



Draft Tier 1 Environmental Impact Statement and Preliminary Section 4(f) Evaluation

Section 3.14, Biological Resources

March 2019



Federal Aid No. 999-M(161)S
ADOT Project No. 999 SW 0 M5180 01P

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1 3.14 Biological Resources

2 Biological resources include terrestrial and aquatic animal species and the vegetative
3 communities that provide habitat for these species. This section describes the regulatory
4 setting, methodology, and affected environment applicable to biological resources within the
5 Interstate 11 (I-11) Corridor Study Area (Study Area). It evaluates the extent to which the No
6 Build Alternative and Build Corridor Alternatives would affect these biological resources and
7 identifies mitigation measures to avoid or minimize these impacts.

8 3.14.1 Regulatory Setting

9 A brief overview of the regulatory framework pertaining to natural habitats is summarized below.
10 A more detailed discussion is provided in the Biological Resources Technical Memorandum in
11 **Appendix E14**.

12 3.14.1.1 Federal Laws, Regulations, and Executive Orders

13 The federal laws and regulations relevant to biological resources include, but are not limited to,
14 the following:

15 **Endangered Species Act (ESA) of 1973** (16 United States Code [USC] § 1531 et. seq., Public
16 Law 93-205). This law provides a program for the conservation of threatened and endangered
17 plants and animals and the habitats in which they are found.

18 **Migratory Bird Treaty Act (MBTA) of 1918** (16 USC § 703-712, as amended). This law
19 protects all migratory birds and their parts (including eggs, nests, and feathers) from being
20 taken. The Act also affirms the commitment of the United States (US) to other international
21 conventions for the protection of migratory birds.

22 **Bald and Golden Eagle Protection Act of 1940** (16 USC § 668-668d, 54 Stat. 250, as
23 amended). This law provides for the protection of bald eagles and golden eagles by prohibiting,
24 except under specified conditions, the taking, possession, and commerce of such birds.

25 **Fish and Wildlife Coordination Act** (16 USC § 661 et. seq.). This law was enacted to protect
26 fish and wildlife when federal actions result in a modification of a natural stream or body of
27 water. If a modification to a natural stream or water body is expected, coordination with the US
28 Fish and Wildlife Service (USFWS) and with state fish and wildlife agencies is required.

29 **Federal Noxious Weed Act** (7 USC § 2801 et. seq.). This law established a federal program to
30 control the spread of noxious weeds. The law also requires any environmental assessments or
31 environmental impact statements (EISs) that may be required to implement plant control
32 agreements that must be completed within 1 year of the time when the need for the document is
33 established.

34 **Wilderness Act of 1964** (16 USC 1131-1136, 78 Stat. 890). The Wilderness Act of 1964
35 directed the Secretary of the Interior, within 10 years, to review all roadless areas of 5,000 acres
36 or larger and all roadless islands, regardless of size, within the National Wildlife Refuge and
37 National Park Systems and to recommend to the President the suitability of each such area or
38 island for inclusion in the National Wilderness Preservation System, with final decisions to be

1 made by Congress. The Secretary of Agriculture was directed to study and recommend suitable
2 areas within the National Forest System. The Act provides criteria for determining suitability and
3 establishes restrictions on activities that can be undertaken in a designated area. It authorizes
4 the acceptance of gifts, bequests, and contributions in furtherance of the purposes of the Act
5 and requires an annual report at the opening of each session of Congress on the status of the
6 wilderness system.

7 **Organic Act of 1916** (16 USC 1 et. seq). This act created the National Park Service (NPS)
8 within the Department of Interior with responsibility for protecting the 35 national parks and
9 monuments then managed by the department and those yet to be established (NPS 2018). An
10 Executive Order (EO) in 1933 transferred 56 national monuments and military sites from the
11 Forest Service and the War Department to NPS.

12 **EO 13112 on Invasive Species**. This EO requires federal agencies to prevent the introduction
13 of invasive species and provide for their control, and then to minimize the economic, ecological,
14 and human health effects that invasive species cause.

15 **EO 13186 on Migratory Birds**. When actions have, or are likely to have, a measurable
16 negative effect on migratory bird populations, this EO directs federal agencies to develop and
17 implement a Memorandum of Understanding with USFWS that promotes the conservation of
18 migratory bird populations.

19 3.14.1.2 State Laws and Regulations

20 The state laws and regulations relevant to biological resources include, but are not limited to,
21 the following:

22 **Arizona Native Plant Law** (Arizona Revised Statute § 3-903 through 3-905). This law protects
23 various native species that are naturally occurring (not landscaped or planted) individuals.

24 **Arizona Noxious Weed Law** (Arizona Revised Statute § 3-201 et seq.). The Arizona Noxious
25 Weed Law establishes that the Arizona Department of Agriculture (AZDA) may treat, spray,
26 control, suppress, or eradicate noxious weeds, crop pests, or diseases through a county-wide,
27 area-wide, or state-wide program or programs. The AZDA may take whatever actions necessary
28 to assist, support, or enforce such programs, including entering any fields to treat, spray,
29 control, suppress, or eradicate noxious weeds, crop pests, or diseases under these authorized
30 or approved programs (Arizona State Legislature 2017).

31 **EO 91-6 Protection of Riparian Areas** (State of Arizona Governor EO 91-6). This order aims
32 to recognize that the protection and restoration of riparian areas are of critical importance to the
33 state, to encourage the development of practices that would enhance and restore degraded
34 riparian areas, to promote public awareness about riparian areas, and to seek cooperation from
35 regulatory and resource agencies to help in the protection and preservation of these areas.

36 3.14.1.3 Local Ordinances and Plans

37 Pima County is the only local jurisdiction within the Study Area with ordinances protecting
38 biological communities.

