Rio Grande Wild and Scenic River
Texas

National Park Service
U.S. Department of the Interior

Dear Friends of the Rio Grande Wild and Scenic River,

What comes to mind when you think about the Rio Grande Wild and Scenic River? An untamed river flowing though spectacular narrow canyons? A boating experience that alternates between quiet floating and exciting rapids? A place of scenic riverside hikes through intriguing desert landscapes? A setting that compels us to learn about the abundant diversity of fragile ecosystems or to better understand the history of those who lived on this land before us?

The Rio Grande Wild and Scenic River is all of this and much more. To help us protect this river for the benefit and enjoyment of future generations, we have contemplated what makes the river truly outstandingly remarkable.

Based on the hard work of National Park Service staff and partners, I am pleased to present to you the outstandingly remarkable values of the Rio Grande Wild and Scenic River. The statements that follow were developed to provide a strong foundation for future management and protection of this nationally significant river and to help us focus our daily attention on the river's most important aspects.

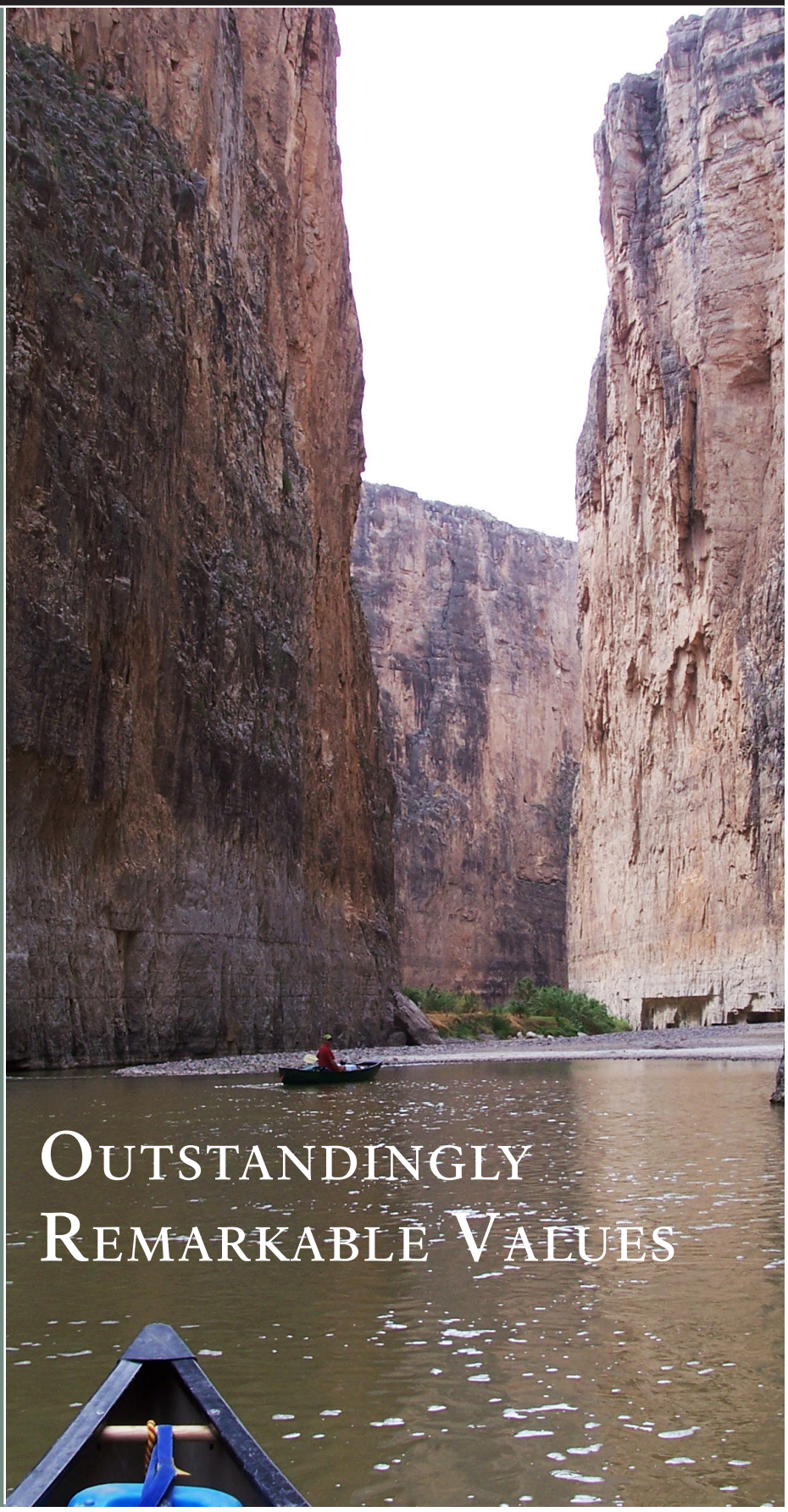
I urge you to read these statements about what makes the Rio Grande so outstandingly remarkable. Thank you for your interest.

Sincerely,

William E. Wellman

Superintendent,

Big Bend National Park and Rio Grande Wild and Scenic River



Outstandingly Remarkable Values

The designated wild and scenic river portion of the Rio Grande begins in Big Bend National Park, opposite the boundary between the Mexican states of Chihuahua and Coahuila. It then flows through Mariscal and Boquillas canyons. Downstream from the park, it extends along the state-managed Black Gap Wildlife Management Area and several parcels of private land in the Lower Canyons. The wild and scenic river segment ends at the county line between Terrell and Val Verde counties, Texas. The river is divided into eleven segments, the first two of which are recommended for wild and scenic river designation.

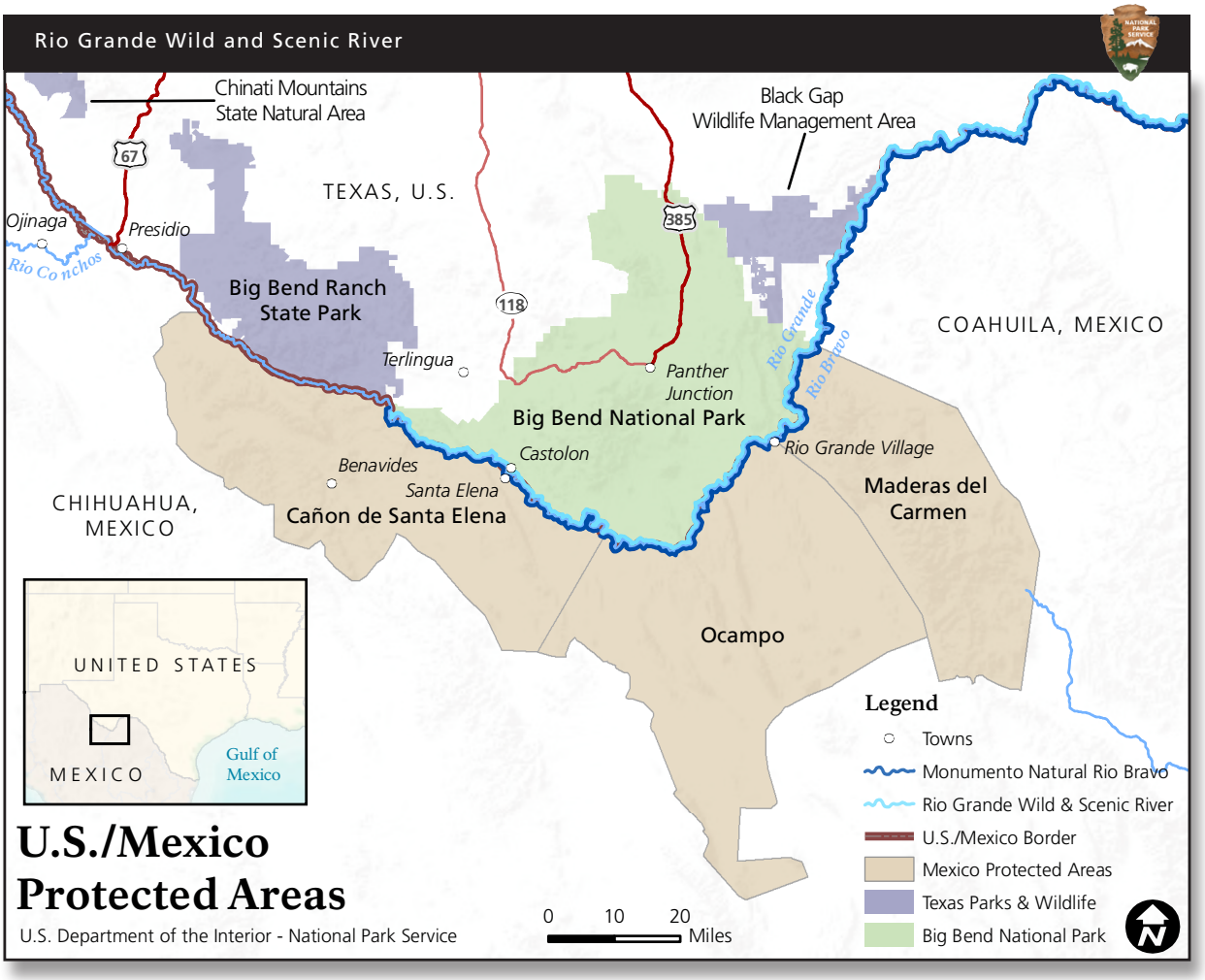
Segment 9A:	Western boundary of Big Bend N.P. to the mouth of Santa Elena Canyon (Proposed)
Segment 9B:	From the mouth of Santa Elena Canyon to the Chihuahua/ Coahuila state line (Proposed)
Segment 1:	From the Chihuahua-Coahuila state line to Talley
Segment 2:	Talley to Solis
Segment 3:	Solis to the entrance of Boquillas Canyon
Segment 4:	Entrance of Boquillas Canyon to exit from Boquillas Canyon
Segment 5:	Boquillas Canyon to Reagan Canyon
Segment 6:	Reagan Canyon to San Francisco Canyon
Segment 7:	San Francisco Canyon to just above Dryden Crossing takeout
Segment 8:	Dryden Crossing to Terrell-Val Verde County line

