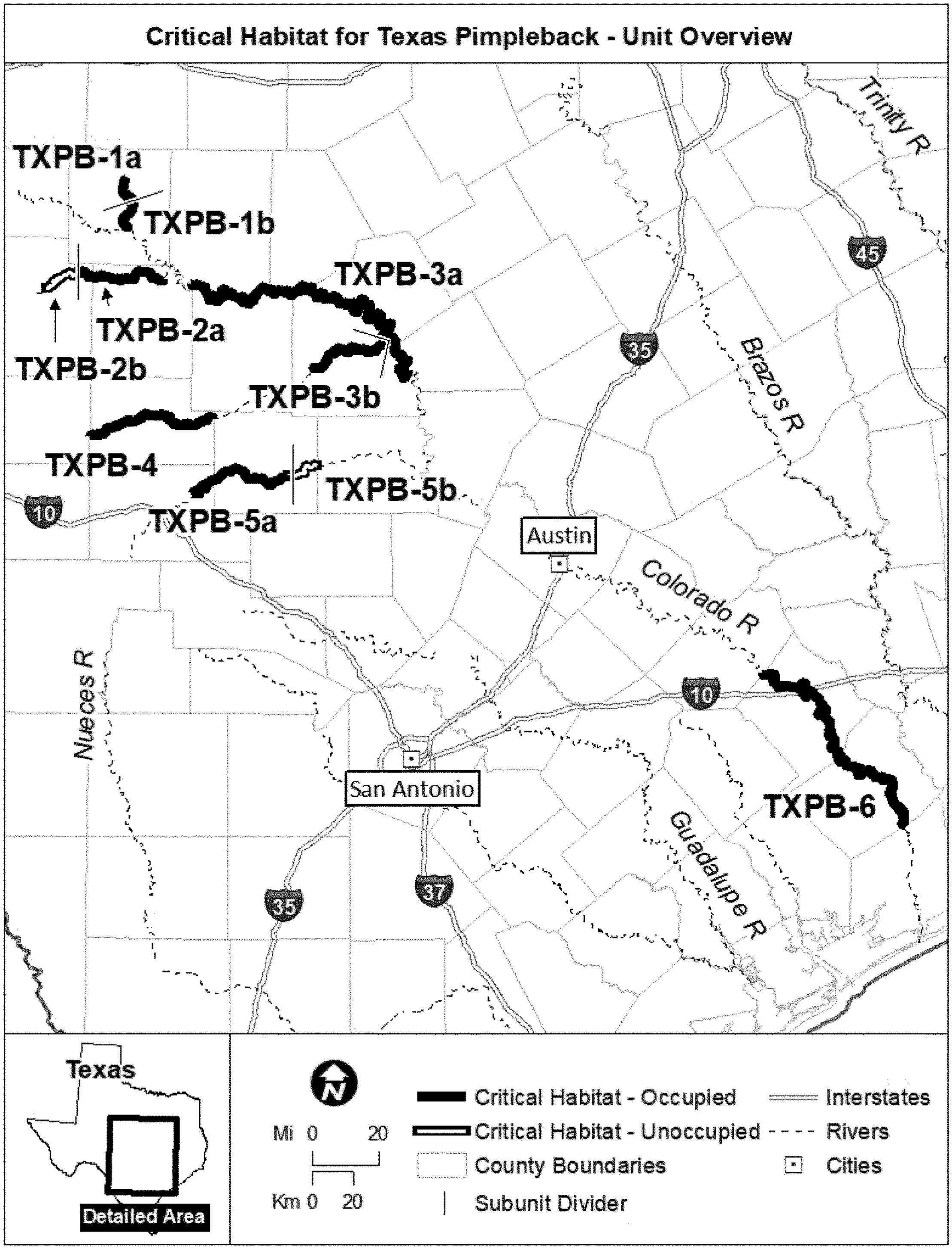
(D) Water temperature <29 °C (84.2 °F); and

(E) Low levels of contaminants.

(3) Critical habitat does not include manmade structures (such as buildings, aqueducts, runways, roads, and other paved areas) and the land on which they are located existing within the legal boundaries on [EFFECTIVE DATE OF THE FINAL RULE].

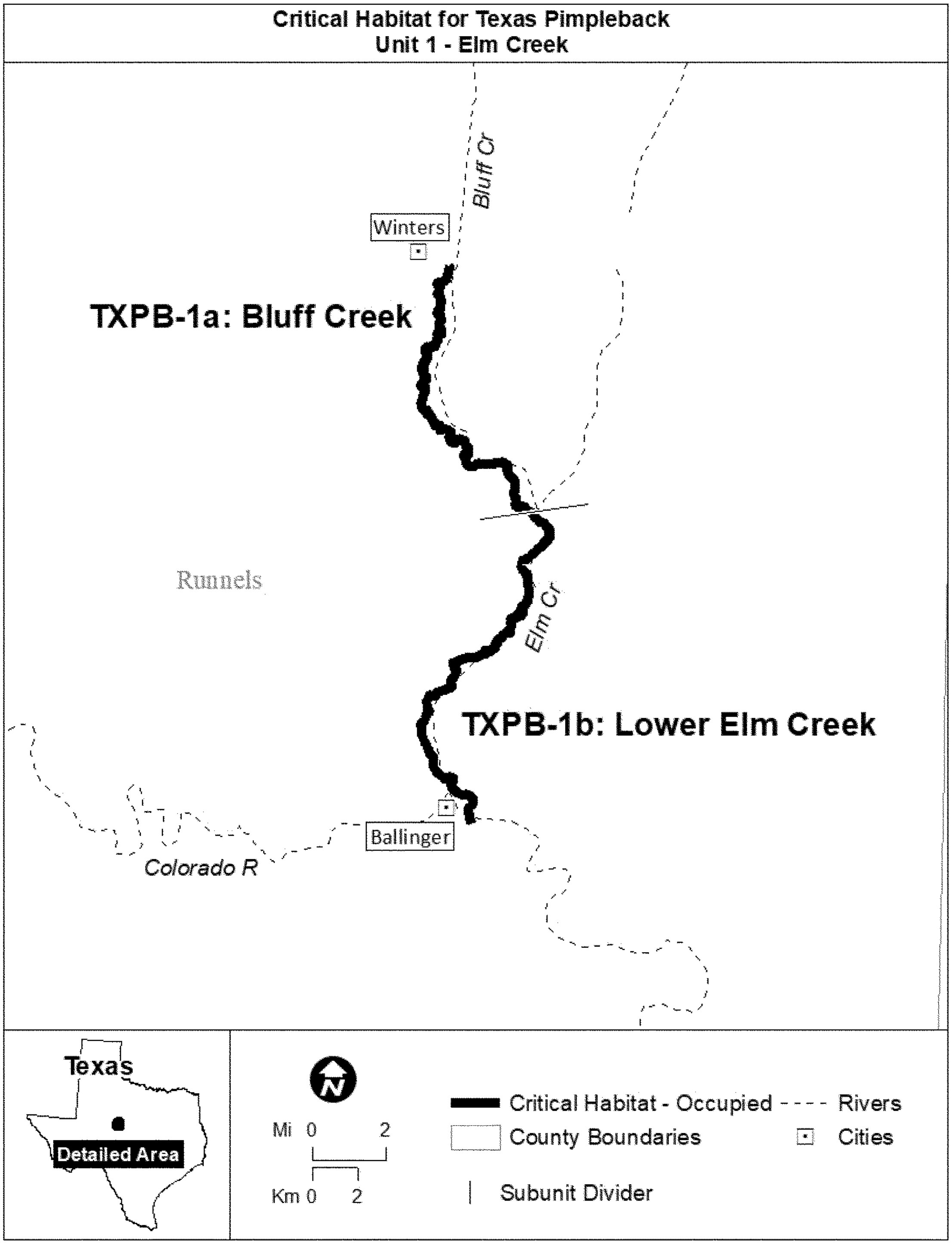
(4) The maps in this entry, as modified by any accompanying regulatory text, establish the boundaries of the critical habitat designation. The coordinates or plot points or both on which each map is based are available to the public at *http://www.regulations.gov* under Docket No. FWS–R2–ES–2019–0061.