39 **Pima County Native Plant Ordinance**. The Pima County Native Plant Ordinance (Pima County
40 Zoning Code §§ 18.72) adopts comprehensive requirements for the preservation in place,

- 1 transplanting on site, and mitigation of protected native plants and native plant communities.
2 The ordinance provides requirements and regulations for the preparation and implementation of
3 preservation plans (Pima County 2017).
- 4 In June 1998 Pima County adopted by resolution the Native Plant Preservation Manual (Pima
5 County 1998). The purpose of the manual is to provide standards and procedures for
6 implementing the requirements of the Pima County Native Plant Ordinance.
- 7 **Pima County Multi-Species Conservation Plan for Pima County, Arizona.** Following the
8 1997 listing of the cactus ferruginous pygmy-owl (*Glaucomys flavescens*) as a
9 federally endangered species, the Pima County Board of Supervisors initiated the Sonoran
10 Desert Conservation Plan (SDCP). The purpose of the SDCP was to develop a regional plan to
11 address the long-term conservation and preservation of Pima County's natural and cultural
12 resources (Pima County 2016).
- 13 This Multi-Species Conservation Plan represents the culmination of many years of planning and
14 studies in the development of the biological element of the SDCP. That work effort was guided
15 by the SDCP biological goal, as established by the Science Technical Advisory Team. In 2001,
16 the Pima County Board of Supervisors adopted the Pima County Comprehensive Land Use
17 Plan Update (Pima County 2001), which incorporated land use concepts, policies, and
18 principles of conservation that were identified in the draft Preliminary SDCP (Pima County
19 2000). Other milestones in the development of the SDCP include defining land-protection
20 priorities, securing funds for land acquisitions, acquiring and managing new preserves, and
21 revising and updating County regulations. Formalizing the County's conservation commitments
22 for compliance with the ESA is the next milestone in advancing the vision of the SDCP.
- 23 **City of Tucson Habitat Conservation Plan (HCP).** The City of Tucson HCP addresses
24 proposed development activities in three City of Tucson planning sub-areas: Southlands, Avra
25 Valley, and Santa Cruz River (City of Tucson 2018). The plan covers eight species: the cactus
26 ferruginous pygmy-owl, the Pima pineapple cactus (PPC) (*Coryphantha scheeri* var.
27 *robustispina*), the western burrowing owl (*Athene cunicularia hypugaea*), the Tucson shovel-
28 nosed snake (*Chionactis occipitalis klauberi*), the ground snake (valley form) (*Sonora*
29 *semiannulata*), the needle-spined pineapple cactus (*Echinomastus erectocentrus* var.
30 *erectocentrus*), the pale Townsend's big-eared bat (*Corynorhinus townsendii pallescens*), and
31 the western yellow-billed cuckoo (*Coccyzus americanus*).
- 32 **City of Tucson Avra Valley HCP.** The City of Tucson owns more than 21,000 acres of land
33 west of the city limits in the Avra Valley area of Pima County. These former farmlands were
34 purchased in the 1970s and 1980s to secure the water rights, preserve groundwater for urban
35 use, and allow for the future development of water infrastructure supply projects. Since
36 purchased, some of the formerly cleared lands have recovered to a more naturally vegetated
37 state and now support native plants and animals, including some federally recognized species.
38 The City of Tucson and USFWS began working on the Avra Valley HCP in 2004, and the final
39 draft plan was submitted to USFWS in 2014 (City of Tucson 2014). Seven species are proposed
40 for coverage by the Avra Valley HCP: the lesser long-nosed bat (*Leptonycteris curasoae*
41 *yerbabuena*), the pale Townsend's big-eared bat, western yellow-billed cuckoo, the cactus
42 ferruginous pygmy-owl, the western burrowing owl, the Sonoran desert tortoise, and the Tucson
43 shovel-nosed snake.

1 **3.14.2 Methodology**

2 Biological resources are described at a landscape-level (i.e., large-scale) within the Study Area
3 as defined in the *Alternative Selection Report* (see **Figure 1-1** [I-11 Corridor Study Area
4 {Nogales to Wickenburg}]).

5 Regional vegetation communities, Large Intact Blocks (LIBs), and riparian areas were identified
6 using available literature and digital spatial data, much of which was provided by the Arizona
7 Game and Fish Department (AGFD). Specific wildlife data also provided by AGFD were used in
8 analyzing potential impacts to wildlife and their habitat.

9 This analysis identifies and considers project effects on general wildlife, special-status species,
10 special management areas, and HCPs within the Study Area. The Study Area encompasses
11 and/or crosses a number of the wildlife linkages identified in the Arizona’s Wildlife Linkages
12 Working Group Assessment (AWLWG 2006a) and in later wildlife corridor identification efforts.
13 Coordination with AGFD, USFWS, the Bureau of Land Management (BLM), and other resource
14 agencies and stakeholders will continue throughout the development of the Draft and Final
15 Tier 1 EIS to address any outstanding issues or concerns. **Appendix E14** provides additional
16 detail on the methodology.

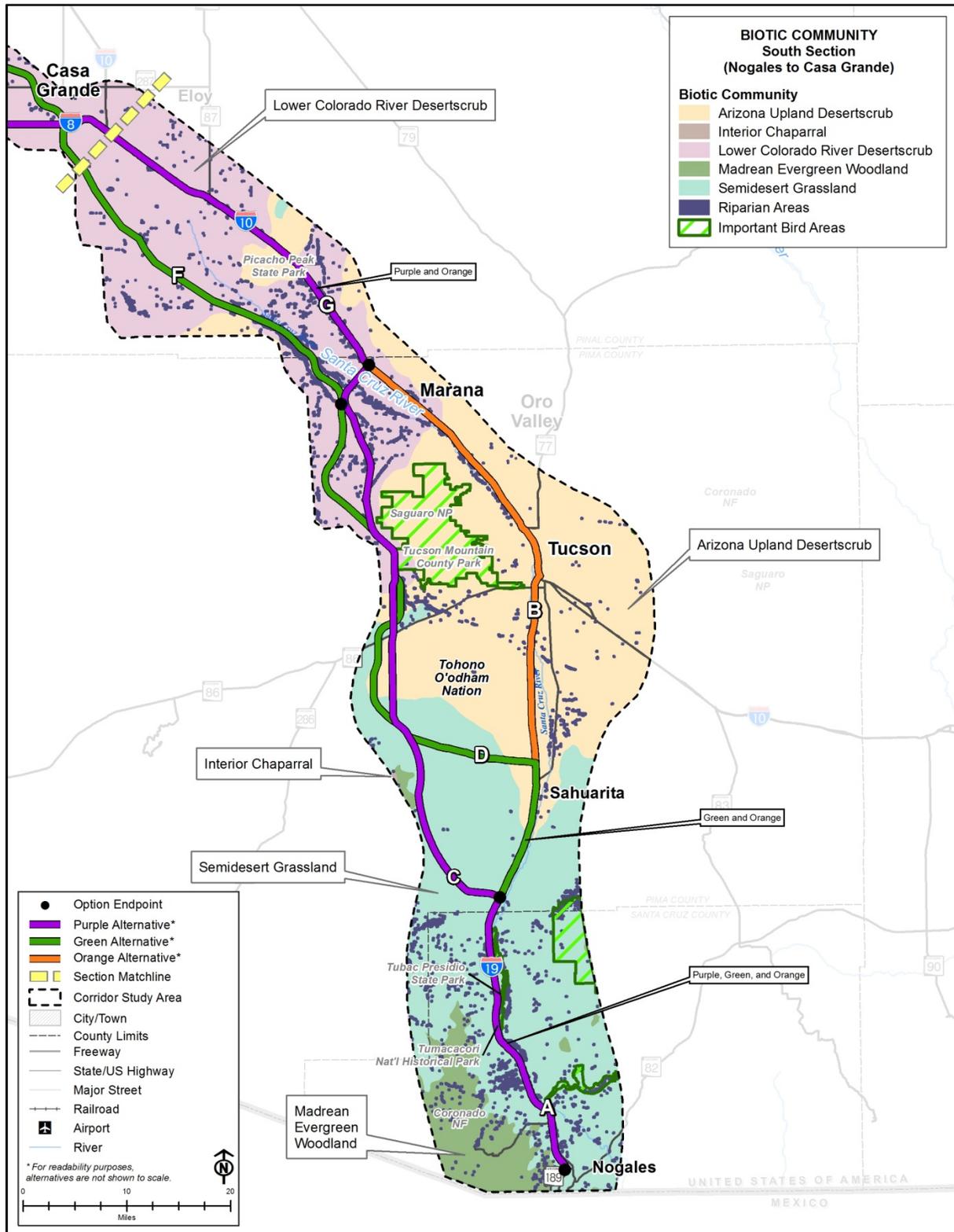
17 The effects analysis qualitatively considers the difference between the biological impacts
18 created by Corridor Options that involve a new roadway versus Options that are co-located with
19 existing roads. Acreage calculations were generated to estimate the presence of resources
20 within the 2,000-foot-wide corridor for all Options that have the potential to be directly impacted.
21 The Options that are not co-located may only involve a 400-foot impact footprint that would be
22 located within the 2,000-foot-wide corridor during the Tier 2 analysis. Options that would be co-
23 located with existing roads may or may not need widening of the existing roadway; therefore,
24 these co-located Options would affect a smaller width of new right-of-way (ROW). This
25 difference in the potential for impact is noted, where necessary, in various discussions.