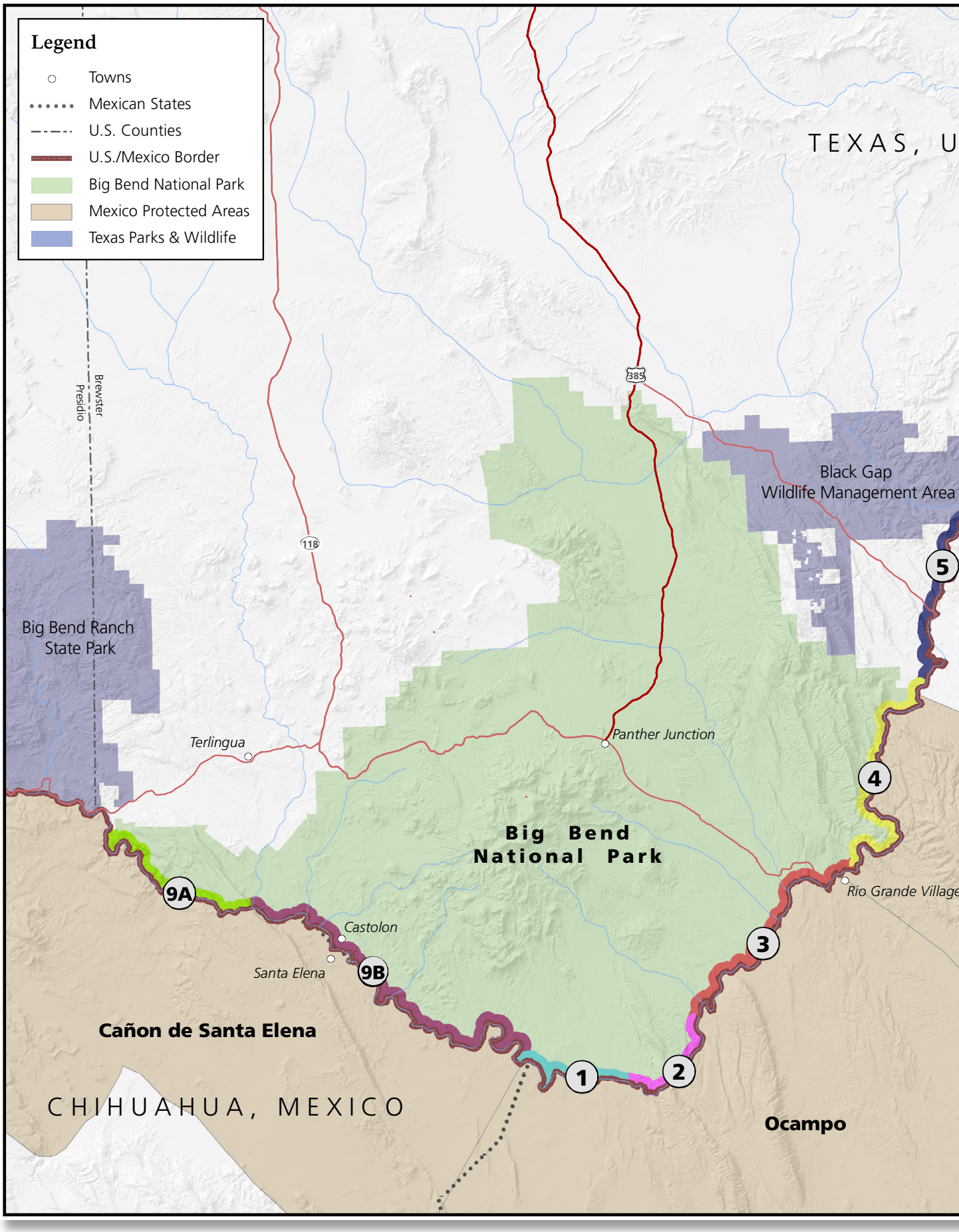
The foundation for wild and scenic river management is a clearly defined set of outstandingly remarkable values. During a workshop held at Big Bend National Park in July 2011, criteria were used to draft a set of ORV statements for the Rio Grande Wild and Scenic River. These criteria are based on the Interagency Wild and Scenic Rivers Coordinating Council guidance for determining ORVs, which states:

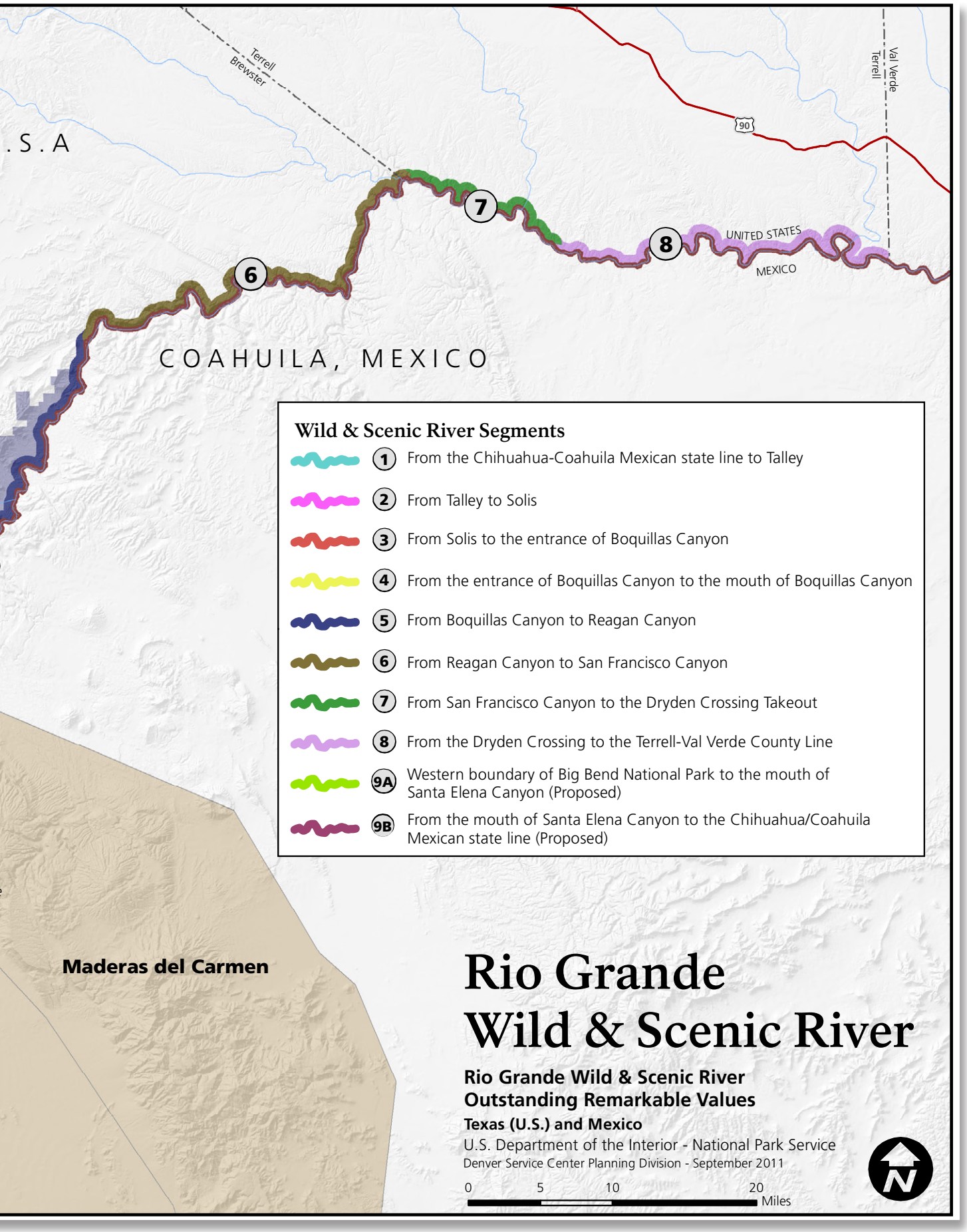
- An ORV must be river related or dependent. This means that a value must:
    - Be located in the river or on its immediate shorelands (generally within 0.25 mile on either side of the river);
    - Contribute substantially to the functioning of the river ecosystem; and/or
    - Owe its location or existence to the presence of the river.
- An ORV must be rare, unique, or exemplary at a comparative regional or national scale. Such a value would be one that is a conspicuous example from among a number of similar values that are themselves uncommon or extraordinary.

The results of the workshop concluded that the Rio Grande Wild and Scenic River contains the following set of outstandingly remarkable values: scenic, geological, cultural, recreational, and biological. A set of broad statements has been developed that articulates each ORV for the entire Rio Grande Wild and Scenic River (including the two proposed segments). An evaluation process for each ORV was used to determine which river segments contain the different ORVs. The results of this evaluation were used to develop ORV sub-statements for those river segments, which provide evidence and support for the broader ORV statements. The following matrix summarizes the evaluation results and provides an organization to the ORV statements and sub-statements that follow.

