D R A F T

ZAPATA BLADDERPOD RECOVERY PLAN

Zapata Bladderpod
(*Lesquerella thamnophila*) Rollins
and Shaw

Region 2
U.S. Fish and Wildlife Service
Albuquerque, New Mexico

D R A F T
ZAPATA BLADDERPOD
RECOVERY PLAN

Prepared by:

Loretta Schanen Pressly
U.S. Fish and Wildlife Service
c/o TAMUCC
6300 Ocean Drive Box 338
Corpus Christi, Texas 78412

For:

Region 2
U.S. Fish and Wildlife Service
Albuquerque, New Mexico

Approved:_____
Regional Director, Region 2

Date: _____

Concurrence:_____
Director, Texas Parks and Wildlife Department

Date:_____

ACKNOWLEDGMENTS

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Recovery plans delineate reasonable actions which are believed to be required to recover and/or protect listed species. Plans are published by the U.S. Fish and Wildlife Service, sometimes prepared with the assistance of recovery teams, contractors, state agencies, and others. Objectives will be attained and any necessary funds made available subject to budgetary and other constraints affecting the parties involved as well as the need to address other priorities. Recovery plans do not necessarily represent the views nor the official positions or approval of any individuals or agencies involved in the plan formulation, other than the U.S. Fish and Wildlife Service **only** after they have been signed by the Regional Director or Director as **approved**. Approved recovery plans are subject to modification as dictated by new findings, changes in species status, and the completion of recovery tasks.

Literature citations should read as follows:

U.S. Fish and Wildlife Service. 2003. Zapata Bladderpod (*Lesquerella thamnophila*) Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. i-vi + 51pp.

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Fish and Wildlife Reference Service
5430 Grosvenor Lane, Suite 110
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EXECUTIVE SUMMARY

Current Status: *Lesquerella thamnophila* (Zapata bladderpod) was listed as endangered on November 22, 1999 (U. S. Fish and Wildlife 1999), with critical habitat designated on December 22, 2000 (U. S. Fish and Wildlife 2000). Historically, eleven Zapata bladderpod populations have been located and described, including the type locality discovered in Zapata County in 1959. Of the eleven populations, seven were known from Starr County, Texas, and four in Zapata County, Texas. Currently, the species occurs on seven sites in Texas in varying numbers. There may be extant populations in Mexico.

Habitat Requirements and Limiting Factors: Zapata bladderpod is known to occur on graveled to sandy-loam upland terraces above the Rio Grande flood plain. The known populations are associated with high calcareous sandstones and clays, within a community of shrub species. Limiting factors include habitat destruction and modification associated with development and ranching activities, oil and gas production, and competition with invasive, aggressive grass species.

Recovery Objective: The recovery objectives of the Zapata Bladderpod Recovery Plan (Recovery Plan) are to: (1) Reclassify the species as threatened; and, (2) Identify the information needed to determine delisting criteria in future revisions of the Recovery Plan.

Recovery Criteria: In order to reclassify the species to threatened, 12 self-sustaining populations of Zapata bladderpod must be maintained or established in the United States. Management plans and agreements with private and public landowners must be developed to ensure the protection of these populations. Populations must demonstrate persistence for five years prior to reclassification to threatened status. As delisting criteria are developed during the downlisting period, recovery actions targeted towards full recovery do not need to wait until the monitoring period is complete to begin; in other words, recovery actions can, and should, move forward during the monitoring period.

Major Actions Needed:

1. Protect and manage existing Zapata bladderpod populations and habitat.
2. Search for new populations in the United States and Mexico.
3. Gather biological information necessary for management and develop a monitoring program for populations.
4. Establish and maintain a botanical garden population.
5. Establish new populations as necessary to meet downlisting criteria, through partnerships with local communities and landowners.
6. Develop a public education and awareness program.
7. Develop delisting criteria and revise the Recovery Plan.

Total Estimated Cost of Recovery ($1,000's):

Year	Need 1	Need 2	Need 3	Need 4	Need 5	Need 6	Need 7	Total
2003	40.0	25.0	45.0	12.0	19.0	5.0	0.0[2]	146.0
2004	31.0	25.0	45.0	12.0	19.0	5.0	0.0	137.0
2005	31.0	25.0	40.0	12.0	19.0	5.0	0.0	132.0
2006	1.0	6.0	18.0	0.0	5.0	5.0	0.0	35.0
2007	1.0	6.0	0.0	0.0	5.0	5.0	0.0	17.0
2008	1.0	3.0	0.0	0.0	1.0	5.0	0.0	10.0
2009	1.0	3.0	0.0	0.0	1.0	5.0	0.0	10.0
2010	1.0	3.0	0.0	0.0	1.0	5.0	0.0	10.0
2011	1.0	3.0	0.0	0.0	1.0	5.0	0.0	10.0
2012	1.0	3.0	0.0	0.0	1.0	5.0	0.0	20.0
2013	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
2014	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Total	111.0	99.0	145.0	36.0	77.0	50.0	0.0	518.0

[1] Costs to recover the species to threatened status are provided; complete cost of recovery can not be determined at this time.

[2] Action will not incur costs unless formation of a recovery team is deemed necessary.

Date of Recovery: Time required to reclassify the species as threatened is estimated at 12 years (2015), based on the time it will take to survey habitat for existing populations, collect data, locate appropriate areas for reintroductions, develop management plans, and monitor populations.

PART I - INTRODUCTION

Background

Lesquerella thamnophila (Zapata bladderpod) was listed as endangered on November 22, 1999 (U. S. Fish and Wildlife 1999), with critical habitat designated on December 22, 2000 (U.S. Fish and Wildlife 2000). The critical habitat units include seven sites (National Wildlife Refuge System tracts) on 2,088 hectares (ha) (5,158 acres (ac)) of Lower Rio Grande Valley National Wildlife Refuge property in Starr County, Texas, and a privately owned site (0.55 ha (1.36 ac)) also located in Starr County, Texas.

This species is threatened by habitat modification and destruction due to increased road and highway construction and associated urban development, increased oil and gas activities, alteration and conversion of native plant communities to improved pastures, overgrazing, and vulnerability from low population numbers. The species may have a more extensive range than what is currently known, although there is limited survey access on private land. Little information has been found to support the potential existence of extensive populations in Mexico. One specimen from Tamaulipas, Mexico, has been identified but the site has not been revisited. Historically, *Lesquerella thamnophila* was used for medicinal purposes in Mexico, as well as other *Lesquerella* species (Garcia 1999 pers. comm.). Seven sites are known to still support the plant in South Texas. Populations in Starr County include two sites in the Lower Rio Grande Valley National Wildlife Refuge (LRGV), and two sites on a private land site that are in close proximity to each other. (These may be one or two disjunct populations; until genetic analysis is performed, the site will remain listed as two populations). In Zapata County, three

sites are still known to support the plant. Two are located on highway right-of-ways between the towns of Zapata and Falcon. Another is in a small subdivision near Falcon Lake.