26 **3.14.3 Affected Environment**

27 **3.14.3.1 Biotic Communities**

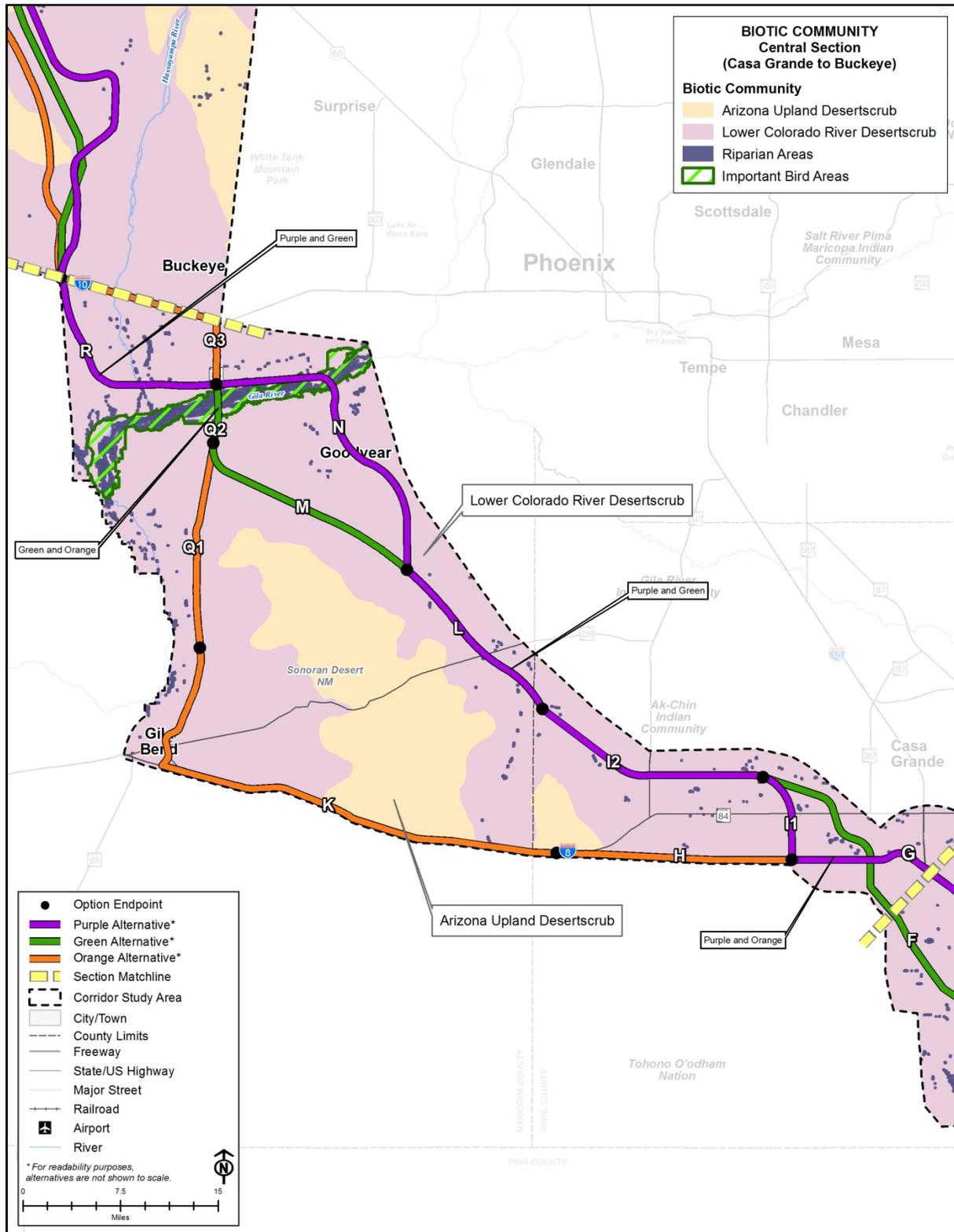
28 Biotic communities are characterized by distinct assemblages of plants and animals that are
29 characteristic of the surrounding soils, geology, climate, and other environmental conditions that
30 interact to develop the distinctiveness of one biotic community from the other communities
31 within a region. The Study Area crosses six major biotic communities. In addition to these major
32 biotic communities, the I-11 Build Corridor Alternatives also cross several smaller ecological
33 communities and/or special conservation areas, such as riparian areas and designated
34 Important Bird Areas (IBAs) (Audubon Arizona 2017) that provide important habitat for birds and
35 other wildlife (see **Appendix E14** for more information on plant and animal assemblages within
36 each biotic community).