River Segment	ORV Category				
	Scenic	Geological	Cultural	Recreation	Biological
Segment 9A	●	●		●	●
Segment 9B	●		●		●
Segment 1			●		●
Segment 2	●	●		●	●
Segment 3	●		●	●	●
Segment 4	●	●		●	●
Segment 5	●	●		●	●
Segment 6	●	●		●	●
Segment 7	●			●	●
Segment 8	●			●	●




Legend
Towns
Mexican States
U.S. Counties
U.S./Mexico Border
Big Bend National Park
Mexico Protected Areas
Texas Parks & Wildlife
TEXAS, U
Brewster
Presidio
385
118
Black Gap
Wildlife Management Area
Big Bend Ranch
State Park
Terlingua
Panther Junction
Big Bend
National Park
Rio Grande Village
Castolon
Santa Elena
Cañon de Santa Elena
CHIHUAHUA, MEXICO
Ocampo
5
4
3
2
1
9A
9B


Terrell
Brewster
Terrell
Val Verde
90
7
8
6
UNITED STATES
MEXICO
COAHUILA, MEXICO
Wild & Scenic River Segments
1 From the Chihuahua-Coahuila Mexican state line to Talley
2 From Talley to Solis
3 From Solis to the entrance of Boquillas Canyon
4 From the entrance of Boquillas Canyon to the mouth of Boquillas Canyon
5 From Boquillas Canyon to Reagan Canyon
6 From Reagan Canyon to San Francisco Canyon
7 From San Francisco Canyon to the Dryden Crossing Takeout
8 From the Dryden Crossing to the Terrell-Val Verde County Line
9A Western boundary of Big Bend National Park to the mouth of Santa Elena Canyon (Proposed)
9B From the mouth of Santa Elena Canyon to the Chihuahua/Coahuila Mexican state line (Proposed)
Maderas del Carmen
Rio Grande
Wild & Scenic River
Rio Grande Wild & Scenic River
Outstanding Remarkable Values
Texas (U.S.) and Mexico
U.S. Department of the Interior - National Park Service
Denver Service Center Planning Division - September 2011
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Scenic Values

The Rio Grande and its tributaries are set within one of the most dramatic and storied landscapes in the West—from stunning narrow and deep canyons, verdant riparian vegetation, striking cliffs, to long and unobstructed views. Sheer cliffs define the landscape where exceptionally rugged canyons meet the sky with unparalleled beauty and the unsurpassed ability to inspire and impress. Remarkable exposures of geologic processes are on display throughout the river course as Cretaceous features express themselves as uplifts, faults, rapids, and spectacular formations. The dynamic history and culture of the region also becomes apparent as ruins and evidence of those who came before dot the landscape. The Rio Grande can be enjoyed throughout all four seasons. Each season brings distinct, different, and dramatic combinations of weather, light, and water to the area. Exceptionally clear, dark night skies can be enjoyed all year.

Segment 9A

From the park entrance to the exit of Santa Elena, the river lures you downriver; first through a most scenic canyon landscape where overlooks abound and trails at Metates and Entrance camps allow for hikes to rim top views of the river. The second part of this reach displays the breathtakingly sheer Santa Elena Canyon, which rises 1,500 feet above the river. Here, the massive limestone canyon rises suddenly as a textbook example of the park's fault block formations and is a clear testament to the erosional power of the river. Once in Santa Elena Canyon, the river runner is greeted by the sounds of the approaching Rockslide Rapid, a labyrinth of house-sized boulders that can challenge even seasoned paddlers.

Segment 9B

Although this segment lacks deep, narrow canyons, it contains outstandingly remarkable scenic values in the form of long unobstructed views, which present optimal night-sky viewing. It is dominated by the subtle beauty of the open desert, and has a few outstanding geologic features, such as the Black Dike. Several elevated landforms provide expansive views of the Chisos Mountains, the river, and the expansive desert sky, all in one grand vista. These include Santa Elena Canyon Overlook, the La Coyota Historic Site, the old Rio Vista site downstream of Castolon Historic District, as well as numerous others downstream. The beauty of the area could not have been lost on the early settlers who lived in this reach along the river. Historic features abound along this segment, including former military encampments at Castolon and Johnson Ranch, existing structures at the Camp Castolon Cavalry Post, a custom's house, Magdalena House, a cotton gin engine at Castolon, 19th and 20th century floodplain farming structures such as Dorgan House at the Sublett Farm Historic District, the Castolon Historic District, and Johnson Ranch.

Segment 1

This segment does not contain all of the scenic values that are found in other segments. It lacks canyon topography and named geologic features. It does include dramatic views of the Chisos Mountains and surrounding open desert. Historic ruins are visible from the

river at Woodson's and Pettit's camps. It does not contain outstandingly remarkable scenic values.

Segment 2

Mariscal is the most remote canyon in Big Bend National Park. It is in this reach that the Rio Grande makes the bend that gives the whole region its name. The river here has cut through more than 1,400 feet of cretaceous limestone exposing some of the most interesting and complex geologic features in the area. One of the features is the Tight Squeeze Rapid where fallen limestone blocks have forced the river through a gap of just a few feet. This reach can also be accessed by the Mariscal Canyon Rim Trail, which imparts spectacular views of the canyon and surrounding desert.

Segment 3

This segment includes the scenic Hot Springs and San Vicente canyons. Dramatic views into the canyons can be found along a number of trails and overlooks, including Hot Springs Canyon, Rio Grande Village Nature Trail, Boquillas Canyon Trail, and other overlooks along the Boquillas Canyon Road—all of which provide exceptional views of the river and surrounding area. The river reach also provides dramatic views of geologic formations and grand vistas of the Sierra del Carmen, including El Pico. Unique views of historic ruins and structures, such as Solis Farm, Hot Springs Historic Site, Daniels Ranch, Barker Lodge, and the picturesque village of Boquillas can also be found along this stretch of the Rio Grande.

Segment 4

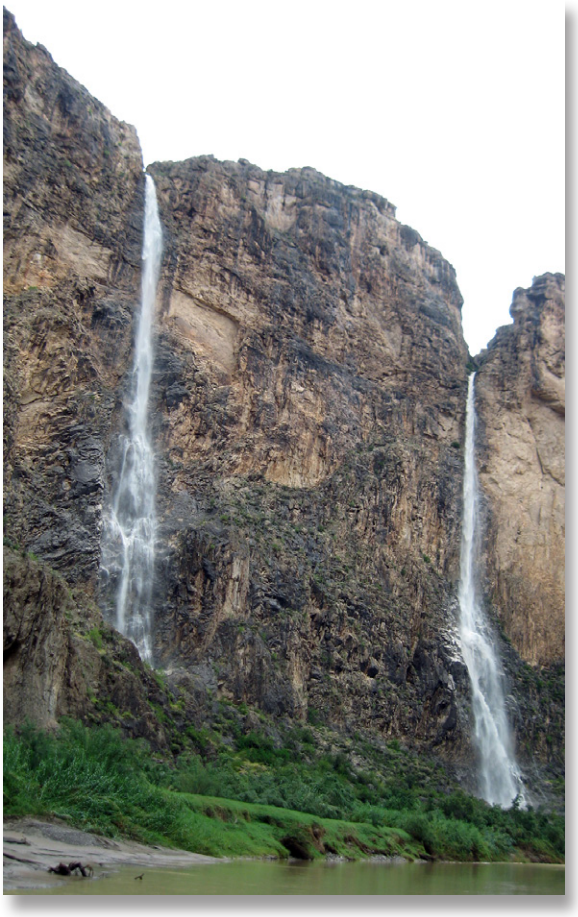
The cliffs forming Boquillas Canyon rise up to form a very dramatic entrance. Once inside, the visitor realizes that Boquillas is a canyon of caves and pouroffs, highly sculpted by the forces of wind and water to create a masterpiece among western canyons. Several large side canyons meet the river in this reach as does the Marufo Vega Trail system, which makes for excellent hiking and overlooks. The river is calm here with only a few minor rapids.

Segment 5

The Black Gap segment begins in beautiful canyon country defined by the weathered formations of Temple Canyon. Several locations along this reach provide outstanding overlooks, including Big Canyon, which is a side canyon along the Rio Grande. More than any other group of springs along the river, the ones here significantly increase the flow and water quality of the river. The geology is best defined by the unique and impressive spires of Temple Canyon and the buttes of Outlaw Flats. This reach exposes the longest and most accessible geologic record. This segment also contains ruins and remnants of the Candelilla Wax Works, which can be viewed from the river.

Segment 6

Reagan Canyon is considered the gateway to this alluring Lower Canyons section of the Rio Grande. This segment is the very embodiment of wild and scenic. Here, the canyon walls soar over 1,000 feet from the river; the canyon



rim is broken only by the equally impressive side canyons such as San Rosendo, Tule, and Panther, which open into the river corridor. It is at the confluence of the river and the side canyon where the most challenging and beautiful rapids are created. Other geologic forces such as the contorted strata of Bullis Fold, numerous gushing springs, and mesmerizing rock formations are all present in this reach. Here too, evidence of the tenacious will of man can be witnessed at the Asa Jones Waterworks, where the historic pump house is perched 200 feet up a sheer cliff. Spectacular views await paddlers around every bend in the river and high overlooks are numerous with the most impressive being the top of Burro Bluff.

Segment 7

This segment is the last of the Lower Canyons and begins with the spectacular San Francisco Canyon and Rapid. From this point down to Dryden Crossing, the canyon rim is closer to the river, revealing the beautifully sculpted Del Carmen and Santa Elena formations. Caves, rock shelters, and narrow side canyons come together to make this one of the most interesting reaches. Lower canyon walls afford many opportunities to hike out of the canyon to view the spectacular Rio Grande cutting through a rugged desert landscape such as Sanderson Canyon.

Segment 8

Although the section between Dryden Crossing and the end of the Wild and Scenic river designation may be the least visited of all segments, it is not for a lack of scenic values. The limited public access between Dryden Crossing and Amistad National Recreation Area contributes to its wild remoteness. This reach offers both deep canyon country and open desert views. Several interesting side canyons enter into the river and create challenging rapids such as the one at La Venada. The side canyons also make excellent opportunities for hikes to scenic overlooks. This segment contains some of the most striking exposures of the contact between the Buda and Boquillas formations. The Devil's Meander, a unique entrenched oxbow formation, is also found in this reach.