Taxonomy

Lesquerella thamnophila is a member of the Brassicaceae (i.e., Cruciferae or Mustard) Family. This species was first collected by Neally in Starr County between 1882 and 1894. The type (original description) specimen was collected in Zapata County, Texas, by R. C. Rollins in 1959. The species was named *Lesquerella thamnophila* in 1973 by R. C. Rollins and E. A. Shaw in their work on the genus *Lesquerella* (Rollins and Shaw 1973). Collected specimens of *Lesquerella thamnophila* were found in Starr and Zapata Counties in Southern Texas.

Morphology

Lesquerella thamnophila is a pubescent (overlaid with short hairs), somewhat silvery-green, herbaceous perennial plant, with sprawling stems 43 to 85 centimeters (cm) (17 to 34 inches (in)) long. Basal leaves are narrow, 4 to 12 cm (1.5 to 4.8 in) long, and 7 to 15 millimeters (mm) (0.3 to 0.6 in) wide, with entire or slightly-toothed margins. Stem leaves are 3 to 4 cm (1 to 1.5 in) long and 2 to 8 mm (0.1 to 0.3 in) wide, with margins similar to basal leaves. The presence of stellate trichomes (small hair-like structures) on the leaves produce the plant's appearance of a whitish or silvery-green color. The inflorescence (arrangement of flowers on a single stalk) is a loose raceme of bright, yellow-petaled flowers. The flowers appear at different seasons of the year depending upon timing and rainfall, and are arranged along an axis with the lower flowers maturing first. Fruits are round and 4.5 to 6.5 mm (0.2 to

120 0.8 in) in diameter on short, downward curving pedicels (slender stalks) (Poole 1989). Little is
121 known of the population genetics, structure, or dynamics of the species.

122 **Habitat**

123 *Lesquerella thamnophila* can occur on graveled to sandy-loam upland terraces above the
124 Rio Grande flood plain. The known populations are associated with three Eocene-age geologic
125 formations, Jackson, Laredo, and Yegua, which have yielded fossiliferous (containing fossils)
126 and highly calcareous (composed of calcium carbonate) sandstones and clays. Historically,
127 populations of Zapata bladderpod were found within the Jimenez-Quemado soil association in
128 Starr County, and the Zapata-Maverick in Zapata County. According to the U.S. Fish and
129 Wildlife Service's (Service) data, Zapata bladderpod may also occur on Copita-Zapata soils in
130 Zapata County.

131 Presently, known Starr County populations occur within the Jimenez-Quemado soil
132 association and on Catarina series soils. Jimenez-Quemado soils are well-drained, shallow,
133 gravelly to sandy loam underlain by caliche (a hard soil layer cemented by calcium carbonate).
134 This soil association is broad, dissected, irregularly shaped, and occurs on huge terraces 6 to 15
135 m (20 to 50 feet (ft)) above the flood plains of the Rio Grande. In most areas, Jimenez soils
136 occupy the slope breaks extending at the tops of ridges to the bottoms of the slopes, and in the
137 narrow valleys between them. Quemado soils occur as narrow areas on ridge tops, on slopes
138 ranging from 3 to 20 percent. Steep escarpments can be present with rocky outcrops adjacent to
139 the river floodplain. Catarina series soils consist of clayey, saline upland soils developed from
140 calcareous, gypsiferous (containing gypsum), or saline clays. Areas dominated by Catarina

series soils usually contain many drainage and other erosional features. The underlying material contains calcareous concretions (rounded masses of mineral matter), gypsum crystals, and marine shell fragments (Thompson *et al*. 1972).

Known populations of Zapata bladderpod in Zapata County occur within the Zapata-Maverick soil association. Zapata soils are shallow, loamy or mixed, hyperthermic (high temperature), well-drained, and nearly level with undulating slopes ranging from 0 to 18 percent, primarily on uplands occurring over caliche. The upper portion of the soil horizon ranges from 5 to 10 cm (2 to 4 in) thick, with chert gravel and course fragments consisting of up to 25 percent of angular caliche 2.5 to 20 cm (1 to 8 in) long. Maverick soils consist of eroding upland clayey soils occurring over caliche, with underlying calcareous material containing shale and gypsum crystals (Thompson *et al.* 1972). The upper zone consists of well-drained, moderately deep soft shale bedrock, sloping 1 to 10 percent and forming clayey sediments.

Population Biology

Little is known about the population biology of *Lesquerella thamnophila*. The plant grows opportunistically as evidenced by fluctuations in the density of plants, and the size of populations in response to availability of rainfall during the time of year with adequate temperatures for plant growth. Populations can respond dramatically to rainfall events, going from barely detectable to a substantial assemblage of thousands of individuals.

Lesquerella thamnophila occurs as an herbaceous component of an *open Leucophyllum frutescens* (cenizo) shrub community that grades into an *Acacia rigidula* (blackbrush) shrub community. Both plant communities dominate upland habitats on shallow soils near the Rio Grande (Diamond 1990). These shrub lands are sparsely vegetated due to the shallow, fast-

draining, highly erosional soils and semi-arid climate. Other related plant species in the cenizo and blackbrush communities include *Acacia berlandieri* (guajillo), *Prosopis* sp. (mesquite), *Celtis pallida* (granjeno), *Yucca treculeana* (Spanish dagger), *Zizyphus obtusifolia* (lotebush), and *Guaiacum angustifolium* (guayacan).

The Zapata bladderpod may occur within areas devoid of other vegetation, or under canopy of associated shrub species. There is some indication that these brush species may serve as nurse plants that filter sunlight on the soil surface or maintain moisture in the root area. In July of 1999, Service personnel took readings of the filtered sunlight through the canopy where bladderpod plants were present. These readings showed average percentages of canopy shade as 28 percent (with a range of 4 to 72 percent). Another possible theory explaining the bladderpod's occurrence directly adjacent to brush species is protection from erosion around the bladderpod's roots. During a site visit in Starr County, after approximately 4-inches of rain fell, the top portion of root material was exposed on many bladderpod plants that did not occur under the canopy of adjacent brush (Pressly 2002 in litt.). Those plants under the brush canopy still had root systems totally covered by soils. The brush species may counteract the buffeting of rain on the soil, reducing erosion under the protection of the canopy cover.

Distribution and Abundance

Lesquerella thamnophila is currently known to exist at seven accessible sites in Starr and Zapata Counties, within 3.2 kilometers (km) (2 miles (mi)) of the Rio Grande. Historically, biologists located and described a total of 11 populations of *Lesquerella thamnophila*, including the type locality discovered by R. C. Rollins in Zapata County in 1959. Seven of the eleven

populations were found in Starr County and four in Zapata County. Locating Zapata bladderpod populations is difficult due to the cryptic vegetative growth characteristic of the species.