37 **Figure 3.14-1** (Biotic Communities – South Section), **Figure 3.14-2** (Biotic Communities –
38 Central Section), and **Figure 3.14-3** (Biotic Communities – North Section), show the biotic
39 communities crossed by each of the Build Corridor Alternatives. A description of each biotic
40 community present in the Study Area is provided. **Table 3.14-1** (Total Acreage for Each Biotic
41 Community within the Study Area) summarizes the areas for each biotic community within the
42 Study Area.



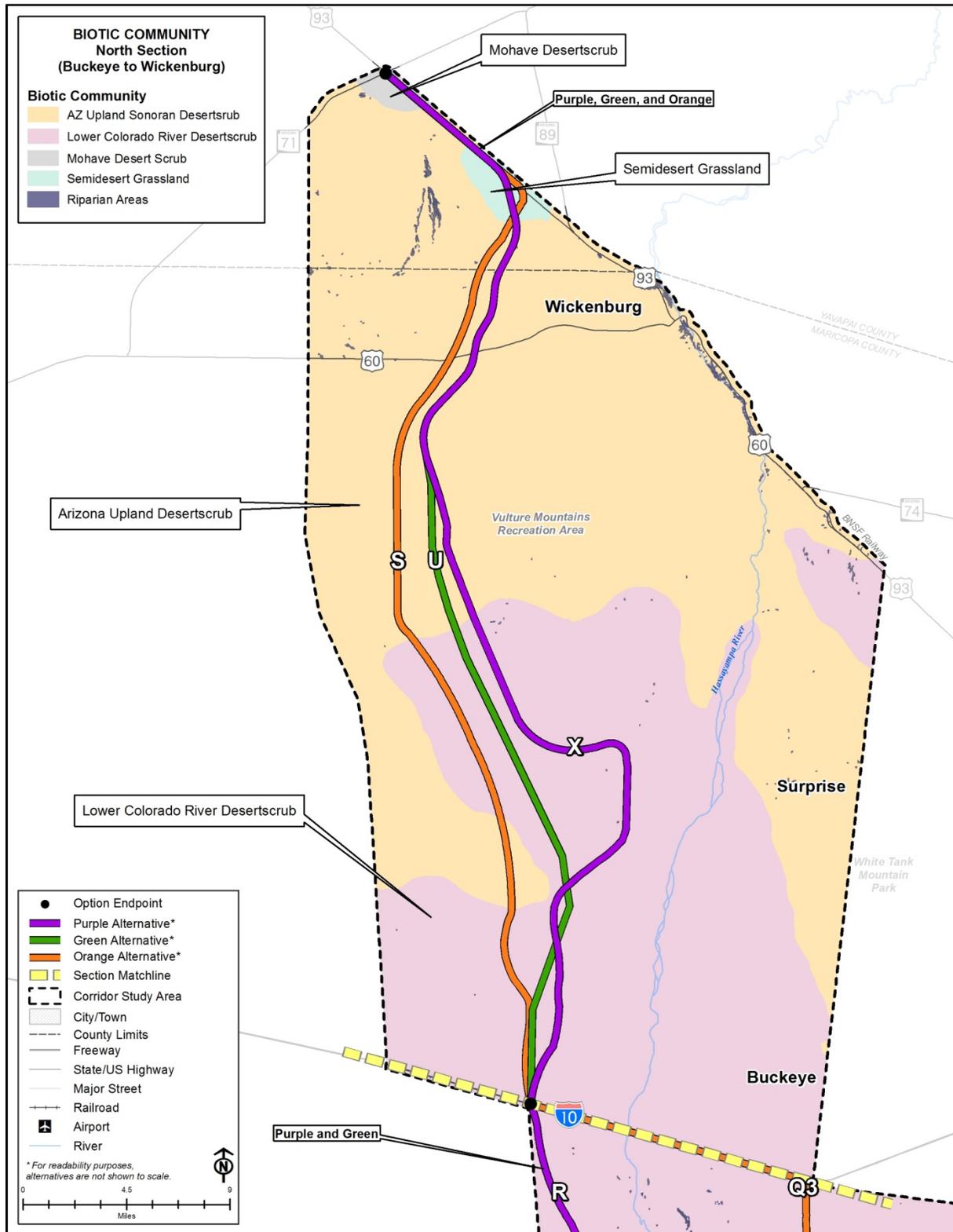
SOURCE: Brown 1994.

Figure 3.14-1 Biotic Communities – South Section



SOURCE: Brown 1994.

Figure 3.14-2 Biotic Communities – Central Section



SOURCE: Brown 1994.

Figure 3.14-3 Biotic Communities – North Section

1 **Semidesert Grassland:** Semidesert grasslands are typically found between 3,600 and
2 5,600 feet above mean sea level (amsl). Winter temperatures are relatively mild, with freezing
3 temperatures occurring less than 100 days out of the year. Summers are warm to hot, with
4 several days over 100 degrees Fahrenheit (Brown 1994). Most areas are characterized by short
5 grasses interspersed with a variety of low-growing trees, shrubs, and cacti. Grass species
6 include: Tobosa grass (*Pleuraphis mutica*), black grama (*Bouteloua eriopoda*), slender grama
7 (*B. repens*), spruce top grama (*B. chondrosioides*), several species of three-awn (*Aristida* spp.),
8 and bush muhly (*Muhlenbergia porter*).

9 **Madrean Evergreen Woodlands:** Madrean Evergreen Woodlands are typically found on low
10 mountains and hills at elevations ranging from 5,000 to 7,000 feet amsl. Evergreen oaks
11 (*Quercus* spp.) dominate, and junipers (*Juniperus* spp.) and pines (*Pinus* spp.) also occur. Open
12 savannas are common in some areas, with numerous grasses growing beneath the oaks.
13 Common tree species include: Emory oak (*Quercus emoryi*), Mexican blue oak (*Q. oblongifolia*),
14 Arizona white oak (*Q. arizonica*), Silverleaf oak (*Q. hypoleucoides*), and one-seed juniper
15 (*Juniperus monosperma*).