Geological Values

The Rio Grande Wild and Scenic River is highly unusual in the region because it flows through portions of two major geologic provinces—Basin and Range and Interior Plains. It also traverses the Basin and Range, Laramide, and Edwards Plateau geologic areas. The river cuts through highlands created by continental extension in three separate events, the Laramide Orogeny, the Basin and Range followed by the Rio Grande Rift. Recent geologic work indicates that the Terlingua Fault marks the western edge of the southern extension of the Rio Grande Rift in the United States; the Sierra Del Carmen range marks the eastern edge. Deep canyons expose 100 million years of geologic history along the river, including one of the largest and most accessible continuous exposures of Cretaceous strata in Texas.

The Rio Grande provides a rare opportunity to see textbook examples of many geologic features, including dramatic faulting, folding, and igneous sills. Diverse erosional and solutional features are also visible, such as arches, hoodoos, spires, pinnacles, caves, mass wasting, and rock shelters. Active geologic processes include hot springs, landslides, and dynamic sediment transport. The dynamic nature of sediment transport is best defined by large pulses of sediment from tributary canyons, which create a series of pool-and-drop river gradients along the wild and scenic river designation. Rapids created by rock slides from canyon walls or boulder fields at the mouths of tributary canyons create habitat diversity, and enhance the recreational values of the river with challenging river running opportunities. Every 15 to 20 years, a climate-driven pulse of large-scale flooding resets the system to more natural conditions.

Geology also influences the location, frequency, and discharge rates of springs in and along the river. These springs are critical for providing continuous flows and improved water quality in the lower river segments, especially during low-water periods.

The river has exposed numerous Cretaceous fossils that can be viewed and studied in place. Fossils include an abundance of invertebrates such as oysters, snails, and ammonites, which are often deposited in fossil reefs or other fossil-rich layers. Unusual invertebrates include giant clams that can be more than three feet in diameter and rudists, an odd group of asymmetrical bivalves. Rare vertebrate fossils include fish, turtles, and mosasaurs.

Segment 9A

This segment exhibits unusual topographic relief, flowing through 1,200-foot-deep Mariscal Canyon that includes a 1,500-foot-high cliff at the mouth of the canyon. There is also a textbook example of a well-exposed Tertiary igneous sill made obvious by dramatic contrasts in color. The Terlingua Fault is found within this reach, characterized by 2,000 feet of displacement and a dipping rock layers that provide an interesting visual illusion for river runners. Other notable features include remarkable calcite crystal formations, numerous pour-offs, and Rockslide Rapid.

Segments 9B and 1

Along these segments, river meander loops and abandoned meander loops have resulted from various stages of floodplain evolution. Exposures of recent alluvium and various Tertiary igneous features, such as Black Dike and older sedimentary rocks punctuate the scenery. However, the absence of rare, unique, or exemplary features led to the determination that outstandingly remarkable geologic values are not found within this segment.

Segment 2

Mariscal Canyon in this segment exhibits an outstanding example of a plunging, recumbent anticline feature that has been dissected by the river—marking the southernmost exposure of the Rocky Mountains (Laramide deformation) in the United States. This dissection has created a visible cross-section of all Cretaceous formations found in the Big Bend area, representing tens of millions of years of sediment deposition. Tight Squeeze Rapid, formed by a rock fall from the steep canyon walls, adds interest and challenge for river runners.

Segment 3

After exiting Mariscal Canyon, the river flows around the north end of the San Vicente Anticline. Thermal springs and Tornillo Creek lend to the geologic interest of this segment. The potentially oldest mosasaur fossil in North America is located within Segment 3 of the river corridor. However, the absence of rare, unique, or exemplary geologic features led to the determination that outstandingly remarkable geologic values are not found within this segment.

Segment 4

This segment of the river flows through deep, steep-walled limestone canyons of the Sierra Del Carmen mountain range. Exposed Cretaceous rocks and evidence of the older Laramide Orogeny occur within these canyons. Fascinating geologic features include faults and folds, spires, pinnacles, rock shelters, minor karst features, and associated mineralization.

Segment 5

The Segment 5 river segment flows through a broad canyon broken by occasional smaller canyons. Long views into Mexico for the upper portion of this segment include several

geologic features including a volcanic intrusion responsible for a large fluorite mine. The village at La Linda grew in response to these mining activities.

Outcrops include alluvial deposits, Cretaceous limestones, and Tertiary igneous sills. The cliffs that hang over the canyon provide breathtaking examples of buttes and temples. Visitors can experience this easily in the appropriately named Temple Canyon. Thermal springs and Maravillas Creek occur along this segment. Although hard to see at times, this segment contains the most productive of natural thermal springs that sustain the aquatic environment during low-flow conditions.

Segment 6

This river segment flows through a limestone canyon that includes the Bullis Fold—a monocline that is at the western edge of Stockton/Edwards Plateau. Other exemplary geologic features include folding and thrust-faulting, indicating that Basin and Range and Laramide deformation is present. This segment contains the most visible thermal springs of the Rio Grande. These are important water sources for lower segments of the river and for river recreation. Rodeo, Madison, Hot Springs, Panther, Reagan, and Palmas rapids are found along this reach. There is also an outstanding example of a geologic fin near the confluence with Tule Creek, and dinosaur footprints have been reported in Segment 6.

Segment 7 and Segment 8

Exposures of Cretaceous limestone with small caves and rock shelters have been identified along these river segments. Tributaries include San Francisco, Sanderson, and Lozier side canyons. These segments need a more complete inventory, but the absence of any known rare, unique, or exemplary features led to the determination that geologic values are not outstandingly remarkable within these segments.

Cultural Values

The Rio Grande Wild and Scenic River provides a unique opportunity to share in the awe-inspiring experience held by early explorers like Major William T. Emory who navigated this route through the untamed wilderness of Big Bend in 1852. Even to this day, the river represents a sense of primitive America.

Although the first Europeans considered the land el despoblado, "the uninhabited land," humans have lived along the river for at least twelve millennia. During the Holocene period, the climate became warmer and drier, gradually changing the landscape from woodlands to a desert shrubland and grassland. This change forced Chihuahuan Desert Archaic hunter-gatherers to adapt in unique ways to changing food and water resources. Prehistoric sites reflect the adaptation to diminishing water resources across the landscape and increased reliance on the river and its tributaries for sustenance. The unusual diversity of sites include rock art; mortar holes, metates, and hearths associated with food processing; open campsites; prehistoric architecture; lithic procurement (quarries); middens; rock shelters; and evidence of early agriculture and horticulture.

The presence of Europeans in the Big Bend region is marked by sites from Hispanic contact (i.e., Spanish conquest and establishment of missions, ranches, and farms), and Anglo settlement (i.e., military, mining, ranching and farming, commerce, resource exploitation, and modern recreation). In the broad open stretches of the Rio Grande through the intermontane basin there are many recent sites associated with floodplain farming and ranching, mining, border trading posts, candelilla wax factories, and other commercial enterprises. Not only does the Rio Grande define an international border between the United States and Mexico, but it is a focal point of human settlements that unifies two countries.

Four sites in the wild and scenic river corridor are listed on the National Register of Historic Places. These include Sublett Farm Historic District, Castolon Historic District, the Hot Springs Historic Site, and the John Daniels Farm Historic Site. Many other prehistoric sites and those dating to Hispanic settlement in the 19th century are eligible for listing. Many of these are found along the lowest river terraces and are susceptible to damage from abnormally high flooding.

Segment 9A

This river segment has not been systematically inventoried for cultural resources; however, it does contain two historic ranching sites and two prehistoric campsites on the Texas side, and one ranching site, one pictograph site, and an open campsite on the Mexican side.

Some of these sites are actively interpreted by river guides. Additional inventory is needed to determine if this segment contains outstandingly remarkable cultural values. Currently, it has been determined not to contain rare, unique, or exemplary cultural features.

Segment 9B

Perhaps the most culturally complex of any river segment, Segment 9B reach traverses an extensive section of open basin containing an array of sites associated with settlement by 18th and 19th century Hispanic people, and late 19th century and early 20th century Anglo-Americans. Most of these sites are associated with simple domestic livestock husbandry, floodplain farming, and irrigation agriculture.

Historic 19th century farming communities include Terlingua de Abajo, La Coyota, and numerous other small settlements along Alamo Creek. These are associated with 19th century Hispanic settlement, temporal and floodplain farming, and animal husbandry. The associated architectural styles include stone masonry, adobe, jacal, and dugout construction, as well as the use of salvaged and reused objects produced by vernacular methods that are unique to the region. Segment 9B also includes a major irrigated farming operation and frontier trading post that was a major military encampment from 1916 to 1920. On the Mexican side of the river are numerous small communal settlements including La Gloria, Santa Elena, La Rana, Enmedio, and others. Downriver from Castolon, Johnson Ranch is the location of a military airfield that operated between 1929 and 1943.