Of the seven historically reported populations in Starr County, four are still known to support *Lesquerella thamnophila* plants in varying numbers. Following substantial rainfall in October 2000, biologists verified previous documentation of Zapata bladderpod plants at the LRGV refuge tract. The site was surveyed again in 2001 and in 2002, and has contained the largest number of plants (of the known populations) with each survey attempt. The second and third populations, which are separated by 0.6-0.8 miles, occur on a private ranch and support the species in small numbers. A new population was found on a LRGV tract in 2002. This population is located on a tract of land that was designated as critical habitat for *Lesquerella thamnophila* in 2000; two populations are now protected on refuge land. The remaining three sites that existed in Starr County have not been surveyed due to in-accessability to the property or insufficient information as to the exact location of the historic population.

In Zapata County three sites are known to support the Zapata bladderpod. During survey work in October of 2000, biologists recorded a small number of plants on the highway right-of-way site near a small subdivision adjacent to Falcon Reservoir. Bladderpod plants were also present within the sub-division site adjacent to the highway. A third site was located on another portion of the highway. In 2001, these three sites again had plants present, although reduced in numbers. The type locality site near the Falcon Lake West Subdivision has not been re-verified and is believed extirpated.

The number of plants at each of the seven existing population sites fluctuate from a few plants to thousands of plants depending on temperature and rainfall (Poole 1989). This perennial plant is a cryptic species and blooms primarily following significant rainfall, creating a short

period in which to survey. These factors contribute to the difficulty of locating the species at documented sites and in surveying for other populations.

Although *Lesquerella thamnophila* has been found primarily in Starr and Zapata Counties, additional populations may exist in Webb County, Texas. Wu and Smeins (1999) developed multiple scale habitat models of rare plants in the region that included physical and chemical properties of soils that were collected at four Zapata bladderpod sites in Starr County. The results of this study indicate that there is potential Zapata bladderpod habitat located north and northwest into Webb County. Surveys have not yet been conducted to determine whether populations exist in Webb County.

Impacts and Threats

The Service (1999) described 4 major threats to the Zapata bladderpod which, when combined, justified listing the species as endangered: (1) Destruction or modification of range through increased urbanization, increase of introduction of non-native pasture grasses, conversion of native rangeland to improved pasture, overgrazing, construction or improvement of highways and utility transmission systems, and oil and gas exploration and production; (2) Disease or predation - Browzing during drought events can appreciably reduce the numbers of Zapata bladderpod. There is evidence of predation on seed material, although predators have not been identified; (3) Genetic variability and viability are decreased through the modification and/or loss of habitat; (4) Inadequacy of existing regulatory mechanisms by Federal and State laws.

Habitat destruction and modification are the primary threats to the species. Specific types of destruction and modification include: habitat loss through the introduction of non-native pasture grasses, conversion of native rangeland to improved pasture, and overgrazing; urban development, such as construction or improvement of highways and utility transmission systems necessary to support urban infrastructures; and oil and gas exploration and production. These types of activities have destroyed or altered more than 95 percent of the native habitat in South Texas (Jahrsdoerfer and Leslie 1988).

Overgrazing by livestock, root-plowing of shrubs, and subsequent planting of non-native grasses for rangeland improvement have eliminated much of the Zapata bladderpod's habitat. Although cattle are not known to graze on the Zapata bladderpod, trampling may cause direct and indirect impacts. Coverage with the aggressively invasive, nonnative grass, *Pennisetum ciliare* (buffelgrass), is extensive at some of the known Zapata bladderpod population sites. *Dichanthium annulatum* (Kleberg bluestem grass), which is used for erosion control on roadway rights-of-way, has also begun to invade natural areas and is present at all *Lesquerella thamnophila* sites, although not as extensively as buffelgrass.

Results from various invasive grass studies indicate that there is shade and root competition between native plants and invasive grasses (Pressly 2002 in litt.) as well as possible allelopathic effects (suppression of growth of one plant species by another due to release of toxic substances) on native forbs and grasses (Nurdin and Fulbright 1990). Where native plants

compete for light, moisture, and/or nutrients, energy is expended to produce vegetative growth for photosynthesis and survival, with consequent decreases in seed production. This decreases the possibility of seedling recruitment and range expansion of the species. Highly invasive species exhibit the ability to create quick monotypic habitats. As natural habitats become increasingly rare, replanting costs for denuded areas become amplified by adding the expense of securing regional native plant species.

Wildlife production for hunting and recreational uses such as bird watching is becoming increasingly important as an economic value to the area. There may be a benefit to *Lesquerella thamnophila* if land converted from livestock pasture to wildlife production includes improvements such as habitat restoration to native plants. Revegetation of native plant species could benefit major game species, including white-tailed deer, quail, mourning dove, turkey, javelina, and feral pig.

Oil and natural gas production has been a significant form of income in the area due to drought-induced decrease in cattle production. Additional seismic operations and the resulting drilling and transport of oil and gas would increase the infrastructure and subsequent roadway construction, electrical services, and associated establishment of urban areas with the increase of utilities.

With the development of import and export exchanges between the United States and Mexico due to the North American Free Trade Act (NAFTA), an increase in number and

expansion of roadways, urbanization, and the infrastructure and facilities necessary to support the development is expected. Two known populations of *Lesquerella thamnophila* occur on State Highway 83, in Zapata County. Potential impacts to the plants at these sites may occur if the roadway is widened from a four-lane undivided roadway. There is also potential for currently unidentified populations to be affected by infrastructure expansion on this highway due to lack of survey information.

Conservation Efforts and Research

Little work has been done on conservation and research efforts for Zapata bladderpod. Conservation measures have included Section 7 Consultation under the Endangered Species Act, re-evaluation of known sites, and surveying for additional populations. The populations that occur on refuge land are under the jurisdiction of the Service, and damage or destruction of this species on Federal land is prohibited. The Texas Parks and Wildlife Department (TPWD) Wildlife Diversity Program conducts multiple surveys for this and other rare plant species especially following measurable rainfall events. Both Service and TPWD personnel assess the known sites several times each year as well as look for additional sites in the known range of the plant. Wu & Smeins (1999) report additional potential habitat based on soil and vegetational characteristics of the known population sites. One population on a highway right-of-way is protected under an informal agreement between TPWD and the Texas Department of

Transportation; the agreement includes mowing at certain times of the year to reduce loss of reproductive organs.

Several informal propagation efforts have been performed on *Lesquerella thamnophila* at the LRGV National Wildlife Refuge in Alamo, Texas, without success. Rigorous, controlled scientific studies are needed in this area. Additional studies are being conducted to determine associated species at the largest known population site in Starr County. Seed collection is ongoing for long-term storage and reintroduction projects. Seed will be held at the San Antonio Botanical Gardens in San Antonio Texas, and the National Seed Storage Lab in Fort Collins, Colorado, under the auspices of the Center for Plant Conservation.

PART II - RECOVERY

Objective and Criteria

The primary objective of this Recovery Plan is to maintain adequate Zapata bladderpod populations within the species' range to ensure that the species is safe from extinction. Zapata bladderpod will be considered for reclassification from endangered to threatened when 12 distinct, self-sustaining populations are maintained in areas of natural habitat where land management is compatible with the needs of the species. Populations should be maintained for five years prior to reclassification to threatened status.