(5) *Note:* An index map of the critical habitat designations for the Central Texas mussels, which includes the Texas pimpleback, can be found in this paragraph (f) at the entry for the Guadalupe fatmucket. An index map of critical habitat units for the Texas pimpleback follows:

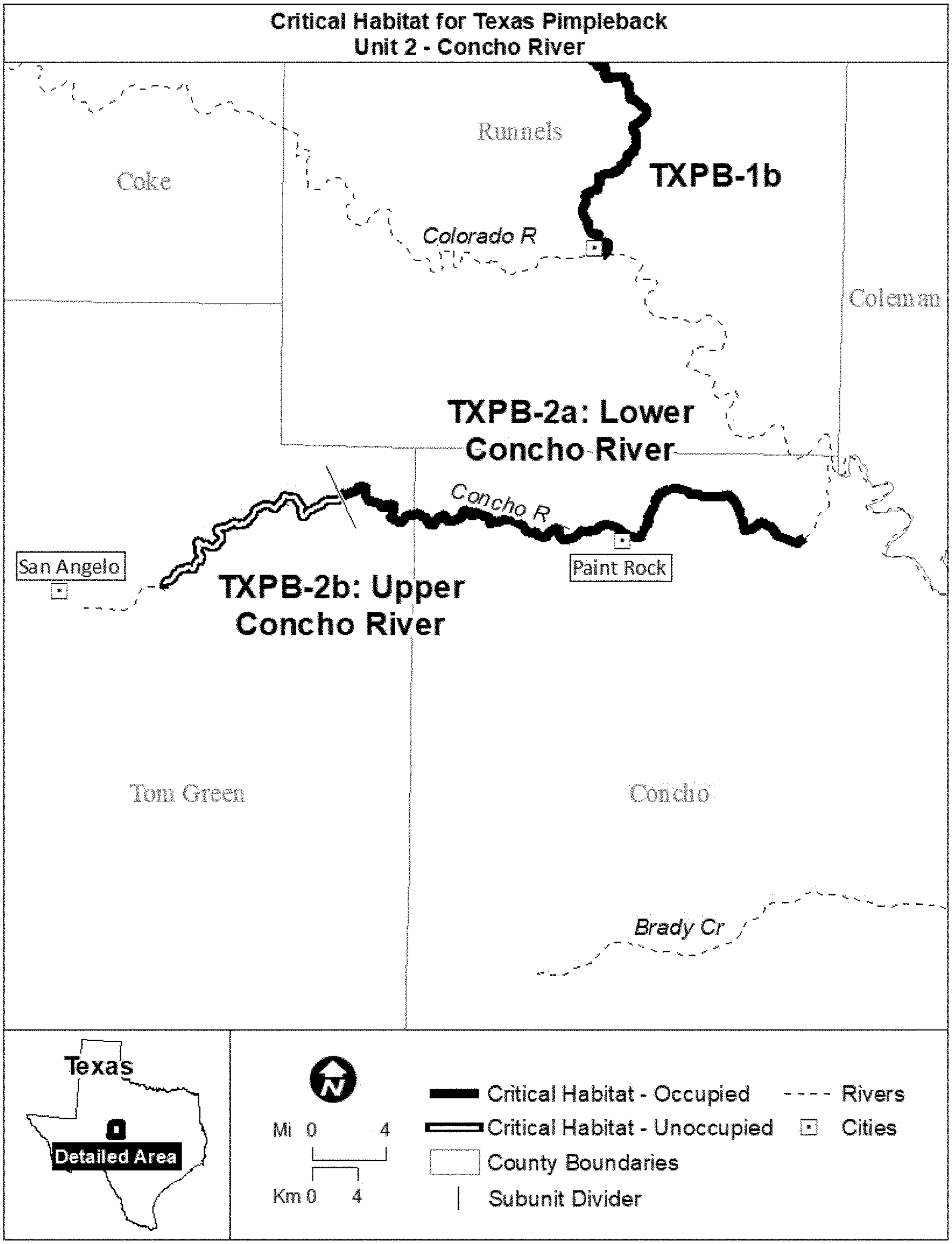


Critical Habitat for Texas Pimpleback - Unit Overview
TXPB-1a
TXPB-1b
TXPB-2a
TXPB-2b
TXPB-3a
TXPB-3b
TXPB-4
TXPB-5a
TXPB-5b
TXPB-6
Trinity R
Brazos R
Colorado R
Guadalupe R
Nueces R
Austin
San Antonio
45
35
10
37
Texas
Detailed Area
Mi 0 20
Km 0 20
Critical Habitat - Occupied
Critical Habitat - Unoccupied
County Boundaries
Subunit Divider
Interstates
Rivers
Cities