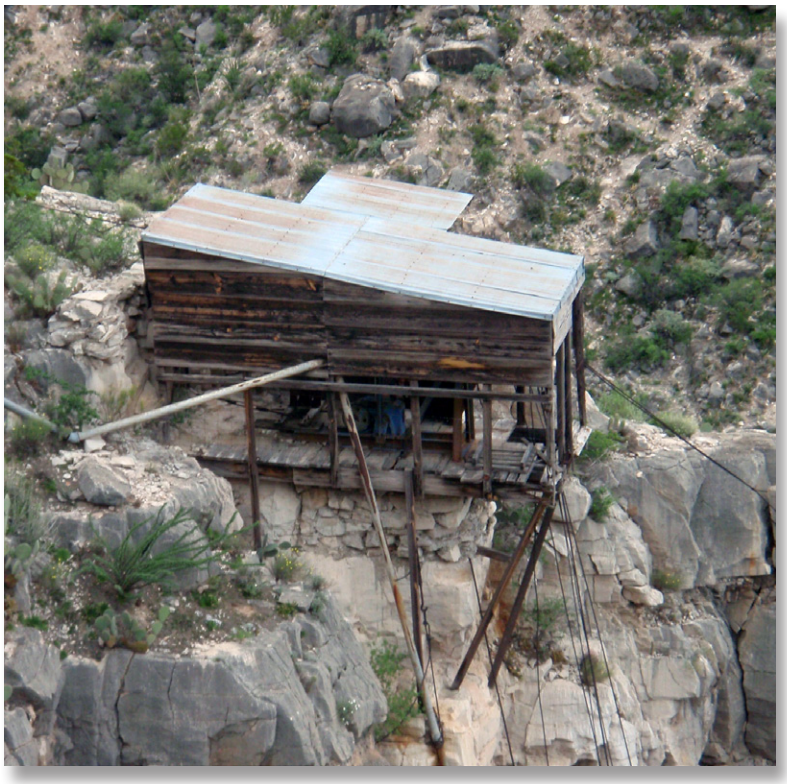
Segment 1

This segment of the river has undergone intensive archeological surveys, identifying 101 prehistoric and historic sites in just 17 miles of river along the United States side. This unusual high density exemplifies how important the river is to human settlement. Prehistoric agricultural sites are extremely rare in Big Bend National Park. Sites containing prehistoric ceramics and charred corn suggest that Casas Grandes-Jornada influence extends farther to the southeast into the Big Bend than previously believed. The river corridor therefore represents fertile grounds for future research into this period of human history.

This segment also contains one of the major routes taken by Comanche/Kiowa raiding parties into northern Mexico. The Vado de Chisos was a well-known Indian crossing before the Comanche began using this route in the 19th century. The crossing was used by several Spanish explorers who traversed the Big Bend including one by the surveyor Juan Pedro Walker whose 1805 map depicts the crossing along with numerous Spanish settlements just south of the Rio Grande that were established during the 18th and 19th centuries. Small ranching enterprises also occur in this river segment, represented by a half dozen structures at the sites of Woodson's, Pettit's, and Talley. Pantera is a historic Hispanic community containing over a dozen structures that remain relatively undisturbed due to its remoteness and lack of modern vehicle access.

Segment 2

Known archeological and historic sites along this segment are in Mexico. A historic candelilla wax processing site and prehistoric petroglyph site are located at Cross Canyons. The motifs of the petroglyphs bear similarities to the Pecked Abstract Tradition that ranges from the Great Basin and greater Southwestern United States to this location in northern Mexico. Other motifs are more commonly found south of this site in northern Coahuila and Chihuahua. Thus, it represents the contact zone between two



major culture areas. Another candelilla wax camp is on the Mexican side, just downstream of the exit from Mariscal Canyon. Because these unique cultural resources are found on the Mexican side of the river, this wild and scenic river segment is not currently recognized to contain outstandingly remarkable cultural values.

Segment 3

The unusually wide variety of cultural sites along this segment include prehistoric open campsites, rock shelters, historic ranching and farming sites, the communities of San Vicente, Boquillas, and the Hot Springs Resort. This segment also contains the San Vicente Crossing, a major route taken by Comanche/Kiowa raiding parties into northern Mexico. The Spanish Presidio of San Vicente, located immediately on the south side of the Rio Grande at San Vicente, Coahuila, was established in 1773 and was garrisoned until it was abandoned in 1784. In 1789, Juan de Ugalde crossed here pursuing a band of Apaches into the Chisos Mountains. The crossing was also used by several Spanish explorers who traversed Big Bend.

The communities of Boquillas, Texas, and San Vicente, Coahuila, practice floodplain agriculture and ranching as they have for generations. San Vicente Viejo, Texas, also irrigated farmland with water pumped from the Rio Grande until major flooding rechanneled the river away from the pump location. The community was forced to shift farming operations downstream where the river meander reestablished itself.

The Solis Ranch is found along this segment, which began operation in the 1880s. It is the site of a major cinnabar discovery that resulted in the establishment of Mariscal Mine, a National Historic Register District. Ruins of the ranch are visible from the river. The town site of Boquillas, Texas, is associated with lead, zinc, and silver mining that began in Coahuila in the 1880s.

The Hot Springs Resort is a national register property containing two buildings and one ruin associated with early 20th century commercial development. The site also contains several Prehistoric archeological properties including a rock art site. Daniel's Farmhouse at Rio Grande Village is listed in the national register and is actively maintained and interpreted. Barker Lodge, eligible for listing, is maintained but is not actively interpreted. Sites along the lower river terraces are susceptible to damage from abnormally high flooding.

Segment 4

Little is known about the cultural resources of this segment. However, seven archeological sites have been recorded along a 1.5-mile stretch, suggesting significant site density. Most sites in the Sierra del Caballo Muerto tend to be quite old, ranging into the Early to Middle Archaic time periods (8,500 to 3,000 years ago). These sites contain rich cultural deposits that preserve paleo-environment data that may aid in reconstructing paleo-climatic conditions during the Holocene period. Sites found along the lower river terraces may be susceptible to damage from abnormally high flooding. Due to the lack of research to better understand the significance of these cultural sites, this segment is not currently recognized to contain outstandingly remarkable cultural values.

Segments 5, 6, 7, and 8

The Rio Grande General Management Plan lists several sites of historical significance in these segments: Asa Jones water works, Burro Bluff, and Dryden Crossing. Shafter Crossing also has significant infrastructure still visible. The Texas Historical Commission reconnaissance of the lower canyons recorded numerous rock shelters, open campsites, cave shelters, and wax camps along these river segments. However, a complete inventory is needed to better understand the significance of these cultural sites to determine if these segments contain outstandingly remarkable cultural values.

Recreational Values

The Rio Grande Wild and Scenic River provides a variety of recreational opportunities that allow visitors to experience a spectacular river corridor as it carves its way through the Chihuahuan Desert. Colorful, expansive landscapes give way to vault-like canyons that carry travelers through time and space, providing world-class year-around boating, hiking, camping, wildlife viewing, photography, and natural springs. Visitors can enjoy and experience rare desert flora and fauna, solitude, natural sounds, and amazing night skies in a remote and dramatic landscape that is largely wild and undeveloped. The river corridor also includes an international port of entry and a chance for visitors to observe and experience unique prehistoric, historic, and modern cultures along the U.S./Mexican border. In addition, visitors travel from all over the world to observe an unparalleled diversity of bird species, including some that are found nowhere else in the United States.

Segment 9A

This segment provides rare opportunities for solitude and unique challenges for boaters, especially through Rockslide Rapid in Santa Elena Canyon. The Santa Elena Formation is unique due to its sheer canyon walls and depth. Birding is outstanding due to the variety of rare species. Excellent hiking opportunities exist, including the Rim hike at Entrance Camp, the Metates Trail, and the Santa Elena Canyon Trail. Photographers enjoy excellent opportunities to photograph Santa Elena Canyon during sunrises, sunsets, and unique shadow and light settings. During rare thunderstorm events, the canyon echoes with thunder, and occasionally flash floods roar into the canyon as spectacular plummeting waterfalls.

Segment 9B and 1

The lack of rare, unique, or exemplary recreational opportunities led to the determination that outstandingly remarkable recreation values do not exist within these segments. They provide some opportunities for solitude and good boating currents, but there are no challenging rapids. These segments also have open desert terrain, but extensive cane and saltcedar along the river can limit hiking opportunities. There are some good views,

but both segments lack spectacular canyons and geologic features found in other reaches. There are only a few springs in the segment and limited opportunities to observe small Mexican border communities and ranching and farming operations.

Segment 2

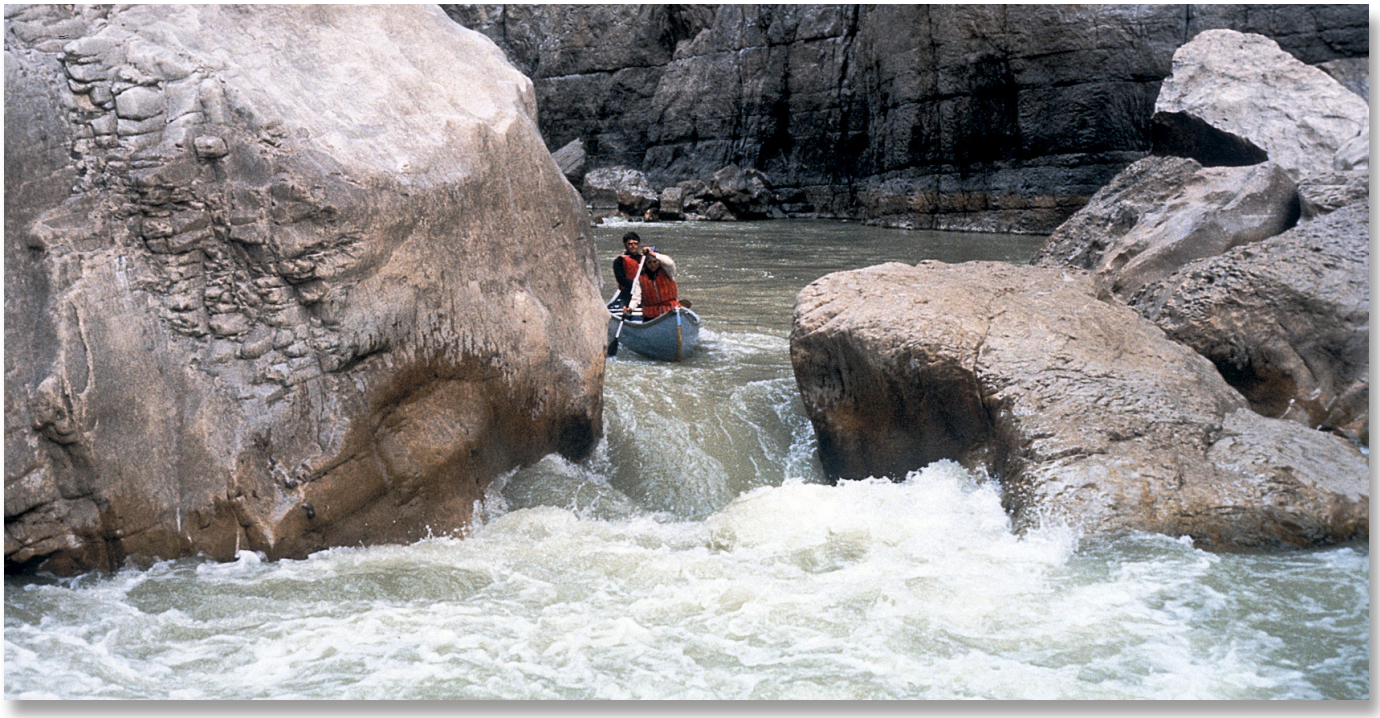
This segment provides rare opportunities for solitude and unique challenges for boaters, especially through Tight Squeeze Rapid. Mariscal Canyon exposes a full spectrum of Cretaceous-aged rock and is a textbook example of an anticline (fold). Birding is outstanding due to the variety of birds not usually seen in the United States and the presence of two peregrine aeries. This remote section provides unique opportunities to observe wildlife, including beavers, javalinas, bobcats, and mountain lions. Excellent hiking opportunities exist, including Canyon Rim Trail. Photographers enjoy excellent opportunities to photograph spectacular formations visible from Cross Canyon Trail and Overlook.