Tasks listed in this Recovery Plan are designed to improve the status of the Zapata bladderpod to a more secure, threatened status, while acquiring the information needed to determine delisting objectives and criteria. Due to the present restricted distribution of the species and the limited understanding of its life history and habitat requirements, it is difficult to predict what measures are needed to fully recover the species. The second objective of the Recovery Plan, therefore, is to recommend actions that will provide information necessary to develop a full recovery strategy and delisting criteria. The Recovery Plan will be revised within five to ten years to incorporate new information and establish specific criteria for delisting and post-delisting monitoring.

The following Criteria should be met in order to reclassify the species to threatened status:

1. *Establish or maintain 12 fully protected, geographically distinct, self-sustaining populations of the Zapata bladderpod within the historical range of the species in the United States. Each population should consist of at least 2,000 reproductive individuals at a size class structure reflecting that plants are reproducing and becoming naturally established within the population. These populations can be composed of smaller subpopulations so that the units function as one large meta-population if habitat availability is limited and fragmented. Distance between (meta) populations should be determined as information on genetics, seed dispersal and pollinators is gathered throughout the recovery process. The number of plants, number of reproductive individuals, and age class structure must be verified through monitoring, including an assessment of the general condition of the habitat. Populations should be maintained for a minimum of 5 years prior to reclassification to threatened status. Reintroductions can occur on Federal land, voluntary State land, or private land that has been voluntarily entered into a stewardship agreement for the Zapata bladderpod by its owners.*

2. *Establish agreements for the protection and management of the 12 self-sustaining populations. While binding agreements are preferable due to the commitment of long-term management continuity, non-binding agreements can contribute to the objectives of this*

Recovery Plan. Protection and management measures for any populations on public land should be fully incorporated into State and Federal management plans.

The recommendation for minimum viable population size for Zapata bladderpod of 2,000 individuals is based on the concept that a minimum viable population (MVP) should maintain enough individuals that there is a 95 percent probability that the population will remain viable over a period of one-hundred years (Mace and Lande 1991). MVP size for the Zapata bladderpod should take into account the life characteristics of the plant, the extent of appropriate habitat, and threats to the species. Characteristics of the plant that should be examined include the life habit, breeding system, growth form, fecundity, ramet production (if any), survivorship, seed duration, environmental variation, and successional status (Pavlik 1996). According to these characterization standards, MVP for the Zapata bladderpod requires a population size of approximately 2,000 individuals. This is based on the perennial nature, possible outcrossing ability, growth form, low fecundity, survivorship, reproduction patterns, seed duration and age when the plant matures, as well as seasonal patterns in relation to rainfall and temperature. Due to the ephemeral nature of the plant in response to measurable rainfall during warm periods, a population size of 2,000 plants is the *minimum* recommendation for population size.

The recommendation to establish or maintain and protect 12 populations is based on available information, taking into consideration the number of known populations (7), the

ephemeral nature of the species (i.e., 12 is deemed appropriate, at a minimum, in order to secure the species, particularly during a time of drought), potential sites for reintroduction (7 or more). Reintroductions can occur on National Wildlife Refuge lands identified as critical habitat (Cuellar, Chapeno, Arroyo Morteros, Las Ruinas, Los Negros, Arroyo Ramirez, and La Puerta National Wildlife Refuge tracts). If, based on information gained during research activities, it is determined that this recommendation needs revision, the Recovery Plan should be updated.

The wording "establish or maintain" in Criteria (1) should be interpreted to mean that the populations (i.e, 12) necessary for reclassifying the species to threatened can include currently existing, newly discovered, or reintroduced populations. Efforts to reintroduce (i.e., "establish") Zapata bladderpod should be pursued as a method to reach reclassification and perform necessary research. It is recommended, however, that survey efforts for the species be intensified concurrently, as populations discovered on Federal, State, or private land that fit the definition of a minimum viable population and can be protected with adequate management and monitoring programs (i.e., "maintain"), can be substituted for reintroduced populations to count towards reclassification. Protecting (and augmenting, if necessary) currently existing and newly discovered populations may decrease the overall financial resources needed to recover the species. The recovery program will greatly benefit from continued and increased collaboration and cooperation between all partners, including private landowners. It is recommended that

populations be maintained for a minimum of five years prior to reclassification to demonstrate persistence.

Reintroductions can take place on Federal, State, or private lands. Seven distinct tracts of Service National Wildlife Refuge land, designated as critical habitat for the species, have the type of soil and habitat necessary for Zapata bladderpod reintroduction (U. S. Fish and Wildlife 2000). These tracts include Cuellular, Chapeno, Arroyo Morteros, Las Ruinas, Los Negros, Arroyo Ramirez, and La Puerta. Other areas with suitable habitat for reintroductions may occur on State or private lands; partnerships and stewardship agreements to reintroduce, manage and protect the species should be pursued with interested parties. To protect the species from smaller-scale catastrophic events (e.g., localized fire), it is recommended that populations be geographically distinct from one another.

Full protection is considered management of the populations on Federal or State lands as part of an approved management plan (e.g., National Wildlife Refuge Comprehensive Conservation Plan), or a formal stewardship agreement for private landowners that includes management and monitoring of the population, habitat, and threats. Management should include measures to lessen or alleviate relevant threats (e.g., habitat modification or loss) to Zapata bladderpod and to measure the species' numbers, habitat quality, and threats.

A full strategy for recovery should be developed based on basic life history of the species, population and community ecology, and an understanding of how to alleviate threats. To make progress toward development of delisting criteria, currently existing, newly discovered, and/or reintroduction sites should also be used for compatible research activities. The research actions listed in the step-down and narrative outlines will be used to determine how many populations are needed for full recovery, how the populations should be distributed, management options for alleviating threats, and other relevant objectives.

Scientific workshops should be held to discuss and resolve information needs for Zapata bladderpod. Genetic data analysis, reintroduction protocol, and research priorities are all topics integral to the development of recommendations for survival and long-term viability of the species. Workshops should include Federal, State, academic, conservation, and other experts as necessary, including binational collaboration with Mexico.

It is unknown to what extent Zapata bladderpod may occur in Mexico. Based on the soil type and general habitat requirements currently documented for the Zapata bladderpod, it is possible that habitat is available in Mexico and that extant populations occur. Formal and informal conservation measures for the species (e.g., a formal Memorandum of Understanding between the United States and Mexico to manage and protect populations, or encouraging

voluntary private lands conservation) should be pursued as part of the long-term conservation strategy for the species, if deemed appropriate based on further clarification of existing habitat.

The time estimated to accomplish these Criteria is twelve years. However, the Recovery Plan should be reevaluated in five to ten years to assess progress on survey projects, research, and reintroductions. The overall management strategy for the species, including the Recovery Plan, should be revised, based on new information, as needed. Delisting criteria should be developed at this time or when the objectives of the Recovery Plan have been met.

Step-down Outline of Recovery Actions

1. Protect known bladderpod populations in the United States.

    1.1 Provide landowners information on the rarity, significance, and threats regarding the Zapata bladderpod population on their property.