16 **Sonoran Desertscrub Arizona Upland Subdivision:** Arizona Upland Subdivision of the
17 Sonoran Desertscrub biotic community (Arizona Upland Desertscrub) typically is found on low
18 mountains, hills, and bajadas at elevations ranging from 980 to 3,500 feet amsl. Trees are
19 common on rocky slopes as well as drainages; saguaros (*Carnegiea gigantea*) are found
20 everywhere except for the valley floors. Dominant trees include yellow palo verde (*Parkinsonia*
21 *microphylla*), blue palo verde (*P. florida*), ironwood (*Olneya tesota*), and mesquite (*Prosopis*
22 spp.). In addition to saguaro, numerous other succulent species are found in this community
23 including: chain-fruit cholla (*Cylindropuntia fulgida*), organ pipe (*Stenocereus thurberi*),
24 pincushion cactus (*Mammillaria* and *Escobaria* spp.), and California barrel cactus (*Ferocactus*
25 *cylindraceus*).

26 **Sonoran Desertscrub Lower Colorado River Valley Subdivision:** The Sonoran Desertscrub
27 Lower Colorado River Valley Subdivision (Lower Colorado River Desertscrub) consists of
28 brushy flatlands transected by dry washes at elevations ranging from 80 to 1,300 feet amsl.
29 Vegetation is dominated by low, open stands of creosote bush (*Larrea tridentata*) and white
30 bursage (*Ambrosia dumosa*). Cacti, although present, are less abundant than in the neighboring
31 upland division. Trees and taller vegetation are largely confined to washes and other drainages.

32 **Mohave Desertscrub:** Topography in this community includes flatlands, plains, low hills, and
33 bajadas at elevations ranging from 980 to 4,270 feet amsl. Landscapes are typically barren and
34 desolate in appearance with low, scattered shrubs. The shrubs are predominately creosote
35 bush, brittlebush (*Encelia farinosa*), white bursage, desert holly (*Atriplex hymenelytra*),
36 shadscale saltbush (*Atriplex confertifolia*), and blackbrush (*Coleogyne ramosissima*). Annuals
37 cover the ground in wet years. Although this landscape is shrub-dominated and lacks giant cacti
38 and many tree species, several large plants such as the Joshua tree (*Yucca brevifolia*) and
39 Mojave yucca (*Yucca schidigera*) form a scattered overstory in places.

Table 3.14-1 Total Acreage for Each Biotic Community within the Study Area

Biotic Community	South Section		Central Section		North Section		Overall	
	Acres	% Total Area	Acres	% Total Area	Acres	% Total Area	Acres	% Total Area
Lower Colorado River Desertscrub	387,235	28.4	640,498	80.2	230,621	42.8	1,258,350	46.6
Arizona Upland Desertscrub	472,095	34.6	157,856	19.8	301,608	56.0	931,560	34.5
Semidesert Grassland	430,718	31.6	0	0.0	4,311	<1	435,029	16.1
Interior Chaparral	222	<0.1	0	0.0	0	0.0	222	<0.1
Madrean Evergreen Woodland	72,657	5.3	0	0.0	0	0.0	72,657	2.7
Mohave Desertscrub	0	0.0	0	0.0	2,301	<1	2,301	<0.1
Total	1,362,927	100	798,354	100	538,841	100	2,700,119	100
Riparian	Acres	% Total Area	Acres	% Total Area	Acres	% Total Area	Acres	% Total Area
North American Warm Desert Lower Montane Riparian Woodland and Shrubland	13	<0.01	0	0.0	0	0.0	13	<0.01
North American Warm Desert Riparian Woodland and Shrubland	241	<0.01	458	0.02	45	<0.01	745	<0.03
North American Arid West Emergent Marsh	12	<0.01	0	0.0	0	0.0	12	<0.01
North American Warm Desert Riparian Mesquite Bosque	849	<0.03	256	0.01	87	<0.01	1,192	0.04
North American Warm Desert Wash	8	<0.01	0	0.0	0	0.0	9	<0.01
Invasive Southwest Riparian Woodland and Shrubland	10	<0.01	354	0.01	0	0.0	364	0.01
Open Water	61	<0.01	63	<0.01	2	<0.01	127	<0.01
Total Riparian	1,195	0.04	1,131	0.04	135	<0.01	2,461	0.09

SOURCE: Surface area values based on a digital map of the biotic communities of Arizona based on Brown's descriptions (The Nature Conservancy 2004) and a map of the distribution of the different types of riparian areas in Arizona (US Geological Survey [USGS] 2004).

1 Riparian Habitats

2 Seven different riparian habitats are described in the USGS National Gap Analysis Program
 3 report Provisional Digital Land Cover Map for the Southwestern US (USGS 2004). Some of the
 4 major riparian habitats within the Study Area include Sonoita Creek and the Santa Cruz, Gila,
 5 and Hassayampa rivers. Segments of Sonoita Creek, the Santa Cruz River, and the Gila River
 6 within the Study Area also are included in IBAs. Many of the riparian areas also fall under the
 7 provisions of the Clean Water Act and are discussed in Section 3.13.

8 *North American Warm Desert Lower Montane Riparian* habitats are riparian woodlands and
 9 shrublands found in the foothills and mountain canyons and valleys. They are usually narrow,



1 wet habitats along the streams, with a patchy mosaic of open woodlands or forests, willows,
2 rushes, sedges, and moist herbs and grasses.

3 *North American Warm Desert Riparian Woodland and Shrubland* habitats are woodlands and
4 shrublands that occur along low-elevation rivers and streams in desert valleys and canyons.

5 *North American Arid West Emergent Marsh* habitats are natural marshes that occur in
6 depressions, as fringes around lakes, and along slow-flowing streams and rivers. They are
7 frequently or continually flooded with water depths up to 6 feet deep, but have rooted, mostly
8 grasslike plants.

9 *The North American Warm Desert Riparian Mesquite Bosque* habitat consists of low elevation
10 riparian corridors along perennial and intermittent streams in valleys of the warm desert regions.
11 Rivers include the Gila, Santa Cruz, and Salt rivers and their tributaries that occur in the desert
12 portions of their range.

13 *North American Warm Desert Wash* habitats are intermittently flooded washes or arroyos that
14 often dissect alluvial fans, mesas, plains, and basin floors. Although often dry, the stream
15 processes define this type, which are often associated with rapid sheet and gully flow. Desert
16 wash plants may be sparse and patchy to moderately dense, and they typically occur along the
17 banks, but occasionally occur within the channel.