Segment 3

This segment includes numerous access points in Big Bend National Park that provide excellent opportunities for novice and family boaters to experience a variety of trip lengths along the river. San Vicente Canyon contains a small but dramatic example of an anticline, and the Hot Springs area contains unique thermal springs along the river. Birding is outstanding due to the variety of species not usually seen in the United States, especially at the rare cottonwood gallery forest near Rio Grande Village. Black and grey hawks can be seen in this segment. Excellent hiking opportunities exist, including Hot Springs Canyon Trail, which traverses the ruins of the old hot springs resort and remains one of the most photographed sections of the Rio Grande. There are excellent opportunities to experience border culture, such as the Mexican villages of San Vicente and Boquillas, and there are numerous springs in this segment.

Segment 4

This segment provides opportunities for boaters of all skills within an isolated setting. The canyon is more open and highly sculpted, providing open vistas of the Sierra del Carmen and Dead Horse mountain ranges. Birding is outstanding due to the variety of birds—a number of which are not typically seen in the United States. Black and zonetail hawks and peregrine falcons are seen in this area. Excellent hiking opportunities exist, including the Marufo Vega Trail and numerous side canyon hikes. There are also excellent opportunities to photograph geologic features



and vistas, including the Rabbit Ears. There are several active candelilla wax camps in this reach that can be viewed from the river and during hikes.

Segment 5

This segment provides opportunities for solitude for boaters of all levels. Temple Canyon is one of the most extraordinary features in this segment and is defined by spectacular rock formations and spires, providing excellent opportunities for photography. Birding is also outstanding due to the variety of birds not usually seen in the United States. A closed fluorspar plant and bridge at La Linda can be observed in this reach. Springs are common from Maravillas Canyon downstream.

Segment 6

One of the most remote rivers in the Lower 48, this segment provides a high degree of solitude and exciting challenges for boaters, especially through Hot Springs, Upper Madison, and Lower Madison rapids. Outstanding examples of geologic features include the Bullis Fold and associated joint

patterns, and the many thermal springs of the area. Birding is outstanding, and excellent hiking exists along historic Burro Bluff Trail, San Francisco Canyon, and numerous other side canyons. There are many opportunities for photography, including the Bullis Fold, side canyons, rapids, and bluffs. There are also some opportunities to experience border culture.

Segment 7

This segment provides a high degree of solitude and exciting challenges for boaters through Sanderson and San Francisco rapids. Tilted strata and heavily sculpted limestone define this reach. Segment 7 also provides extremely rare opportunities for sightings of black bears, mountain lions, or their sign, and birding is exceptional. Hiking is excellent with numerous side canyons to explore.

Segment 8

Challenging boating exists along Segment 8 of the Rio Grande Wild and Scenic River, especially through Head and Shoulders Rapid. Unique geologic features range from subtle canyon walls to the Devil's Meander bend. Birding is outstanding due to the diversity of birds as well as the number of species not commonly found in the United States. There are few trails but hiking opportunities are excellent through numerous side canyons. A number of springs also exist in this segment.

Biological Values

The Rio Grande Wild and Scenic River corridor supports a diverse assemblage of rare fish and wildlife species unparalleled in the greater Rio Grande watershed. The unique biological characteristics of the Rio Grande result from a mosaic of high-gradient flows through narrow, steep-walled canyons to slow-moving waters that meander through wide alluvial channels. These varied river environments are further punctuated by small patches of refugia, including run and riffle environments near tributary mouths, backwater wetlands in abandoned river channels and floodplain springs, and spring inputs that provide high-quality water and more reliable flows. Remnant cottonwood stands and other imperiled riparian plant communities are also present, but faced with the harmful effects of highly invasive, nonnative tamarisk and giant cane. As the only major river system in the Chihuahuan Desert, the dynamic and varied aquatic and riparian environments of the Rio Grande serve as the lifeblood for numerous threatened fish, mussels, reptiles, amphibians, birds, mammals, and insects.

The wild and scenic river supports 40 native fish species, of which 17 are listed as species of concern—the majority of which are found only in this area. These include the recently reintroduced federally listed Rio Grande silvery minnow. Other threatened and endangered fish species include the Chihuahua shiner, Rio Grande shiner, Mexican stoneroller, speckled chub, long-nosed dace, round-nosed minnow, Rio Grande blue catfish, Big Bend Gambusia, and Rio Grande blue sucker. Found nowhere else, the wild and scenic river is the last refuge for the Rio Grande blue sucker.

Other rare aquatic species include a variety of native freshwater unionid (mussel and clam) species such as the Texas hornshell, Salina mucket, Tampico pearlymussel, and fingernail clam. Rare aquatic insects include Stictotarsus neomexicanus (a threatened diving beetle), Argia rhoadsi (the northernmost extent of this damselfly species), and Thermo spheroma (a rare endemic isopod unique to hot springs found along the river).

The presence of 14 nonnative fish species continues to affect the long-term viability of native aquatic species. This, along with habitat alternations, water quality degradation, and flow regulations, has already contributed to the extirpation of four native fish species—the roundnose minnow, Conchos pupfish, American eel, and the shovelnose sturgeon—and the extinction of seven others, including the phantom shiner, Maravillas red shiner, and Conchos pupfish.

Rare mammals that inhabit the river corridor include the Mexicanus subspecies of Mexican beaver, coatimundi, and the Western mastiff bat. Rare herpafauna include the Big Bend slider. Rare peregrine falcons, Mexican black hawks, grey hawks, and yellow-billed cuckoos are also present.

The wild and scenic river corridor supports at least 38 native plant species that are considered rare. Thirty are listed by Texas Parks and Wildlife as "species of greatest conservation need"—2 "critically imperiled"species, 2 "critically imperiled" varieties, 14 "imperiled" species, and 16 "vulnerable" species. All are listed as "critically imperiled" to "vulnerable" by the State of Texas. One species has only recently been found in the wild in the United States (the only known location is in a Rio Grande tributary canyon less than 0.10 mile from the river), and one species is so rare that it has not been ranked in NatureServe. Many of the species are found in the United States in Texas only, and only in Brewster and Presidio counties along or near the Rio Grande. The status of many species in Mexico is unknown as global rankings are based on historic reports rather than verified current status.

Segment 9A

The Santa Elena Canyon in this segment supports a number of rare native fish species, including the Rio Grande silvery minnow, Rio Grande blue catfish, and Rio Grande blue sucker. The Texas hornshell mussel has also been found in extremely low numbers along this segment. Narrow canyon walls, high-gradient flows, and a side canyon provides perennial stream flows and habitat complexity for these and other native species.

Rare mammals that inhabit this segment of the river corridor include the Mexicanus subspecies of beaver, occasional migrant nonresident coatimundi, and the Western mastiff bat, which roosts in high crevices of the canyon walls. Rare herpetofauna include the Big Bend slider. Rare peregrine falcons nest in aeries high on canyon walls. Yellow-billed cuckoos are also present upstream of the canyon.

This segment contains one of the five known populations of the Boquillas Gaura or (Gaura boquillensis). The population grows on the steep cliffs of the Texas side of the river within 1.0 to 1.5 miles of the exit to Santa Elena Canyon, with most existing along the Santa Elena Canyon Nature Trail. Blooming in March and April, the trail offers a rare opportunity to view this species.

A side hike into Metates Canyon in February or early March will present the hiker with a spectacular view of the only known U.S. population of Mexican Tulip Poppy (Hunnemannia fumariifolia). From just above the floodplain for over a kilometer, the cliffs of Metates Canyon are thickly sprayed with these large, brilliant yellow poppies. At least three other Rio Grande tributary canyons in the same general area also produce spectacular displays of this species.