    1.2 Work with landowners to develop and implement management for the species.

        1.2.1 Determine landowner short-term and long-term land use goals and compatibility for Zapata bladderpod conservation.

        1.2.2 Develop partnerships with landowners and implement management plans that are beneficial to Zapata bladderpod.

        1.2.3 Develop a monitoring program to be implemented with voluntary landowner assistance.

        1.2.4 Encourage the establishment of stewardship agreements.

    1.3 Enforce applicable laws and regulations.

2. Search for new populations.

3. Conduct studies to gather biological information about Zapata bladderpod that is needed for management and recovery in the wild .

    3.1 Determine specific habitat requirements.

3.1.1 Study soils and underlying geology.

3.1.2 Determine community structure.

3.1.3 Study ecology and dynamic processes of associated community.

3.1.3.1 Study direct and indirect effects of land use practices on Zapata bladderpod and its associated habitat.

3.1.3.2 Study the responses to periodic or cyclic processes such as flooding, fire, and freezing temperatures.

3.1.3.3 Study interactions with other species (beneficial and negative).

3.2 Study population biology.

3.2.1 Conduct a demographic analysis of the populations.

3.2.2 Characterize phenology.

3.2.3 Study pollination biology.

3.2.4 Study seed production and dispersal in the wild.

3.2.5 Study seedling recruitment.

4. Establish a botanical garden population and seed bank.

5. Establish new populations as necessary to meet downlisting criteria.

5.1 Incorporate any reintroduction program plans into applicable agency land management plans.

5.2 Develop a monitoring program to assess reintroduction success.

6. Develop a public information and awareness program.

7. Develop delisting criteria and a post-delisting monitoring plan.

Narrative Outline of Recovery Actions

1. Protect known bladderpod populations in the United States. The known populations of Zapata bladderpod must be protected from habitat destruction or degradation. Relationships with private landowners, soil conservation district agencies, roadway construction agencies, oil and gas exploration/production agencies, and rural development agencies, should be developed to conserve the habitat where bladderpod populations are located.

1.1 Provide landowners information on the rarity, significance, and threats regarding the Zapata bladderpod population on their property. Private landowners in the United States should receive an explanation of the Endangered Species Act protection for plants and an explanation of Federal policies concerning recovery of listed plant species. Work with the government of Mexico (as populations are located) to provide information on the significance of the preservation and natural heritage of the plant so both countries can work collectively with landowners. Landowner cooperation is an

essential requirement for the preservation of currently known and newly discovered populations.

1.2 Work with landowners to develop and implement management for the species. Landowner cooperation and involvement is critical to the survival of Zapata bladderpod and its habitat. Landowners who are interested in surveying for the species on their property and/or implementing management for the species may contact the Service for information: U.S. Fish and Wildlife Service, Corpus Christi Ecological Services, c/o TAMUCC, 6300 Ocean Dr., Box 338, Corpus Christi, Texas 78412. Tel. (361) 994-9005.

1.2.1 Determine landowner short-term and long-term land use goals and the effect of those goals on Zapata bladderpod. It is possible that the areas where Zapata bladderpod generally occurs are under private land grazing regimes. Pasture improvements such as the introduction of non-native forage grasses, mechanical or chemical brush removal, or an increased animal stocking rate could destroy or degrade bladderpod habitat.

1.2.2 Develop partnerships with landowners and implement management plans that are beneficial. It is possible for landowners to indirectly protect and maintain the species through land management that includes

improvements that support hunting and other recreational uses. Long-term management plans that provide optimum conditions for the Zapata bladderpod and its habitat need to be developed. The management plans should include best management plans to incorporate reduction of soil disturbance, grazing management, management of non-native invasive plant species, and monitoring. As information becomes available on the life history, ecology, and population biology of this species, it should be incorporated into the plans.

1.2.3 Develop a monitoring program to be implemented with voluntary landowner assistance. Work with landowners to develop monitoring programs for the Zapata bladderpod. When feasible, monitoring techniques should be standardized so that results between different populations/sites will be comparable. The results from the monitoring program should enable an evaluation of management practices. Factors to be assessed during the monitoring include the general condition of the habitat, reproductive success, and responses to management practices. Monitoring should be conducted at least three times annually during and following flowering and fruiting. Any decline noted in the species' condition during monitoring should be brought to

the attention of the landowners and other parties involved in the species' recovery so that an effective response is possible.

1.2.4 Encourage the establishment of stewardship agreements. Agreements with conservation organizations such as the Nature Conservancy should be established with the landowners. These non-binding agreements help recognize landowners who voluntarily protect sensitive species or ecosystems. Binding management agreements with landowners could provide long-term conservation of the species. One such program, the TPWD's Landowner Incentive Program, pays the landowner to implement and maintain management practices compatible with land use and conservation goals. Other long-term, binding agreements could include conservation easements or the sale or donation of land to a conservation organization. Programs through which these more binding agreements could be funded include the Service's Partners for Wildlife or private lands programs with TPWD.

1.3 Enforce applicable laws and regulations. Federal and State agents should exercise their full authority to protect populations on public and private land. The legal responsibilities of landowners for endangered plants occurring on their land are limited. If the landowners receive Federal funds or authorization for a project on

their land, the Federal action agency providing the funds or authorization must ensure that those activities do not jeopardize the continued existence of the species. Federal agencies must conduct formal section 7 consultations under the Act if an action authorized, funded, or carried out by a Federal agency may adversely affect a threatened or endangered species. Informal consultations with the Service are often undertaken by Federal agencies to assist them with their determination of a project's potential impact. It is a violation of the Act for any person to maliciously damage or destroy an endangered plant in the course of a violation of a state criminal trespass law. Investigators must obtain permission from landowners prior to conducting studies on private land.

2. Search for new populations. Areas of potential habitat for the Zapata bladderpod should be surveyed in the United States and Mexico. There are many areas of native habitat that have not been surveyed for this species due to lack of access on private lands. Additionally, this species is difficult to detect without an intensive search due to its cryptic tendencies during drought conditions. Federal and State agency field personnel and private landowners should be educated about the Zapata bladderpod's appearance, rarity, and threats. Surveys carried out at the most favorable times to find the plants, focusing on associated soil types, are an important component of the recovery strategy.

3. Conduct studies to gather information about Zapata bladderpod that is needed for management and recovery in the wild. Information on the ecology, life history, population biology, and pollination for the Zapata bladderpod in its native habitat is lacking. Efforts to understand and manage the species are therefore currently hindered. Studies conducted to gather basic biological information on the species should focus on factors that will enable a better understanding of habitat and provide insight into effective management for the species. Information obtained from the studies should be incorporated into management plans as appropriate to assist recovery of the species.

3.1 Determine specific habitat requirements. Detailed habitat information will help target survey efforts. This information would also enable the U. S. Fish and Wildlife Service to identify specific locations on Service lands for reintroduction efforts.