18 *Invasive Southwest Riparian Woodland and Shrubland* habitats are dominated by introduced
19 (invasive) plant species such as tamarisk (*Tamarisk* spp). Land occupied by introduced
20 vegetation is generally permanently altered or converted. Land cover in this habitat is
21 altered/disturbed by introduced riparian and wetland vegetation.

22 *Open Water* habitats are relatively permanent water bodies that are primarily unvegetated.
23 Open water habitats include ponds, lakes, streams, and canals.

24 **Important Bird Areas**

25 The Arizona Important Bird Area Program is part of an international program with the purpose of
26 identifying a network of sites that maintain the long-term viability of wild bird populations. Six
27 Arizona Important Bird Area Program sites are located within the Study Area (Arizona Important
28 Bird Area Program 2011) and are shown in **Figure 3.14-1** (Biotic Communities – South Section)
29 and **Table 3.14-2** (Important Bird Areas within the Study Area). Many of the IBAs within the
30 Study Area, such as the Sonoita Creek IBA, Upper Santa Cruz River IBA, and the Gila River
31 IBA, are associated with riparian habitats. Other IBAs, such as the Santa Rita Mountains and
32 the Tucson Sky Islands IBAs are associated with large, relatively undisturbed habitat blocks.
33 **Table 3.14-2** (Important Bird Areas within the Study Area) summarizes the acreages of IBAs
34 within the Study Area.

Table 3.14-2 Important Bird Areas within the Study Area

Important Bird Areas (IBA)	South Section		Central Section		North Section		Corridor Study Area	
	Acres	% of Area	Acres	% of Area	Acres	% of Area	Acres	% of Area
Sonoita Creek State Natural Area/Patagonia Lake IBA	3,193	0.2	0	0.0	0	0.0	3,193	0.1
Upper Santa Cruz River IBA	2,184	0.2	0	0.0	0	0.0	2,184	<0.1
Santa Rita Mountains IBA	13,565	1.0	0	0.0	0	0.0	13,565	0.5
Tanque Verde Wash/Sabino Canyon IBA	26	<0.1	0	0.0	0	0.0	26	<0.1
Tucson Sky Islands IBA	47,183	3.5	0	0.0	0	0.0	47,183	1.7
Lower Salt and Gila Riparian Ecosystem IBA	0	0.0	27,125	3.4	0	0.0	27,125	1.0
Total IBA Area	66,151	4.9	27,125	3.4	0	0.0	93,275	3.5

1 Species of Economic and Recreational Importance

2 Some of the more common species associated with the biotic communities within the I-11 Study
3 Area also are AGFD Species of Economic and Recreational Importance (SERI) in the state. The
4 Arizona State Wildlife Action Plan – 2012-2022 (SWAP) (AGFD 2012a) describes five factors
5 that are important in modeling areas for conservation potential. One of the factors is the
6 economic importance of the landscape, which is represented by SERI.

7 This category represents the economic and recreational importance of 13 of Arizona’s huntable
8 species. The distribution of these species influences important aspects of wildlife-related
9 recreation and the distribution of consumer spending across the state. Together, the economic
10 and recreational importance of game species to hunters, the community, and AGFD provide a
11 realistic view of the importance of game habitat for conservation. The SWAP provides a
12 description of the model and its various elements (AGFD 2012a).

13 AGFD and the Theodore Roosevelt Conservation Partnership conducted a survey of randomly
14 selected Arizona hunters/anglers, asking them to identify the areas of Arizona they most value
15 for hunting and fishing. A map depicting the results of the survey (AGFD 2016) suggests that a
16 high to moderate number of participants found portions of the Study Area to be of value to them
17 for hunting mule deer (*Odocoileus hemionus*), whitetail deer (*Odocoileus virginianus*), javelina
18 (*Pecari tajacu*), desert bighorn sheep (*Ovis canadensis nelsoni*), Gambel’s quail (*Callipepla*
19 *gambelii*), dove species, waterfowl species, and other small game species. Respondents also
20 noted they valued a few areas within the Study Area for warmwater sportfishing (AGFD 2018a).

21 Invasive Species

22 Invasive and noxious species are a major concern in Arizona and across the country. These
23 species are generally well suited to colonizing disturbed areas such as roadways. Because
24 these species can readily adapt, they frequently supplant the native species, affecting the
25 overall viability of the biotic community. The Arizona Department of Transportation (ADOT)
26 tracks the location of invasive species within the road ROW for which they have responsibility
27 and attempts to eradicate or control the spread of these species. The presence of invasive or
28 noxious weed species within undeveloped areas is generally unknown.

29 The Biological Technical Memorandum (**Appendix E14**) lists the non-native invasive plants
30 known to occur within the Study Area. The list is not an all-inclusive list, as much of the Study



1 Area is located in undeveloped lands where invasive and noxious weed surveys have not
2 previously occurred.

3 Fifty-two invasive and noxious plant species have been found within the Study Area. Three of
4 the species listed are aquatic and 49 are terrestrial. Data were compiled from several sources
5 and include information on federally listed noxious weeds, state-regulated noxious weeds, and
6 state-listed prohibited noxious weeds, and on lists maintained by AZDA and ADOT.

7 **3.14.3.2 Special-Status Species**

8 Special-status species include plant and animal species that have received special designations
9 by a federal, state, or local governmental agency due to concerns regarding rarity and/or a
10 species' sensitivity to perturbations in the environment.

11 **Endangered Species Act Species**

12 USFWS Information for Planning and Consultation publishes information online for ESA
13 threatened, endangered, proposed, candidate, petitioned, and conservation agreement species.
14 Special-status species potentially occurring in Santa Cruz, Pima, Pinal, Maricopa, and Yavapai
15 counties were reviewed to determine if any of these species could potentially occur in the
16 vicinity of the Study Area. Twelve species listed as threatened or endangered and critical habitat
17 for five species occur within the Study Area.

18 Only species listed as threatened or endangered were analyzed as ESA-listed species, with the
19 exception of the Sonoran desert tortoise (*Gopherus morafkai*), which is a Candidate
20 Conservation Agreement (CCA) species. The tortoise was given Candidate status (under ESA)
21 on December 14, 2010. On October 6, 2015, USFWS determined that listing this species was
22 not warranted at this time, due in part to the CCA (USFWS 2015b) developed in cooperation
23 with AGFD, USFWS, ADOT, and 13 other federal agencies. The tortoise was included in the
24 ESA species analysis because of the potentially large detrimental impacts of I-11 to this species
25 and because ADOT is a signatory to the tortoise CCA. Other species protected under a
26 conservation agreement were included with other sensitive species in this analysis. No
27 proposed, candidate, or petitioned species were located in the Study Area.