The dissected rockdaisy (Perityle dissecta), a Chihuahuan Desert endemic found only in Brewster and Presidio counties, Texas, and restricted to specific and rather rare limestone outcrops, grows on the cliffs along the Rio Grande and its tributaries within Segment 9A. Texas Thelypody (Thelypodium texanum) and Rio Grande palafox (Palafoxia riograndensis) bloom within the floodplain along this segment. A short hike into the limestone canyons may favor the hiker with the discovery of the tiny and rarely seen pingpong-ball cactus (Epithelantha bokii) and Duncan's cory cactus (Coryphantha duncanii)—restricted to southern Brewster County and very specific limestone strata—or Schott's acacia (Acacia schottii), also restricted to specific, but different, geologic strata. Texas false saltgrass (Allolepis texana) is historically reported from the Castolon area.

Segment 9B

Segment 9B is unique in the greater Rio Grande watershed due to a combination of rare and important meso-habitats, primarily influenced by Terlingua Creek. This perennial tributary provides sediment inputs and occasional channel scouring along the Rio Grande that enhances habitat complexity and aquatic biodiversity. Just downstream from the confluence of Santa Elena Canyon and Terlingua Creek, the river channel widens and begins to meander across a more open desert landscape. This, in turn, results in a mosaic of geomorphic features (including cobble, gravel, and sand bars and substrates) that provide nursery habitat for many rare aquatic species. The majority of rare aquatic and terrestrial species of the Rio Grande Wild and Scenic

River are within this segment. This segment also contains the only known site of the round-nosed minnow in the wild and scenic river. Native remnant riparian vegetation is also more widespread throughout this river segment, and in many areas the channel morphology and hydrology provides an opportunity to improve riparian conditions.

Rare mammals that inhabit this segment of the river corridor include the Mexicanus subspecies of beaver, occasional nonresident coatimundi, and the Western mastiff bat. Rare herpetofauna include the Big Bend slider. Rare peregrine falcons hunt the riparian zone, and rare grey hawks and yellow-billed cuckoos are also present.

Along this segment are two of the five known populations of bigpod ladies' nightcap (Bonamia ovalifolia), a rare bush morning glory known only from within Big Bend National Park. This segment is the historic location of Durango watercress (Rorippa ramose), which has not been found in the United States since 1948. Short hikes along the floodplain or on the terraces overlooking the Rio Grande may lead the hiker to populations of fleshy honeysweet (Tidestromia carnosa), littleleaf moonpod (Selinocarpus parvifolius), Chiracahua Mountains rhombopod (Cleomella longipes), and Havard's standing cypress (Ipomopsis havardii). The segment contains several impressive populations of the unusual candle cholla (Opuntia kleiniae), thought to be a species of hybrid origin between the much more common cane cholla (Opuntia imbricate) and Tasajillo (Opuntia leptocaulis).

Segment 1

Segment 1 contains a variety of meso-habitats. As with Segment 9B, the river continues to exhibit alluvial channel characteristics as it meanders toward Mariscal Canyon. Geomorphic features include cobble, gravel, and sand bars and substrates, providing important habitat for many rare aquatic species. The majority of rare aquatic and terrestrial species found in the Rio Grande Wild and Scenic River are within Segment 1. As with the segment upstream, invasive species and excessive sedimentation are problematic. However, it retains some small amounts of native riparian habitat, providing an opportunity to improve riparian conditions.

Along this segment is another of the five known populations of bigpod ladies' nightcap (Bonamia ovalifolia). The habitat containing this rare species also contains Havard's standing cypress (Ipomopsis havardii), littleleaf moonpod (Selinocarpus parvifolius), and Mexican blazingstar (Mentzelia mexicana). Rare mammals that inhabit that river corridor include the Mexicanus subspecies of beaver, occasional migrant nonresident coatimundi, and the Western mastiff bat. Rare herpetofauna include the Big Bend slider. Rare peregrine falcons hunt the riparian zone. Rare grey hawks and yellow-billed cuckoos are also present.

Segment 2

The remote, steep-walled Mariscal Canyon provides habitat features unique to the wild and scenic river designation. However, due to the limited accessibility of this river segment, few species inventories have occurred. Based on the distribution of species described in the other segments, it is likely that a similar complement of species occur in Mariscal Canyon. The Texas hornshell, Salina mucket, Tampico pearlymussel, and the Big Bend slider have been found in this reach. The steep walls provide excellent shade and "meso-habitat" conditions.

Rare mammals that inhabit that river corridor include the Mexicanus subspecies of beaver, occasional migrant nonresident coatimundi, and the Western mastiff bat roosts in high

crevices of canyon walls. Rare herpetofauna include the Big Bend slider. Rare peregrine falcons nest in aeries high on canyon walls.

This segment contains the westernmost known population of littleleaf brongniartia (Brongniartia minutifolia). This rare legume is known only from scattered populations within Big Bend National Park along and near the Rio Grande and two to five small populations in Mexico (Mexican population information is very spotty). Along the cliffs within Mariscal Canyon may be found the rare Gregg's cloakfern (Notholaena greggii), occurring in the United States, only in southern Brewster and Presidio counties. The limestone cliffs are also home to the silver cholla (Opuntia imbricata var. argentea), a beautiful and rare variety of the common cane cholla (Opuntia imbricata var. imbricata). This unique variety is found only on Mariscal Mountain and immediately adjacent limestone hills along the Rio Grande. White column cactus (Escobaria albicolumnaria), Duncan's cory cactus (Coryphantha duncanii), and pingpong-ball cactus (Epithelantha bokei) also populate some of the limestone cliffs.

Segment 3

Segment 3 contains an assemblage of alluvial and canyon features, as well as inputs from Tornillo Creek and numerous thermal springs. The series of springs found along this reach and Tornillo Creek provide a significant input of groundwater that helps ensure stable base flows for the remainder of the wild and scenic designation. The higher temperature thermal springs provide important habitat for thermosphaeroma, a rare endemic isopod. The endangered Big Bend gambusia, a rare mosquito fish found nowhere else in the world, survives in only two thermal springs near Rio Grande Village.

Rare mammals that inhabit that river corridor include the Mexicanus subspecies of beaver, and the occasional migrant, nonresident coatimundi. Western mastiff bats hunt the riparian corridor. Rare herpetofauna include the Big Bend slider. Rare peregrine falcons, Mexican black hawks, grey hawks, and yellow-billed cuckoos are also present.

The limestone hills immediately adjacent to the Rio Grande are the habitat of several rare cacti. Overlooking the Rio Grande, the federally listed (threatened) bunched corycactus (Coryphantha ramillosa) shares its habitat with the Chihuahuan endemic white column cactus (Escobaria albicolumnaria), Duncan's cory cactus (Coryphantha duncanii), pingpong-ball cactus (Epithelantha bokei), the easternmost population of the silver cholla (Opuntia imbricata var. argentea), and one of the half dozen tiny populations of golden-spined prickly-pear (Opuntia aureispina), a rare and unusual species known only from limestone areas from Mariscal Mountain to Boquillas Canyon along and near the Rio Grande.

The lower half of this segment is the beginning of the small area that is home to the spiny fruited prickly-pear (Opuntia spinosibacca). This rare and unique prickly-pear grows in the limestone and limestone rubble from near Gravel Pit, through Boquillas Canyon and up the Dead Horse Mountains for a few miles. The area between Rio Grande Village and the entrance to Boquillas Canyon is home to one of the largest known populations of zig-zag croton (Croton pottsii var. thermopholis), considered "critically

imperiled," with "few occurrences; extremely restricted geographically" (NatureServe 2011). Cutler's twistflower (Streptanthus cutleri), known only from "intermittent drainages of the Rio Grande in eastern Brewster County" [NatureServe 2011] occurs at or near the mouth of an unnamed drainage near Boquillas Canyon Overlook.

Segment 4

The majority of rare aquatic species found in the Rio Grande Wild and Scenic River are within Boquillas Canyon in this segment. The greater presence of species in this segment is due in part to groundwater inputs upstream that result in stronger, continuous base flows and improved water quality. These qualities are reflected in the increasing invertebrate diversity and abundance beginning in this reach. Significant efforts to control nonnative vegetation have further improved the quality of aquatic and riparian habitat.

Rare mammals that inhabit that river corridor include the Mexicanus subspecies of beaver, and occasional migrant, nonresident coatimundi. Western mastiff bats roost in crevices of high canyon walls. Rare herpetofauna include the Big Bend slider. Rare peregrine falcons nest in aeries high on cliff walls.

The entrance to Boquillas Canyon is habitat for six rare plant species. Here, another of the five known populations of bigpod ladies' nightcap (Bonamia ovalifolia) occurs, in direct conjunction with another of the five known populations of the Boquillas Gaura (Gaura boquillensis). Two rare spurges, bristlecup sandmat (Chamaesyce chaetocalyx var. triligulata)—found only in southeastern Brewster County near the Rio Grande—and Boquillas broomspurge, (Chamaesyce golondrina)—found in widespread and highly isolated populations in only three trans-Pecos counties near the Rio Grande—occur in and along the floodplain, just within the head of Boquillas Canyon. One of only two recent (since 1967) occurrences of Rio Grande palafox (Palafoxia riograndensis) occurred at the head of Boquillas Canyon in 2006. A small population of approximately 30 plants of the rare false grama grass (Cathestecacum erectum) occurs on the cliffs at the very entrance to the canyon.

Spiny fruited prickly-pear (Opuntia spinosibacca—unrated), Cutler's twistflower (Streptanthus cutleri), creeping ladies' nightcap (Bonamia repens), pingpong-ball cactus (Epithelantha bokii), and bluff rockdaisy (Perityle aglossa) are all found in the drainages and on the cliffs adjoining the river.

Segments 5 and 6

Segment 5 and Segment 6 have similar groundwater features characterized by long stretches of broad spring inputs. There are multiple spring complexes throughout this portion of the wild and scenic river designation, providing substantial groundwater inputs that further sustain base flows and enhance water quality. Maravillas Canyon and San Rosedro are the largest of the tributaries, and there are numerous others, including Palmas, Tule, and Silber canyons. The majority of the known rare aquatic species found within the designated river are within Segment 5 and the Bullis Canyon reaches.