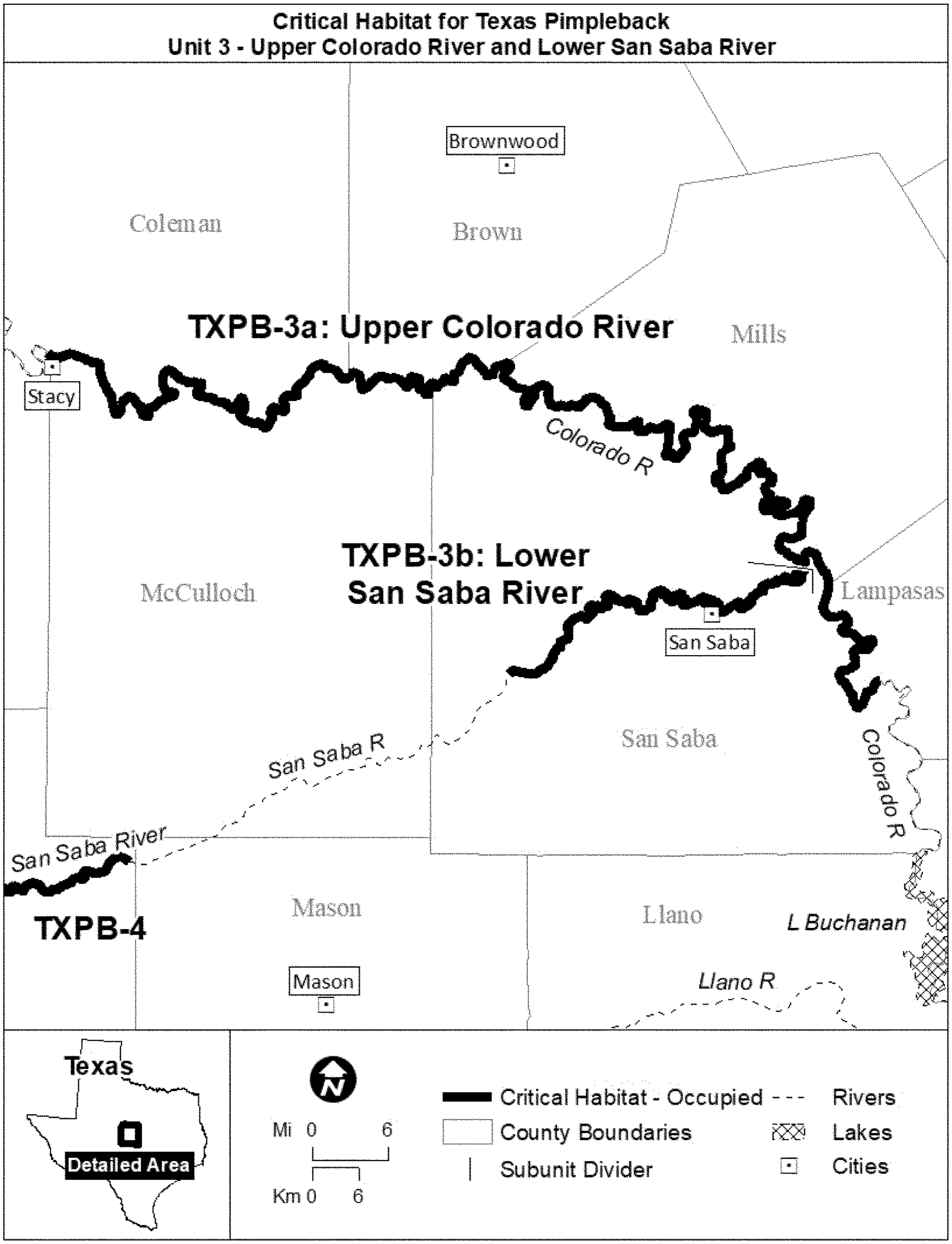
(6) Map of Unit TXPB–1: Elm Creek follows:



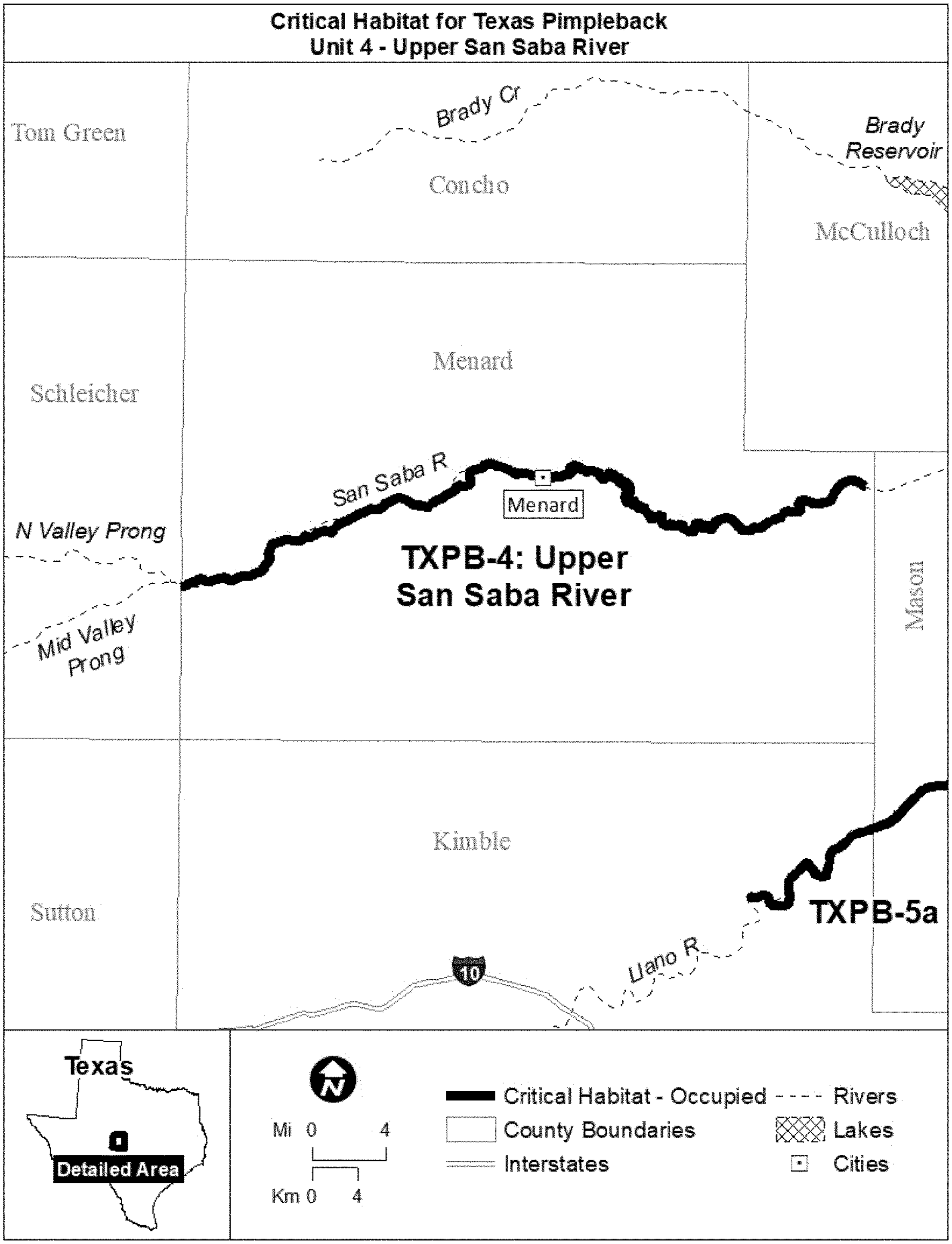
(7) Map of Unit TXPB–2: Concho River follows:



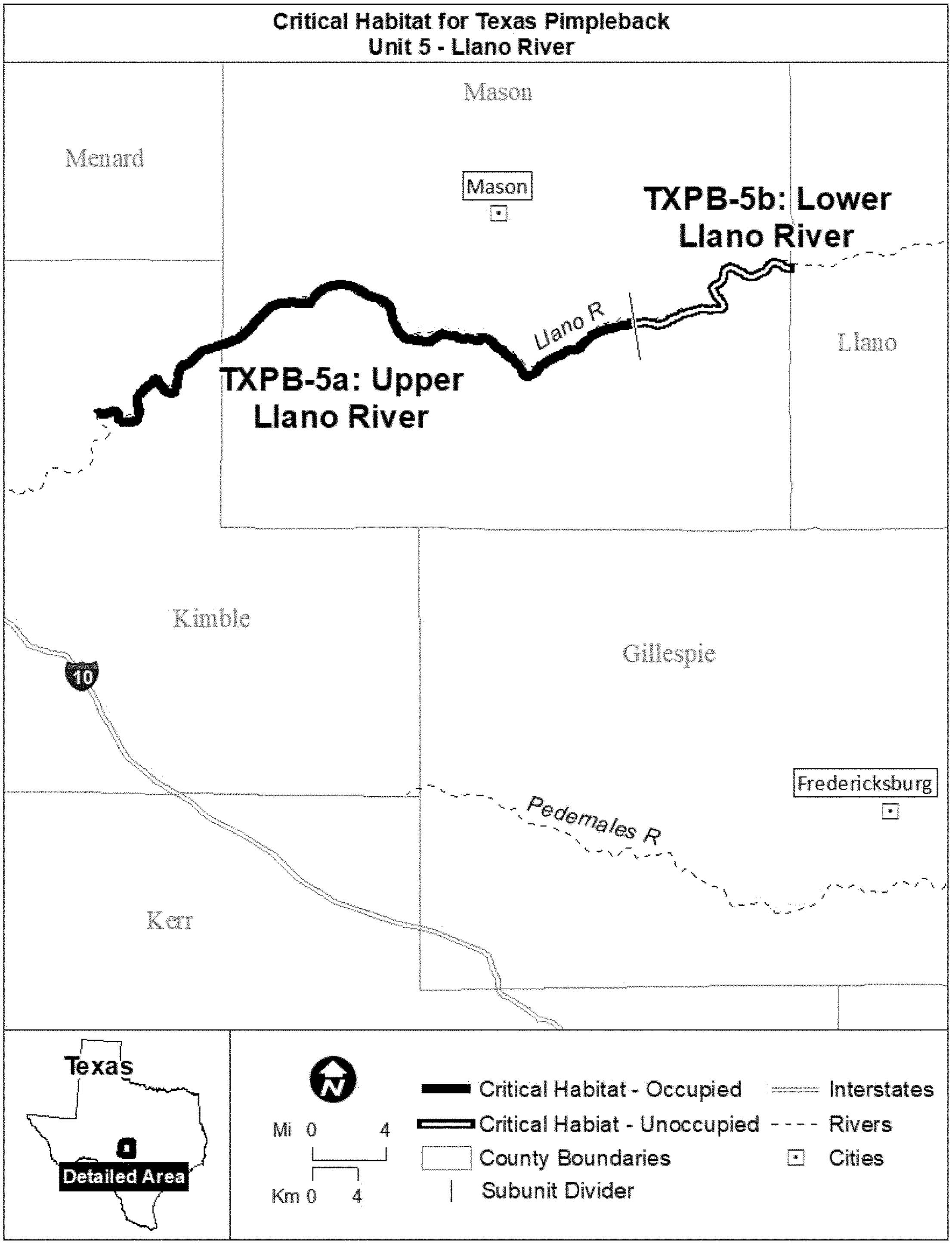
(8) Map of Unit TXPB–3: Upper Colorado River and Lower San Saba River follows:



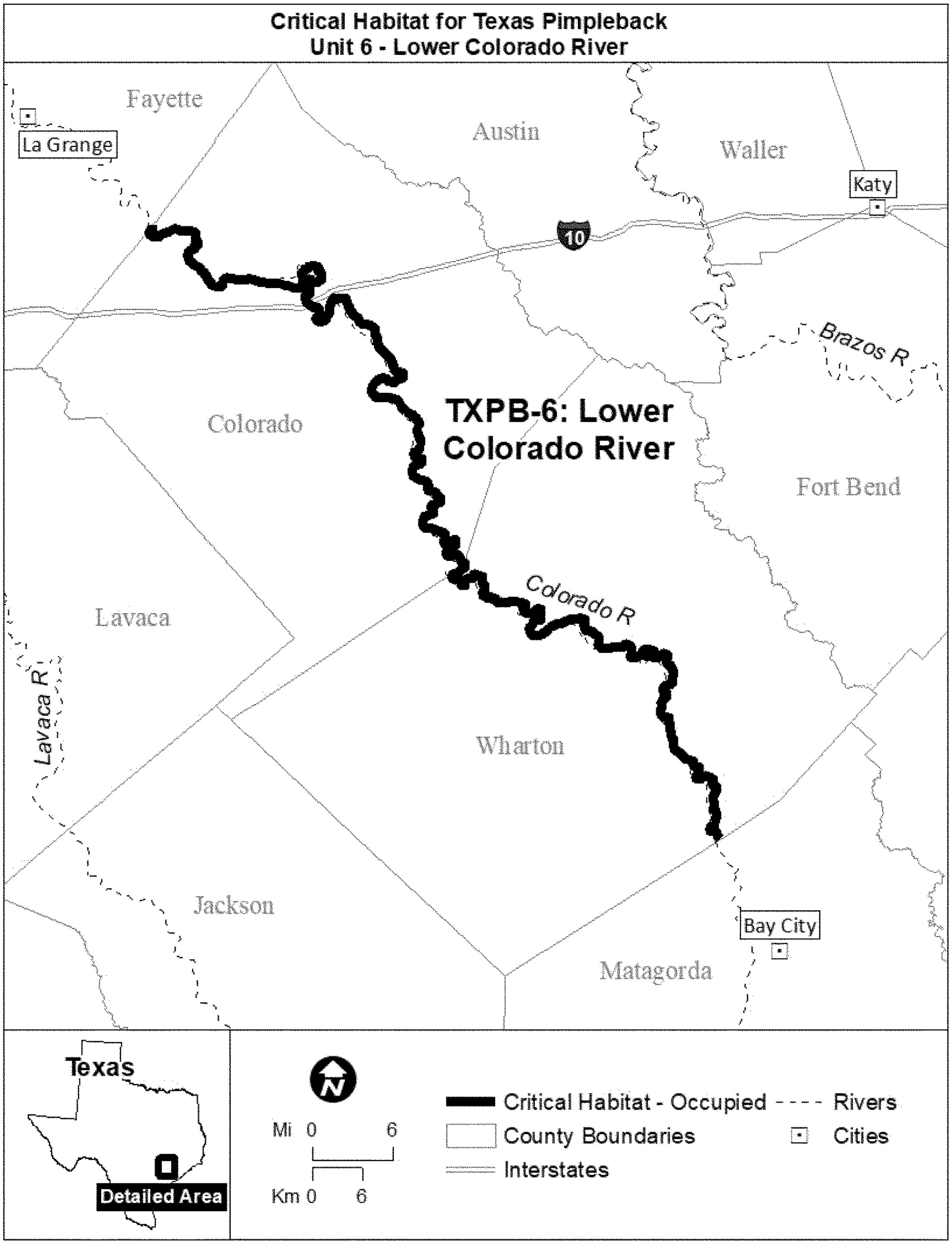
(9) Map of Unit TXPB–4: Upper San Saba River follows:



(10) Map of Unit TXPB–5: Llano River follows:



(11) Map of Unit TXPB–6: Lower Colorado River follows:



False Spike (*Fusconaia mitchelli*)

(1) Critical habitat units are depicted for DeWitt, Gonzales, Kimble, Mason, Milam, San Saba, Victoria, and Williamson Counties, Texas, on the maps in this critical habitat entry.

(2) Within these areas, the physical or biological features essential to the conservation of false spike consist of the following components within waters and streambeds up to the ordinary high-water mark:

(i) Flowing water at rates suitable to keep riffle habitats wetted and well oxygenated, and to prevent excess sedimentation but not so high as to dislodge individuals;

(ii) Stable riffles and runs with cobble, gravel, and fine sediments;

(iii) Blacktail shiner (*Cyprinella venusta*) and red shiner (*Cyprinella lutrensis*) present; and

(iv) Water quality parameters within the following ranges:

(A) Dissolved oxygen >2 mg/L;

(B) Salinity <2 ppt;

(C) Total ammonia <0.77 mg/L total ammonia nitrogen;