28 The potential for an ESA species to occur within the South, Central and North Sections of the
29 Study Area is denoted in **Table 3.14-3** (Distribution of ESA Protected Species within the Study
30 Area). The table provides information on habitat requirements and species distribution to
31 determine the likelihood that habitat for a particular species may be present in each section of
32 the Study Area.

33 **Critical and Protected Habitat**

34 **Table 3.14-4** (Total Surface Area Covered by ESA Critical Habitat, 10(j) Experimental
35 Population Areas or other Protected Populations within the Study Area) provides information on
36 critical habitat for ESA species that occur within the Study Area. In addition to ESA proposed
37 and designated critical habitat, **Table 3.14-4** (Total Surface Area Covered by ESA Critical
38 Habitat, 10(j) Experimental Population Areas or other Protected Populations within the Study
39 Area) provides information on other protected habitats, such as USFWS 10(j) Experimental
40 Population/Reintroduction Areas for the Mexican wolf (*Canis lupus baileyi*) and the Sonoran
41 pronghorn (*Antilocapra americana sonoriensis*). The table also includes information on Sonoran
42 desert tortoise BLM Category I and II habitat as well as habitat modeled by USFWS as "High

1 Value Potential Habitat” (USFWS 2015e). Critical habitat for the Sonora chub (*Gila ditaenia*)
2 does not occur within the Study Area; this species is therefore not included in the table.

3 **Other Sensitive Species**

4 In addition to species protected under the federal ESA (see **Table 3.14-3** [Distribution of ESA
5 Protected Species within the Study Area] and **Table 3.14-4** [Total Surface Area Covered by
6 ESA Critical Habitat, 10(j) Experimental Population Areas or other Protected Populations within
7 the Study Area]), additional sensitive species were analyzed. All sensitive species were
8 analyzed to determine if they occur within the Study Area. **Appendix E14** (Biological Technical
9 Memorandum), includes several additional categories of species deemed sensitive by BLM, the
10 US Forest Service (USFS), and USFWS; species protected under the Bald and Golden Eagle
11 Protection Act; state listed Species of Greatest Conservation Need (SGCN); county-listed
12 species; and plant species protected under the Arizona Native Plant Law as Salvage Restricted
13 or Highly Safeguarded.

14 Geographic Information System (GIS) data provided by AGFD (AGFD 2017a) along with Pima
15 County’s list of sensitive species and Pima County Priority Conservation Area coverages (Pima
16 County 2016, 2013) were used to find species that were within the Study Area but not included
17 on the AGFD Heritage Data Management System (HDMS) list. The majority of the species listed
18 in the Tohono O’odham Nation’s list of sensitive species are included in the Tier I analyses, as
19 these species are considered sensitive by other land management entities as well. The Build
20 Corridor Alternatives generally avoid Tribal lands, so the remaining Tohono O’odham Nation
21 sensitive species were therefore not analyzed.

22 **Migratory Bird Treaty Act**

23 The Sonoran Desert is home to more than 500 species of birds (Arizona-Sonora Desert
24 Museum 2000). The majority of these species are migratory and are protected under the MBTA.
25 Nonnative species whose occurrences in the US are solely the result of intentional or
26 unintentional human-assisted introduction are not covered by the MBTA. Migratory birds’
27 requirements for habitat vary by species, and many species use Sonoran Desert habitats,
28 agricultural and floodplain habitats, and/or open water habitats. The sensitive species analysis
29 includes a discussion of impacts to migratory birds. .

Table 3.14-3 Distribution of ESA Protected Species within the Study Area

Common Name	Scientific Name	Status (defined in table note)	South	Central	North	Habitat Requirement
Amphibians						
Chiricahua leopard frog with critical habitat	<i>Lithobates chiricahuensis</i>	USFWS - LT, AGFD SGCN 1A, Pima	X			Permanent or semi-permanent streams, rivers, backwaters, ponds, and stock tanks that are mostly free from introduced fish, crayfish, and bullfrogs. Elevation: 3,300 – 8,900 feet amsl (AGFD 2015).
Birds						
Mexican spotted owl with critical habitat	<i>Strix occidentalis lucida</i>	USFWS - LT, AGFD SGCN 1A	X			Mature, multistoried, uneven-aged forests with high canopy cover and diverse understories of shade-tolerant species, or rocky canyons with water, cool microclimates, and vertical cliffs containing crevices, ledges, and caves. Cover types include pine-oak, mixed-conifer, riparian, or Madrean woodlands. Elevation: 4,100 – 9,000 feet amsl (AGFD 2005; USFWS 2013a, 2012).
Southwestern willow flycatcher with critical habitat	<i>Empidonax traillii extimus</i>	USFWS - LE, AGFD SGCN 1A, Pima	X	X	X	Dense riparian vegetation with thickets of trees and shrub along rivers, streams, perimeters of lakes, or other wetlands. Generally require surface water or saturated soil. Dominant plant species, vegetation height and density, size and shape of habitat patches, and canopy structure vary widely, but generally flycatchers are not found nesting in areas without willows, tamarisk, or both. Elevation: sea level to over 8,500 feet amsl (AGFD 2002; USFWS 2014a).

Table 3.14-3 Distribution of ESA Protected Species within the Study Area (Continued)

Common Name	Scientific Name	Status (defined in table note)	South	Central	North	Habitat Requirement
Yellow-billed cuckoo (Western Distinct Population Segment [DPS]) with proposed critical habitat	<i>Coccyzus americanus</i>	USFWS - LT, USFS - S, AGFD SGCN 1A, Pima	X	X	X	Highly variable. Occurs in riparian woodlands, mesquite woodlands, or Madrean evergreen woodlands in perennial, intermittent, or ephemeral drainages, from dense contiguous patches of trees on wide floodplains to narrow stringers and small groves of scattered trees in more xero-riparian habitats. Canopy closure varies between and often within drainages. Elevation: sea level to 7,000 feet amsl (AGFD 2017b; Halterman et al. 2015; USFWS unpublished data).
Yuma Ridgeway's rail	<i>Rallus obsoletus yumanensis</i>	USFWS - LE, AGFD SGCN 1A		X		Cattail and bulrush marshes interspersed with areas of open water, mudflats, and drier upland benches with riparian trees and shrubs along rivers and backwaters. Also occurs in drains or sumps supported by irrigation water. Habitat value decreases over time due to natural marshland succession unless periodic flooding, fire, or management intervention occurs. Elevation: below 1,500 feet amsl (AGFD 2006; USFWS 2015c, 2010).