In addition to other rare mammals, desert bighorn sheep, being restored to the area by the Texas Parks and Wildlife Department and cooperating landowners in the United States and Mexico, are often visible in the lower reaches of Segment 5 and Segment 6.

Plant species occurrences for these reaches and Segment 8 stretches must be based on locations reported in the University of Texas herbarium and a few scattered references. Rare plants recorded as occurring along the Rio Grande, either in the floodplain or on the cliffs along both Segment 5 and Segment 6

stretches are: Mexican blazingstar (Mentzelia mexicana), Cutler's twistflower (Streptanthus cutleri), bluff rockdaisy (Perityle aglossa), Maravillas milkwort (Polygala maravillasensis), creeping ladies' nightcap (Bonamia repens), and cliff thistle (Cirsium turneri). Additionally, emorybush (Emorya suaveolens) and two-bristle rockdaisy (Perityle bisetosa var. apressa) are reported occurring along Segment 5, and cliff bedstraw (Galium correllii), gray rockdaisy (Perityle cinerea), and heather leaf-flower (Phyllanthus ericoides) are reported along Segment 6.

Segments 7 and 8

The presence of numerous rare aquatic species within the Red House segment is due in part to the groundwater and tributary inputs upstream that result in continuous flows and improved water quality. Although few inventories have occurred, it is likely that Segment 8 contains similar species composition as upstream reaches. Alligator gar is also found in the Segment 8 reach.

The Red House segment includes elements of Tamaulipan thornscrub habitat in the riparian corridor (including Berlandier ash), which continues throughout Segment 8. As with other segments within the wild and scenic river designation, invasive species and excessive sedimentation are problematic and there are opportunities to improve riparian conditions.

Cliff thistle (Cirsium turneri) and narrow-leaved rockdaisy (Perityle angustifolia) are found within both segments. Bluff rockdaisy (Perityle aglossa), creeping ladies' nightcap (Bonamia repens), heather leaf-flower (Phyllanthus ericoides), and gray rockdaisy (Perityle cinerea) are recorded within Segment 7. Cliff bedstraw (Galium correllii), Wright's trumpets (Acleisanthes wrightii), and broadpod jewelflower (Streptanthus platycarpus) are reported from areas within Segment 8.

Given that the highest water quality and most natural flow conditions of the wild and scenic river exist in this segment, mussel species become more abundant than any other section. Salina mucket and Tampico pearlymussel shells are visible on most beaches and gravel bars, and the rare Texas hornshell is not uncommon.

Free-Flowing Condition and Water Quality

Outstandingly remarkable values, free-flowing condition, and water quality form the three pillars of protection under the Wild and Scenic River Act. Because free-flowing condition and water quality support the integrity of the ORVs and are key components of future management, they are included as part of this ORV statement. These fundamental characteristics of the Rio Grande Wild and Scenic River are described below.

Free-Flowing Condition

The Rio Grande Wild and Scenic River is unique in that peak flows are dominated by late summer thunderstorms rather than a snowmelt-generated freshet. Historically, peak flows generated by runoff from the North American monsoon were considerably greater than runoff from the northern branch. Considerable distance from the headwaters in southern Colorado meant that the snowmelt did not reach Big Bend until early summer and was quickly overwhelmed by runoff from the monsoon. The free-flow nature of the river is best experienced during extreme rainfall events and tributary flash floods, as well as during low-flow periods when groundwater contributions sustain flows in the lower reaches. These spring inputs are unique and regionally significant, comprising roughly a quarter of the mean annual river flow and a majority of the river's flow during dry periods. These springs have been designated as ecologically significant by the State of Texas.

Agricultural use of the river upstream from Big Bend National Park and Rio Grande Wild and Scenic River is longstanding. Pueblo peoples in New Mexico were using ditch irrigation on a limited scale at the time of Spanish exploration in 1591 (Scurlock 1998). Spanish and Mexican settlers expanded irrigation on floodplains and terraces in New Mexico (Sorenson and Linford 1967, cited by Scurlock 1998). Ditch irrigation began in the mid-1600s in the El Paso/Juarez Valley, and direct diversions of the main channel in this valley were underway by at least the late 1700s (Stotz 2000). Water was being diverted from the Rio Conchos for use at the presidio in the Presidio Valley by

1750. Depletions of stream flow caused by irrigation withdrawals have been substantial for more than a century. Kelley (1986, cited by Stotz 2000) estimated that more than half the summer stream flow from central and northern New Mexico between 1890 and 1893 was consumed by irrigation.

Following construction of two dams in 1915: La Boquilla on the Rio Conchos in Mexico and Elephant Butte on the middle Rio Grande in New Mexico, the natural hydrology of the Rio Grande changed dramatically downstream from the Rio Conchos. The hydrology of the Rio Conchos is entirely determined by rainfall and runoff in the Sierra Madre Occidental, which is greatest during the North American monsoon. This watershed yields the bulk of its natural stream flow between July and the following March (Schmidt et al. 2003). Prior to 1915, the magnitude of peak flows downstream from the Rio Conchos was approximately four times what they were upstream (Schmidt et al. 2003). During September, when the Rio Conchos reached its annual maximum discharge, approximately 93% of the lower Rio Grande's total monthly flow came from the Rio Conchos.

Flow depletions in the northern branch of the Rio Grande in the United States and Mexico have a significant impact on the timing of onset of peak annual flows. Unlike most streams and rivers of the American West, with peak flows occurring during the spring freshet, the Rio Grande below the Rio Conchos historically saw peak flows in late summer and early fall. Annual peak flows are now an artifact of dam operations at Presa (Lake) Luis Leon in the Mexican state of Chihuahua. Timing is governed by agreements between MX and the United States made under the Water Treaty of 1944 and administered by the MX agency CONAGUA. Annual peak floods can come during any month of the year.

The loss of annual scouring flows has had a significant negative impact on ecological and hydrological function within the river. Tributary sediment, which would be carried away by annual high flows, now aggrades within the channel, covering cobble bars and filling backwaters. As the channel constricts, the conveyance capacity is reduced and flooding frequency increases. This phenomenon is well documented for the reach within Big Bend National Park. Its extent in the Lower Canyons is a little less known. With a steeper gradient in Segment 8 canyons and steeper tributaries that deliver a more coarse sediment load, it is likely that the style and extent of channel constriction alters with distance downstream.

Large, decadal scale, hydro-climatic events that can overwhelm diversion and storage structures on the Rio Conchos are capable of moving much of this sediment downstream and into Lake Powell. In 2008, several tropical systems moved through Chihuahua, Mexico, filling reservoirs and necessitating a large release that inundated every riverside community downstream of Presidio. Despite the dramatic event , the scouring provided by this flood did not widen the channel to previous dimensions. Channel width is progressively narrower over the past 50 years (Dean 2011).

Alluvial and bedrock rivers are fundamentally different in that alluvial channels are shaped by sediment transport and bedrock channels are shaped by structural and lithologic controls. Several differences exist between the hydrologic conditions in canyon reaches versus alluvial reaches within Rio Grande Wild and Scenic River. Canyon reaches like Santa Elena have steeper gradients, more exciting rapids, less sediment storage, and a thin, patchy riparian zone. Alluvial reaches like Segment 9B

have a wide meandering channel with a wide and dense riparian forest. Canyon reaches like Segment 5 have numerous springs issuing from limestone cliffs at river's edge and ephemeral spring ponds formed by scouring floods on floodplains. Alluvial reaches lose water to the underlying basin. Some reaches, like Segment 3 are imprinted on a series of basin and range tilted blocks and are neither completely canyon or alluvial. Sediment transport determines channel condition in much of the reach, yet there are locations with bedrock springs right next to the river.

Along the entire wild and scenic river designation there are no impoundments, modifications, or diversions. This is extremely rare for an almost 250-mile stretch of a major river in the United States. However, flow inputs to this wild and scenic river are regulated, both on the Upper Rio Grande and Rio Conchos. For example, upstream levees and diversions above the designation fail to attenuate larger floods that exacerbate downstream sediment deposition problems. International treaty obligations and water delivery requirements further affect the water quantity aspect of the river's free-flowing nature. These influences have resulted in a river system that can no longer maintain its natural channel morphology.

Water Quality

Water quality throughout the Rio Grande Wild and Scenic River is critical to many aquatic and terrestrial life forms, streamside communities, and visitors. Water quality is generally considered to be good throughout the river designation and conditions are usually within Texas state standards. However, for the purposes of reporting water quality of the water bodies within the state, Texas has included Rio Grande Wild and Scenic River with the reach upstream to Presidio. In 2010, the state included this segment on its list of impaired water bodies—on the basis of sulfate, chloride, and total dissolved solids content. In places and at times (for example after significant rain events), water quality conditions may spike with concentrations of organic matter, heavy metals, and other contaminants—a reflection of local geology, historic mining activities, and anthropogenic effects of modern society.

The severely degraded waters of the upper reaches quickly improve downstream as significant spring discharges and groundwater contributions intermingle with the flow of the main stem river. These groundwater inputs are well below state standards, providing the sole source of drinking water for river recreationists and a refreshing swim in an otherwise hot, arid environment. Water temperature is flow dependent and may be elevated during periods of extended low-flow conditions, but for the most part temperatures remain well-suited for native aquatic life.

Natural inputs of sediments both on the main stem of the river and from tributary flash flood events deliver high sediment loads to the river. This sediment loading and resulting turbidity, while problematic, is largely an attribute of natural conditions, yet it is exacerbated by upstream flow regulations.

Rio Grande Wild and Scenic River
Outstandingly Remarkable Values

National Park Service
U.S. Department of the Interior