3.1.1 Study soils and underlying geology. Soil analysis has been performed (Wu & Smeins 1999) at four Zapata bladderpod population sites in Starr and Zapata counties. Further analysis and sampling efforts will also help in the discovery of other populations within the plant's historic range.

3.1.2 Determine community structure. Only general information regarding the community structure at the sites is known. Specific, detailed, quantitative measurements have not been carried out for the existing populations. The

characterization of the community structure should include associated species, calculations of dominance, density, frequency, constancy, species diversity, age class structure, and spatial patterning of associated thornshrub and the Zapata bladderpod.

3.1.3 Study ecology and dynamic processes of associated community. Little is known about the basic community ecology and dynamic processes that may be critical to the preservation of Zapata bladderpod. Studies are needed to determine the species' response to seasonal and cyclical processes such as rainfall, periodic climatic factors such as flooding and freezing, fire suppression, differing management practices and disturbance (such as grazing, trampling), and interactions with associated species. Successful management and recovery of the species will be dependent on an understanding of the species' habitat, and its' role in the community.

3.1.3.1 Study direct and indirect effects of land use practices on the Zapata bladderpod and its associated habitat. One of the known population sites where the Zapata bladderpod occurs is subject to grazing. Potential direct effects to the species such as alteration of existing vegetation, nutrient cycling alteration, or alteration of the

edaphic (stability and water infiltration ability) characteristics should be investigated.

3.1.3.2 Study the responses to periodic or cyclic processes such as flooding or freezing. Little is known about the response of the Zapata bladderpod to seasonal events such as flooding or freezing. The effect of periodic freezes on Zapata bladderpod is unknown, although based on the perennial lifestyle and deep tap root the species exhibits, it is probably capable of withstanding freezing temperatures. Surveys after strong rain events indicate that the upper portion of the soils in this area are prone to erosion, which in turn may affect the survival of the plant by exposing the root structures. This type of information may be helpful when determining specific reintroduction sites.

3.1.3.3 Study interactions with other species (beneficial and negative). Interaction studies between Zapata bladderpod and associated species need to be conducted. Although plants are sometimes found in the open, most individuals are located within the protection and semi-shade of open, scattered thornshrub. The

extent to which other plants may act as "nurse plants" providing shelter from predation, shading (with the resultant tempered microclimate), more favorable microclimate for seedling germination and establishment, higher nutrient levels or other favorable edaphic factors warrants investigation (Barbour et al. 1979, Nabhan 1987). The degree of fidelity of Zapata bladderpod with other species is not known.

The Zapata bladderpod is vulnerable to increased competition from invasive, non-native forage grasses such as buffelgrass. This grass is commonly introduced for cattle forage following range improvement practices such as root-plowing and brush removal. Buffelgrass can displace native vegetation, possibly creating changes in the habitat through allelopathic or direct soil and nutrient competition that prevent re-establishment of other species.

Although cattle are not known to graze on Zapata bladderpod, grazing and trampling may cause direct and indirect impacts to the species through: direct damage from trampling on

individuals; alteration of vegetation composition and structure; change in soil and water resource distribution as a result of long-term grazing in an arid environment; introduction of non-native species; disruption of nutrient cycling through damage to the thin microbiotic crust over the soil; and edaphic macrohabitat changes such as soil compaction/erosion, decreased water infiltration ability, and the reduction of soil litter (Schlesigner et al. 1990, Fleischner 1994). Small exclosure studies may provide some insight. No specific predators or pests have been identified for Zapata bladderpod, however entrance and exit cavities have been seen in the pods, which could affect seed production.

3.2 Study population biology. Little is known about the status of Zapata bladderpod in terms of population stability over time, demographic trends, genetic viability and variation within and between populations (intra- and inter-population), phenology (relationship of climate and seasonality to plant life cycle stages), and the reproductive biology of the species in the wild. This information is critical to an understanding of the species that would allow effective management for the maintenance and establishment of populations.

3.2.1 Conduct a demographic analysis of the populations. Little is known of the demographics of the Zapata bladderpod populations. The largest site occurs on the refuge tract where numbers of plants found within different surveying efforts ranged from few to thousands. Studies on the natural population variation, age class distribution, survivorship, resource allocation patterns, and the spatial relationships of the Zapata bladderpod to associated species are necessary to evaluate critical life stages and vulnerability to threats.

3.2.2 Characterize phenology. The relationship of climate and seasonality on the Zapata bladderpod life cycle in the wild needs investigation. Phenological observations during growing and dormant seasons are needed to assess the species' response to varied climatic conditions. Observations at each visit should note present and recent climatic conditions at the time so that climatic data can be correlated with life cycle stages. This information would be necessary to determine management strategies to address vulnerable life stages and favorable times for establishment of individuals.

3.2.3 Study pollination biology. There is little data to suggest that Zapata bladderpod reproduces vegetatively based on the long tap root that it exhibits. It is more likely that the plant reproduces strictly sexually through

outcrossing; therefore, understanding the pollination biology of this species is critical to the establishment and maintenance of populations. The bright yellow flower would likely attract pollinators; however, none have been observed at any of the locations. Identification of pollinators would be of value for management of the species and an evaluation of pesticide threats to pollinators.

3.2.4 Study seed production and dispersal in the wild. Seed production and dispersal mechanisms in the wild are poorly understood. Observations are that some mature fruits dehisce while still attached to the plant, and others drop to the soil. It is likely that rain carries the seed to establishment sites. This type of information from plants in the wild could prove invaluable in determining recruitment potential and long-term survivability for the species.

3.2.5 Study seedling recruitment. Seedlings have been observed in the wild although there is little known about the conditions necessary for seedling growth. Studies are needed to determine optimum conditions for seedling establishment and growth, effects of disease and predation on seed production, and habitat factors that may be limiting seed production and

seedling establishment. This information is vital for creating reintroduction sites within the species' range.

4. Establish a botanical garden population and seed bank. Specimens from the known population(s) should be maintained at different institutions. A seed bank should be established for the species and maintained at the National Seed Storage Laboratory in Fort Collins, Colorado. The San Antonio, Texas Botanical Garden has indicated an interest in working with the bladderpod to research propagation techniques and seedling production, and to establish an educational botanical garden population. At least two refugia collections and seed bank reserves should be established and maintained to provide assurance against extinction if a loss of the natural population should occur. Cultivated plants could provide individuals for research efforts and as a plant source for possible reintroductions. Genetic guidelines should be developed for replication of newly located populations.

5. Establish new populations as necessary to meet downlisting criteria. Due to the apparent rarity of the Zapata bladderpod within its range, reintroductions of the species may be necessary to aid recovery. The Service defines reintroduction as placing species in the general range where they occurred historically. As some of the collection data for this species is somewhat ambiguous, any reintroduction will need to be undertaken in areas of appropriate habitat within the historic range of the species. Reintroduction efforts could be

implemented on Federal lands such as those within the Lower Rio Grande Valley National Wildlife Refuge Complex or on State or private lands volunteered for use. Any reintroduction efforts will follow Service policy on controlled propagation of endangered and threatened species, and incorporate the most recent reintroduction guidelines available (Falk, Millar, Olwell, eds. 1996).