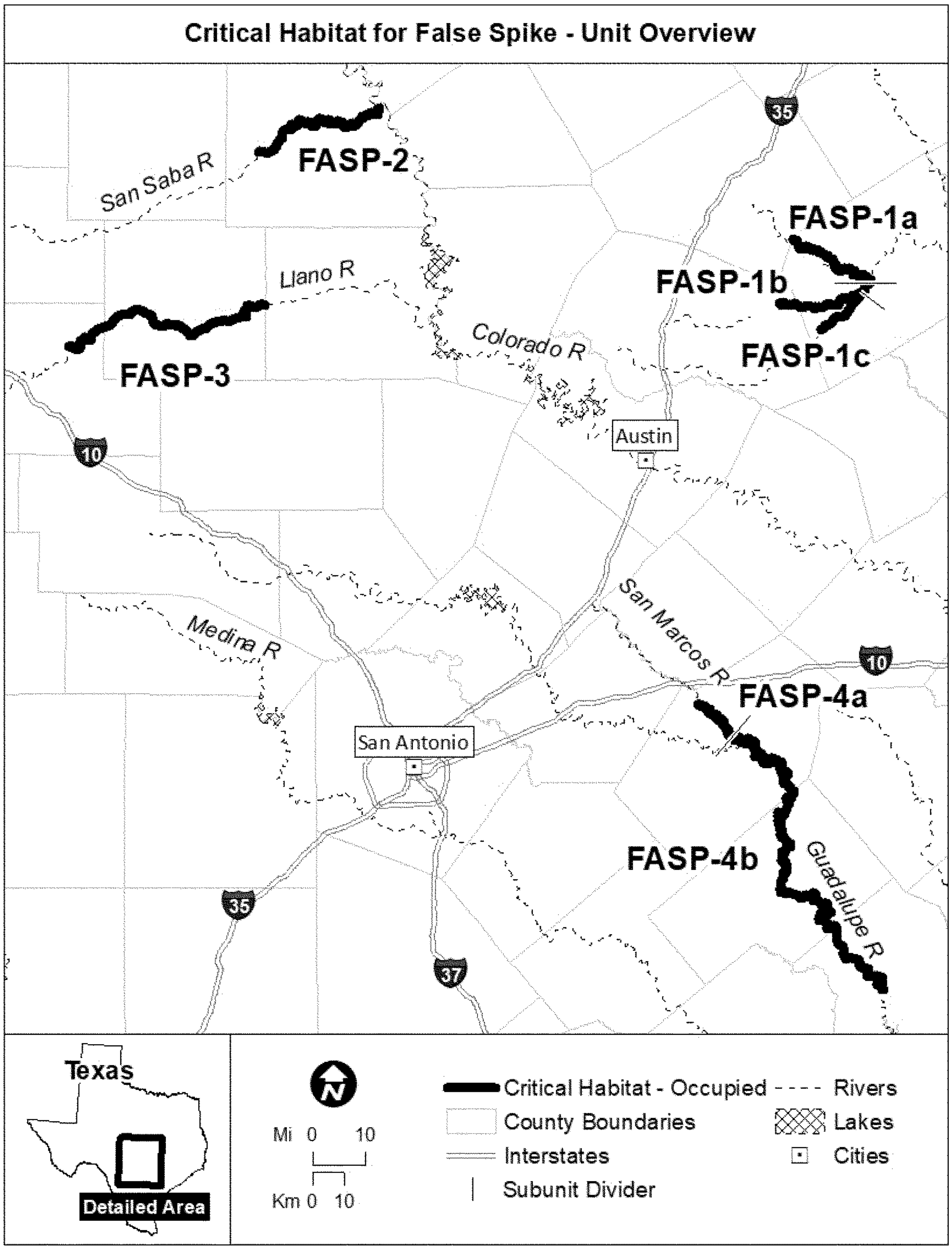
(D) Water temperature <29 °C (84.2 °F); and

(E) Low levels of contaminants.

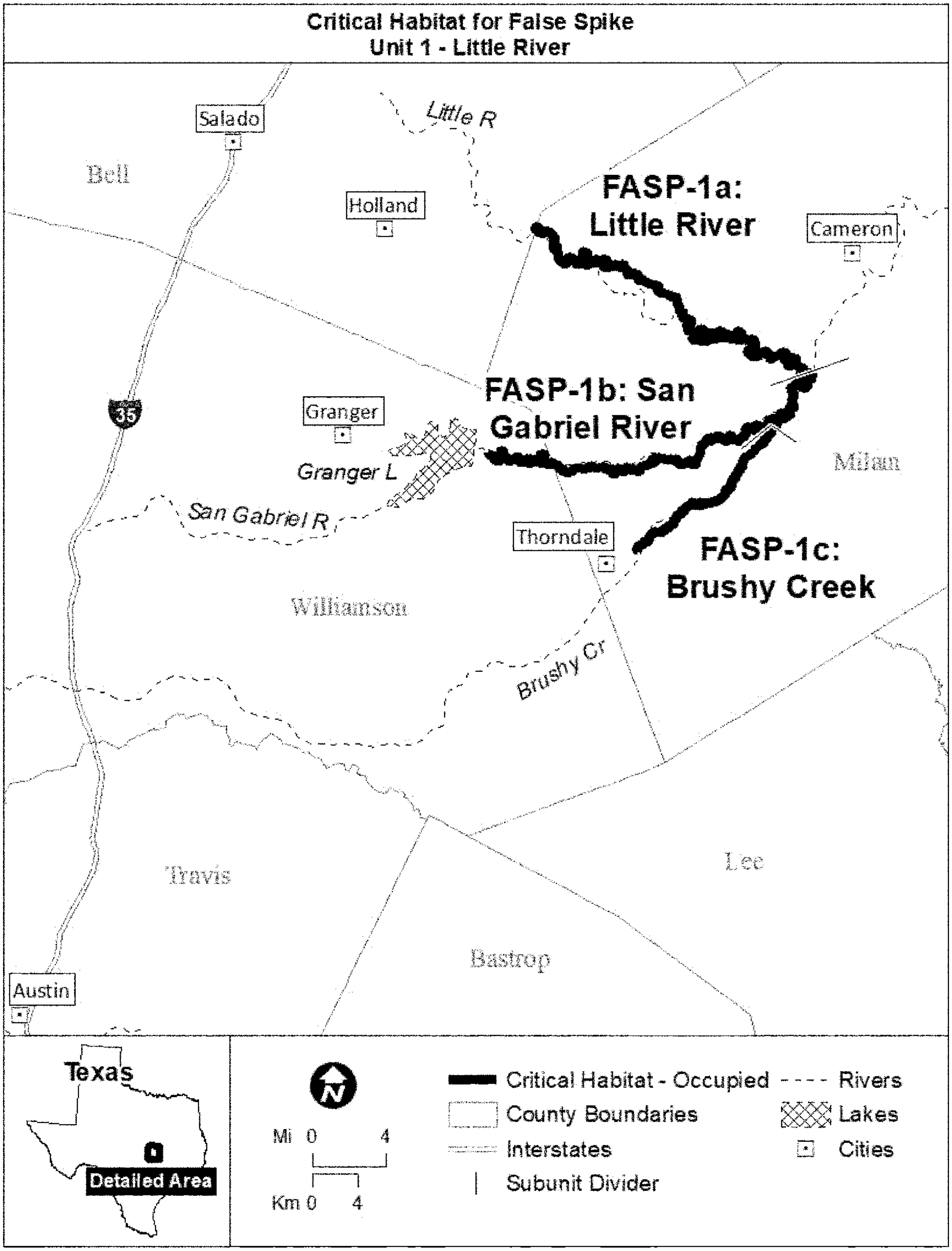
(3) Critical habitat does not include manmade structures (such as buildings, aqueducts, runways, roads, and other paved areas) and the land on which they are located existing within the legal boundaries on [EFFECTIVE DATE OF THE FINAL RULE].

(4) The maps in this entry, as modified by any accompanying regulatory text, establish the boundaries of the critical habitat designation. The coordinates or plot points or both on which each map is based are available to the public at *http://www.regulations.gov* under Docket No. FWS–R2–ES–2019–0061.

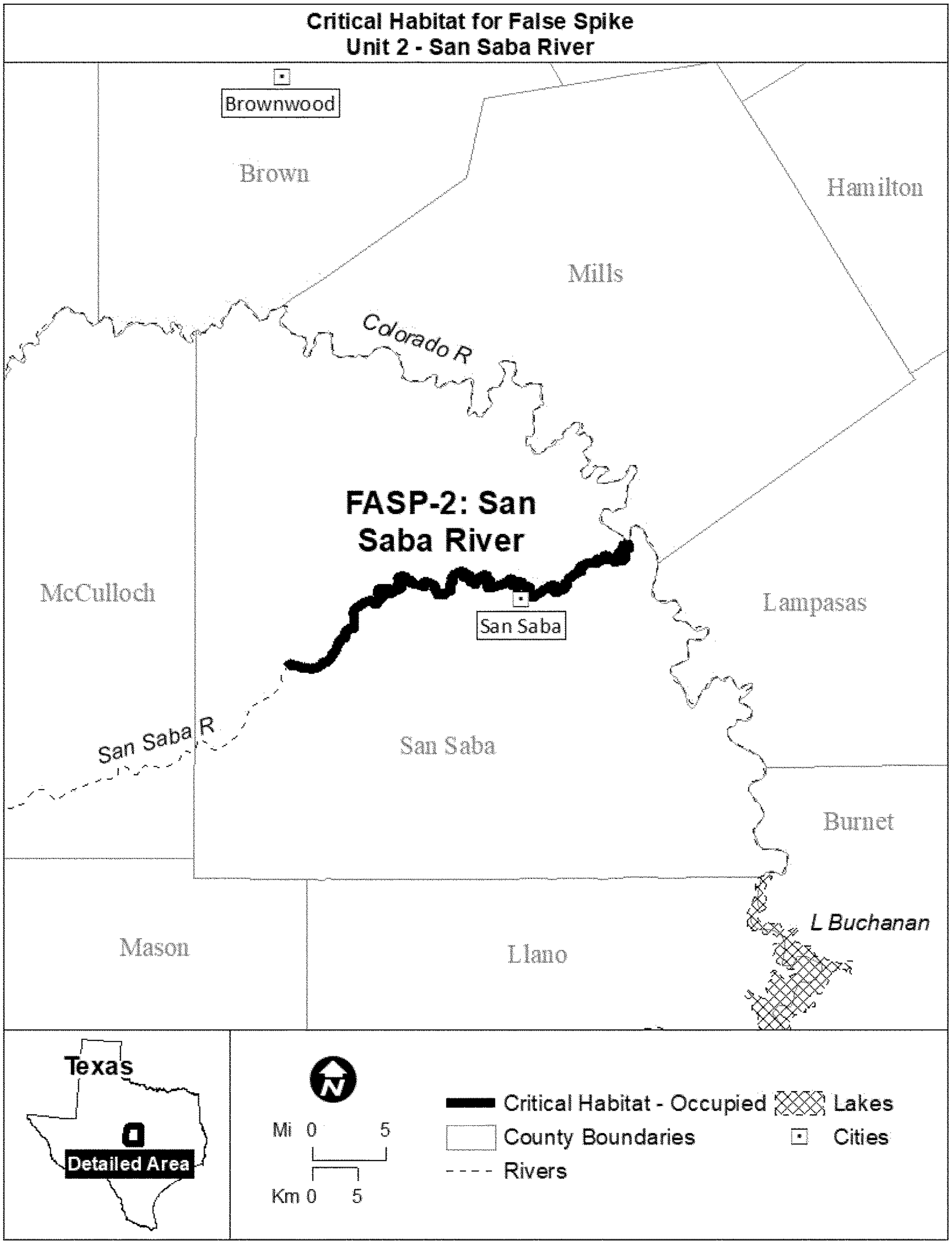
(5) *Note:* An index map of the critical habitat designations for the Central Texas mussels, which includes the false spike, can be found in this paragraph (f) at the entry for the Guadalupe fatmucket. An index map of critical habitat units for the false spike follows:



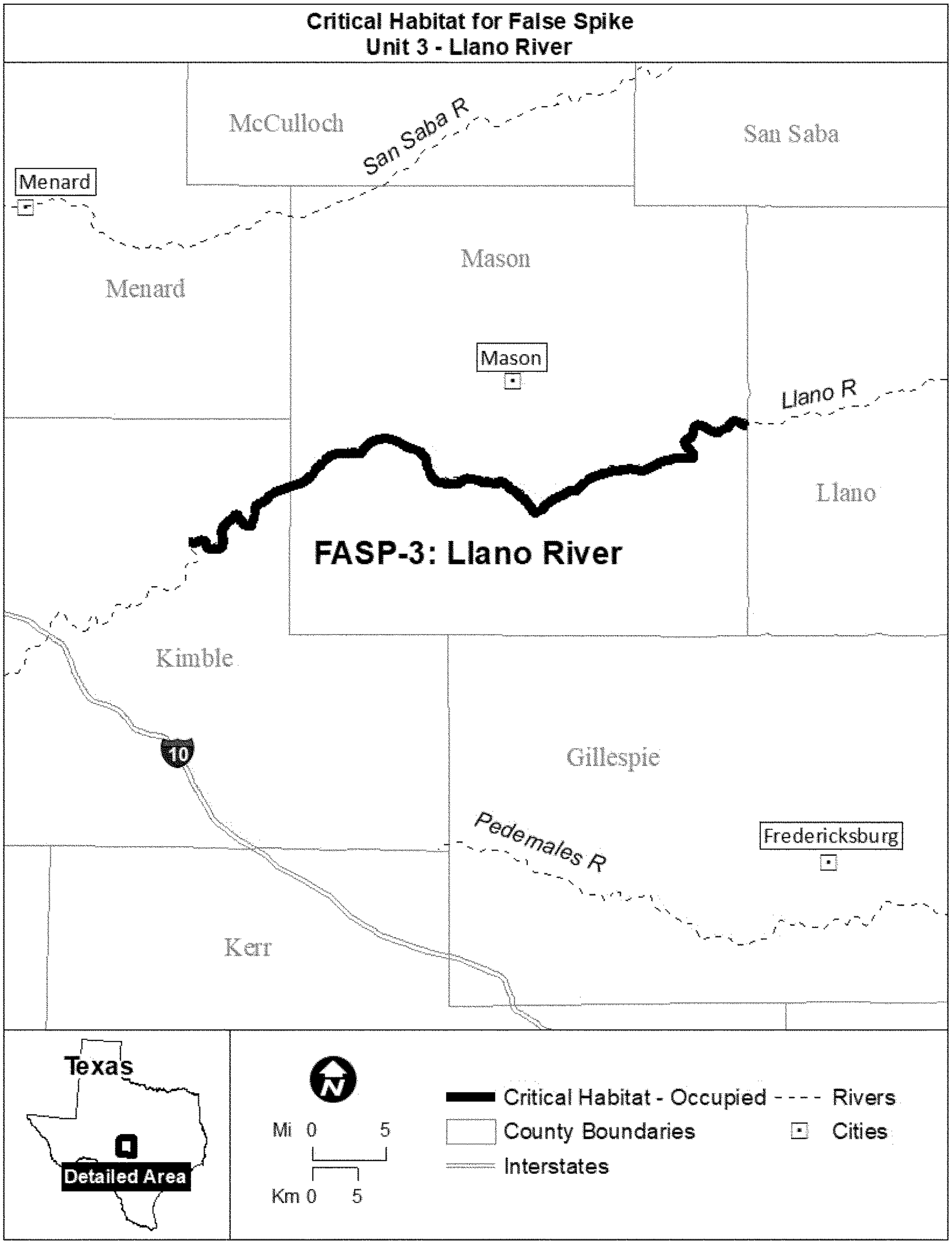
(6) Map of Unit FASP–1: Little River follows:



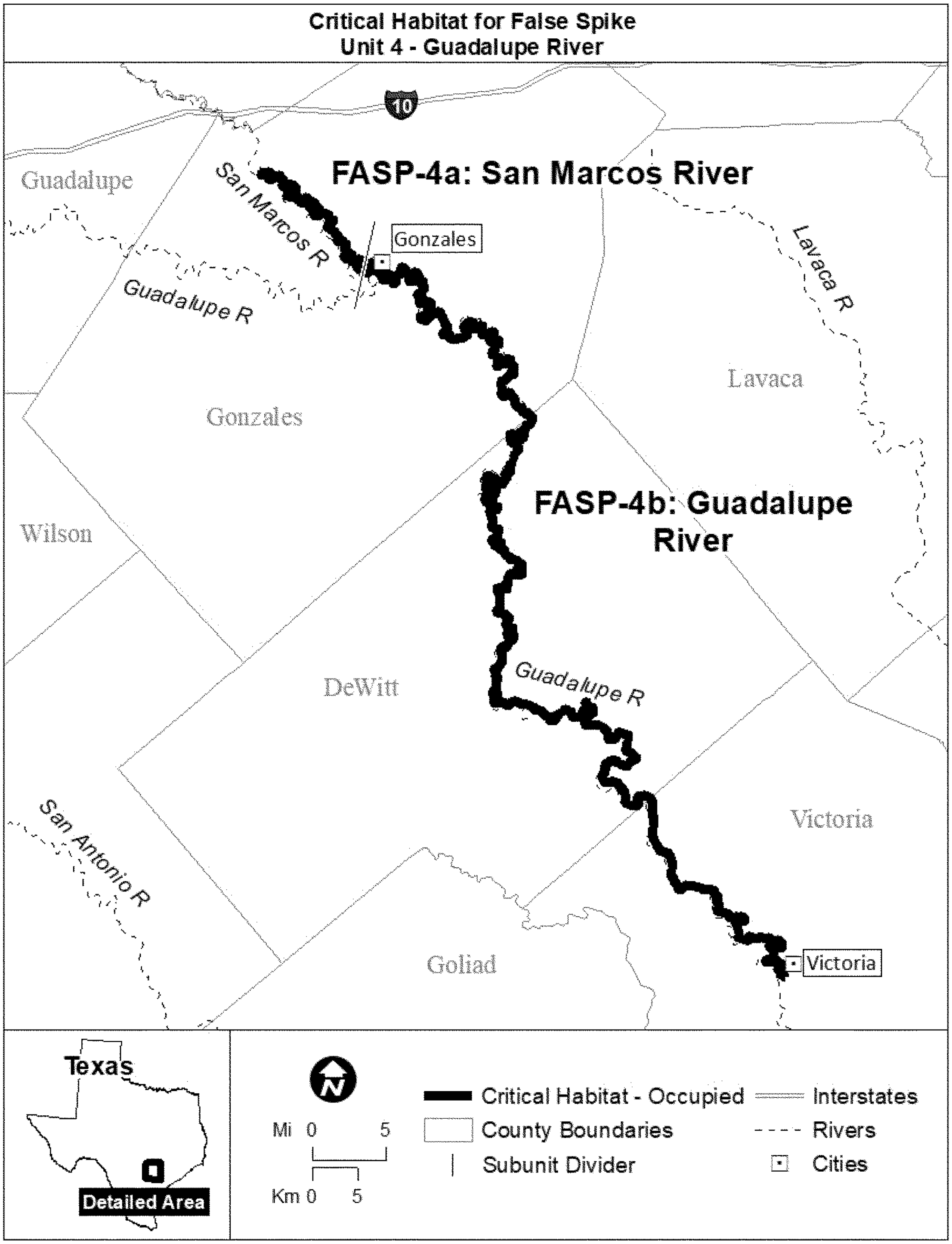
(7) Map of Unit FASP–2: San Saba River follows:



(8) Map of Unit FASP–3: Llano River follows:



(9) Map of Unit FASP–4: Guadalupe River follows:



* * * * *

Martha Williams,

Principal Deputy Director, Exercising the Delegated Authority of the Director U.S. Fish and Wildlife Service.

[FR Doc. 2021–18012 Filed 8–25–21; 8:45 am]

BILLING CODE 4333–15–C