5.1 Incorporate any reintroduction program plans into applicable agency land management plans. Federal lands occurring within the historic range of the Zapata bladderpod primarily consist of sites under the management of the Lower Rio Grande Valley National Wildlife Refuge system; reintroduction programs for the Zapata bladderpod could be incorporated into ongoing habitat restoration projects and land protection plans. State or private lands volunteered for use should also be considered for reintroduction programs for the Zapata bladderpod within the known range.

5.2 Develop a monitoring program to assess reintroduction success. Reintroduction success can only be assessed through the development and implementation of a long-term monitoring program. A monitoring program may reveal information needs, management strategies, or a need for different approaches to reintroduction. Monitoring procedures for assessing reintroduction success should be the same as those implemented for the natural population so that comparisons between

688 populations can be verifiable and valid. The monitoring program should be
689 incorporated into the management plans as procedures are developed.

690 6. Develop a public information and awareness program. Public awareness and cooperation are
691 essential for the success of the Zapata bladderpod recovery program. An informative
692 program about the Zapata bladderpod, threats to the species, the Recovery Plan, and the
693 Endangered Species Act in general, should be developed for presentation to private
694 landowners, agency personnel, and other interested groups. The program should include the
695 identification of recovery tasks that the individuals or groups being addressed can
696 accomplish to participate in recovery of the species. Additionally, information on the Zapata
697 bladderpod should be included within any Lower Rio Grande or Mexico/United States Bi-
698 national Ecosystem program so that a coordinated approach to recovery can be implemented.
699 7. Develop delisting criteria and a post-recovery monitoring plan. Following the
700 accomplishment of the objectives of this plan (particularly information needs), delisting
701 criteria and a post-delisting monitoring plan will be developed. The post-delisting
702 monitoring must be conducted for a minimum of five years as required by the Endangered
703 Species Act. All information needs for Zapata bladderpod that have been determined as
704 critical during the course of recovery-oriented research must be evaluated prior to delisting.

If at any time the downlisting criteria are no longer being maintained, the species should be returned to the status of endangered.

Minimization of Threats to the Zapata bladderpod Through Implementation of Recovery Actions

The final rule listing the Zapata bladderpod as endangered under the Endangered Species Act evaluated threats to the species in terms of the five ESA listing factors. Implementation of the recovery actions recommended in the Recovery Plan would minimize these threats as follows:

Listing Factor A: The present or threatened destruction, modification, or curtailment of its habitat or range. These threats include the introduction of non-native pasture grasses, such as buffelgrass, and conversion of native rangeland to improved pasture, overgrazing, construction or improvement of highways and utility transmission systems necessary to support urban infrastructures, and oil and gas exploration and production. Implementation of recovery actions 1.1, 1.1.1, 1.2.1, 1.2.2, 1.2.3, 1.2.4, 1.3, 2.1.3. 1, 3, and 6, will help to protect the Zapata bladderpod's habitat by: (a) Providing landowners and land managers information on the significance, rarity and threats facing the Zapata bladderpod; (b) Encouraging establishment of

721 Stewardship Agreements; c) Determining short-term and long-term land use goals; (d)
722 Developing management and monitoring plans with willing landowners and land managers; (e)
723 Encouraging stewardship agreements; (f) Studying effects of land use patterns on the
724 bladderpod's associated habitat; (g) Searching for additional populations on private, State and
725 Federal lands, as well in Mexico; (h) Establishing new populations on private, state, and federal
726 lands; (i) Promoting conservation of the species in Mexico; (j) Developing public awareness
727 through outreach efforts to protect both the Zapata bladderpod populations and its associated
728 habitat.

729 Listing Factor B: Overutilization for commercial, recreational, scientific, or educational
730 purposes. Although reported to have medicinal values, the species is not known to be a product
731 in commercial trade. Implementation of recovery action 6 will help inform scientific agencies or
732 any interested party of the importance of protecting this rare species.

733 Listing Factor C: Disease or predation. Current populations of Zapata bladderpod have
734 shown no evidence of disease. Biologists surveying the sites owned and protected by the LRGV
735 National Wildlife Refuge found evidence of browsing by native animal species on the plants.
736 While consumption by herbivores is a natural event, browsing can be a greater threat during
737 drought conditions when range quality is reduced and other forage species have been reduced or
738 removed. The small number of Zapata bladderpod populations that currently exist may increase

the overall susceptibility of the species to browsing (or any threat) than likely was present when populations were at historical levels. Plants in this portion of south Texas are sensitive to browsing during drought conditions due to the semi-arid environment and the sparseness of vegetation, even under ideal range conditions. Biologists have also discovered evidence of predation on seed material of Zapata bladderpod during surveys. Implementation of recovery actions 1.1, 1.1.1, 1.2.1, 1.2.3, 2.1.1, 2.1.2, 2.1.3.1, 2.1.3.2, 2.1.3.3,3, 4, and 5, will provide landowners information on protection and stewardship for populations that may be under stress by natural or manmade causes. Determining the effects of non-native plants on the Zapata bladderpod will help to formulate management for the species, as well as other native plants and animals. Research on drought conditions, freezing, flooding, and/or fire suppression should enhance our knowledge of natural and non-natural events, and management responses to them. Reintroduction with willing landowners will help augment current populations, as well as offering additional sites for research.

Listing Factor D. Inadequacy of existing regulatory mechanisms by Federal and State laws. Protection of the Zapata bladderpod under the Endangered Species Act provides mechanisms to recover the species. Other regulatory mechanisms identified herein to recover the Zapata bladderpod are described in recovery action 1.3. Recovery action 1.3 will continue the ongoing efforts of Section 7 Consultation, whereby Federal agencies are required to consult

with the Service on projects that they fund, authorize, or permit that may impact listed species. Recovery implementation actions 1.2, 2, 3, 4, and 5 will contribute to the species' recovery by increasing the interests of non-governmental organizations, Federal and State agencies, and academics, in searching for populations, performing research activities, establishing seed banking projects, and undertaking reintroduction projects.

Listing Factor E. Other Natural or Manmade Factors Affecting its Continued Existence. In the final listing of the Zapata bladderpod, only two sites were known to occur that had viable populations. Two other populations occurred on roadway rights-of-way in limited numbers. Zapata bladderpod populations adjacent to maintained highway rights-of-way are exposed to herbicides used to control vegetation around bridges, guardrails, signs, and reflector posts. Plants near roadways are subjected to herbicides, and maintenance practices such as blading, disking, and re-seeding with erosion control seed mixtures that may contain non-native invasive grasses. Only seven populations of Zapata bladderpod are known to exist, and these have widely fluctuating numbers of plants. Loss of individuals within a population can result in genetic drift which can restrict genetic variability, thereby reducing the species' ability to overcome environmental stresses, especially in drought years. The extreme rarity of the species makes populations vulnerable to extirpation and extinction from the variety of random environmental events, as well as human exploitation of its habitat. Implementation of recovery actions 1.1,

775 1.2.2, 1.3, 2.1, 3.3, 4, and 6 will help to achieve recovery by providing assistance to landowners
776 and land management agencies to encourage conservation practices where known populations
777 occur. The section 7 ESA process will help conserve populations that may be affected with
778 proposed projects that are permitted, funded or otherwise carried out by a Federal agency.

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III - IMPLEMENTATION SCHEDULE

The following Implementation Schedule outlines actions and costs for the Zapata bladderpod recovery program. It is a guide for meeting the objectives elaborated in Part II of the Recovery Plan. This schedule specifies task priorities, task numbers, task descriptions, duration of tasks, responsible agencies, and estimated costs. It should be noted that the estimated costs for all parties involved in recovery are identified for the first three years only, and therefore do not reflect total recovery costs. An estimate of total costs to reach the goal of the Recovery Plan is shown in the "Executive Summary" on page vi. The costs estimated are intended to assist in planning. The Recovery Plan does not obligate any involved agency to expend the estimated funds. Although collaboration with private landowners is recommended in the Recovery Plan, private landowners are also not obligated to expend any funds.

Task Priorities

Priority 1 - An action that must be taken to prevent extinction or to prevent the species from declining irreversibly in the foreseeable future. Priority 2 - An action that must be taken to prevent a significant decline in species population/habitat quality, or some other significant negative impact short of extinction. Priority 3 - All other actions necessary to meet the recovery objectives.

Implementation Schedule Acronyms

CPC - Center for Plant Conservation

EPA - Environmental Protection Agency

ES - Ecological Services, U. S. Fish and Wildlife Service

LRGV NWR - Lower Rio Grande Valley National Wildlife Refuge

SABG - San Antonio Botanical Gardens

TAMUK - Texas A & M University - Kingsville

TNC- The Nature Conservancy

TPWD - Texas Parks and Wildlife

TX DOT - Texas Department of Transportation

US DOT - U. S. Department of Transportation

UT-PanAM - University of Texas PanAmerican

RECOVERY PLAN IMPLEMENTATION SCHEDULE

PRIORITY #	TASK #	TASK DESCRIPTION	TASK TERM (YEARS)	POTENTIAL PARTNERS FWS/REGION 2 PROGRAM / OTHER	COST ESTIMATES ($1000s)			COMMENTS
					YEAR 1	YEAR 2	YEAR 3	
1	1.1	Provide landowners information on the rarity, significance, and threats	1	ES / TPWD / LRGV NWR	5.0	5.0	5.0	Protection of existing populations is crucial to the species' survival.
2	1.1.1	Encourage establishment of Stewardship agreements	5	ES / TPWD	6.0	3.0	3.0	Years 4 and 5 Two Thousand
2	1.2.1	Determine landowner short-term and long-term land use goals	3	ES / TNC	3.0 / 2.0	3.0 / 1.0	3.0 / 1.0	
1	1.2.2	Develop and implement management plans for known sites	5	ES	10.0	5.0	5.0	Years 4 and 5 Five Thousand. See comment 1.1.
1	1.2.3	Develop monitoring program with voluntary landowner assistance	5	ES / TPWD	3.0 / 3.0	3.0 / 3.0	3.0 / 3.0	Years 4 and 5 $3,000. See comment 1.1.

PRIORITY #	TASK #	TASK DESCRIPTION	TASK TERM (YEARS)	POTENTIAL PARTNERS FWS/REGION 2 PROGRAM / OTHER	COST ESTIMATES ($1000s)			COMMENTS
					YEAR 1	YEAR 2	YEAR 3	
1	1.3	Enforce applicable laws and regulations	ongoing	ES / TPWD / LRGV NWR/US DOT/TX DOT	2.0	2.0	2.0	See comment 1.1.
1	2	Search for new populations	ongoing	ES / TPWD UT-PanAm / LRGV NWR	10.0 / 10.0 5.0	10.0 / 10.0 5.0	10.0 / 10.0 5.0	Surveys should be conducted as needed until recovery is achieved
3	3.1.1	Study soils and underlying geology	2	ES / TAMUK	2.0	2.0	2.0	
2	3.1.2	Determine community structure	3	ES / LRGV NWR	5.0	5.0	5.0	Necessary for surveying and re-introduction efforts
1	3.1.3.1	Study effects of land use practices on Zapata bladderpod and its associated habitat	5	ES	5.0	5.0	5.0	Years 4 and 5 $2,000. See comment 1.1.

PRIORITY #	TASK #	TASK DESCRIPTION	TASK TERM (YEARS)	POTENTIAL PARTNERS FWS/REGION 2 PROGRAM / OTHER	COST ESTIMATES ($1000s)			COMMENTS
					YEAR 1	YEAR 2	YEAR 3	
3	3.1.3.2	Study response to periodic or cyclic processes such as flooding, fire, and freezing temperatures	3	ES / LRGV NWR	2.0	2.0	2.0	Years 4 and 5 $2,000.
2	3.1.3.3	Study interactions with associated species	5	ES / LRGV NWR	3.0	3.0	3.0	Years 4 and 5 $2,000.
1	3.2.1	Conduct a demographic analysis of the populations	3	ES / LRGV NWR	10.0	10.0	10.0	Necessary for conducting surveys and re-introduction efforts
2	3.2.2	Characterize phenology	5	ES / LRGV NWR	5.0	5.0	5.0	Years 4 and 5 $3,000.
2	3.2.3	Study pollination biology	3	ES / LRGV NWR / EPA	3.0	3.0	3.0	Years 4 and 5 $3,000.
2	3.2.4	Study seed production and dispersal in the wild	5	ES / LRGV NWR	5.0	5.0	5.0	Years 4 and 5 $3,000.

PRIORITY #	TASK #	TASK DESCRIPTION	TASK TERM (YEARS)	POTENTIAL PARTNERS FWS/REGION 2 PROGRAM / OTHER	COST ESTIMATES ($1000s)			COMMENTS
					YEAR 1	YEAR 2	YEAR 3	
2	3.2.5	Study seedling recruitment	5	ES / LRGV NWR	5.0	5.0	5.0	Years 4 and 5 $3,000.
1	4	Establish a botanical garden population and seed bank	ongoing	ES - CPC SABG	4.0 4.0 4.0	4.0 4.0 4.0	4.0 4.0 4.0	Necessary to ensure survival of the species due to unprotected status of existing populations.
3	5	Establish new populations as necessary to achieve recovery	5	ES / TNC / LRGV NWR	10.0 / 5.0	10.0 / 5.0	10.0 / 5.0	Years 4 and 5 $5,000.
3	6	Develop a public information and awareness program	5	ES / TPWD / LRGV NWR	2.0 / 2.0	2.0 / 2.0	2.0 / 2.0	Years 4 and 5 $2,000 / $2,000.
3	7	Develop delisting criteria and a post-delisting monitoring plan.		ES / TPWD / LRGV NWR	–	–	–	No costs associated, unless it is determined that a recovery team should be convened.