Table 3.14-3 Distribution of ESA Protected Species within the Study Area (Continued)

Common Name	Scientific Name	Status (defined in table note)	South	Central	North	Habitat Requirement
Fish						
Gila topminnow	<i>Poeciliopsis occidentalis occidentalis</i>	USFWS - LE, AGFD SGCN 1A, Pima	X			Shallow, warm margins of perennial and intermittent rivers, streams, pools, backwaters, and springs with slow currents and aquatic vegetation for cover. Can tolerate relatively high water temperatures and low dissolved oxygen. Elevation: below 5,000 feet amsl (AGFD 2001a; USFWS 2015d, 2008).
Sonora chub with critical habitat	<i>Gila ditaenia</i>	USFWS - LT, AGFD SGCN 1A	X			Regularly confined to pools near cliffs, boulders, or other cover during arid periods, but prefers riverine habitats with fairly swift current over sand and gravel substrates. Elevation: below 3,900 feet amsl (AGFD 2001b; USFWS 2013b).
Mammals						
Jaguar with critical habitat	<i>Panthera onca</i>	USFWS - LE, AGFD SGCN 1A	X			No habitat use studies have been conducted for jaguars in Arizona; however, based on limited records, Arizona jaguars appear to be associated with Madrean evergreen woodland and semidesert grassland biotic communities, usually in intermediately rugged to extremely rugged terrain with low human disturbance, within 6.2 miles of water. Elevation: all Arizona records are between 3,400 and 9,000 feet amsl (AGFD 2004; Culver 2016; USFWS 2016, 2014b).

Table 3.14-3 Distribution of ESA Protected Species within the Study Area (Continued)

Common Name	Scientific Name	Status (defined in table note)	South	Central	North	Habitat Requirement
Ocelot	<i>Leopardus pardalis</i>	USFWS - LE, AGFD SGCN 1A	X			Although no habitat use studies have been conducted for ocelots in Arizona, based on limited records, Arizona ocelots appear to be associated with Madrean evergreen woodland semidesert grassland, and Great Basin grassland biotic communities (AGFD 2010). Recorded locations in Arizona on average were <1.5 miles from perennial water, had 23% tree cover, and were >3.5 miles from a major road. Elevation: on average 5,500 feet amsl (Avila-Villegas and Lamberton-Moreno 2013; Culver 2016; USFWS 2016).
Plants						
Huachuca water-umbel	<i>Lilaeopsis schaffneriana</i> ssp. <i>recurva</i>	USFWS - LE, NPL - HS, Pima	X			Wide range of marshland communities, including cienegas, rivers, streams, and springs in permanently wet, muddy, or silty substrates. Generally occurs in perennial, shallow, slow-flowing, or quiet waters, or in active stream channels containing refugial sites where plants can escape scouring by floods. Considered a taxon of perennial water but can survive short periods without water. Elevation: 2,000 – 7,100 feet amsl (AGFD 2003a; USFWS 2017b, 2014c).
PPC	<i>Coryphantha scheeri</i> var. <i>robustispina</i>	USFWS - LE, NPL - HS, Pima	X			Ridges in semidesert grassland and alluvial fans in Sonoran desertscrub. Occurs on alluvial hillsides in rocky, sandy soils. Habitat type is primarily desert grassland. Elevation: 2,300 – 5,000 feet amsl (AGFD 2003b).

Table 3.14-3 Distribution of ESA Protected Species within the Study Area (Continued)

Common Name	Scientific Name	Status (defined in table note)	South	Central	North	Habitat Requirement
Reptiles						
Northern Mexican gartersnake	<i>Thamnophis eques megalops</i>	USFWS - LT, USFS - S, AGFD SGCN 1A, Pima	X			Lotic and lentic habitats with edges of dense emergent vegetation, including cienegas, ponds, stock tanks and lower gradient rivers and streams with pools, protected backwaters, braided side channels, and beaver ponds. Terrestrial habitats are used during gestation and periods of inactivity, and can occur up to 1 mile from surface water. Adequate ground cover important; canopy cover less so. Elevation: 3,000 – 5,000 feet amsl, but up to 6,500 feet (range-wide up to 8,500 feet) (AGFD 2012b; Emmons and Nowak 2016; USFWS 2017c, 2014d).
Sonoran desert tortoise	<i>Gopherus morafkai</i>	USFWS - CCA, USFS - S, BLM-S; AGFD SGCN 1A, Pima	X	X	X	Primarily rocky (often steep) hillsides and bajadas of Mojave and Sonoran desertscrub. May encroach into desert grassland, juniper woodland, interior chaparral, and pine communities. Washes and valley bottoms are used in dispersal. Elevation: 500 – 5,300 feet amsl (AGFD 2015d).

NOTE: **1A** = Tier of SGCN species for which the AGFD has entered into an agreement or has legal or contractual obligation, or warrants the protection of a closed season; **1B** = Tier of SGCN species that are not Tier 1A species; **AGFD** = Arizona Game and Fish Department; **CCA** = Candidate Conservation Agreement under the ESA; **USHS** = Highly Safeguarded under Arizona Native Plant Law; **LE** = Listed as Endangered under the ESA; **LT** = Listed as Threatened under the ESA; **NPL** = Arizona Native Plant Law; **Pima** = Listed by Pima County as Sensitive; **S** = Sensitive Species **SGCN** = Species of Greatest Conservation Need; **USFS** = US Forest Service; **USFWS** = US Fish and Wildlife Service.

SOURCE: **X** = documented species presence, AGFD (2017a).

Table 3.14-4 Total Surface Area Covered by ESA Critical Habitat, 10(j) Experimental Population Areas or other Protected Populations within the Study Area

Critical/Protected Habitat	South Section		Central Section		North Section		Overall	
	Acres	% Total Area	Acres	% Total Area	Acres	% Total Area	Acres	% Total Area
USFWS Designated or Proposed Critical Habitat								
Chiricahua leopard frog	54	<0.1	0	0.0	0	0.0	54	<0.1
Mexican spotted owl	40,027	2.9	0	0.0	0	0.0	40,027	1.5
Southwestern willow flycatcher	4,536	0.3	0	0.0	468	<0.1	5,003	0.2
Yellow-billed cuckoo (Western DPS)	4,398	0.3	12,961	1.6	1,110	0.2	18,468	0.7
Jaguar	127,179	9.3	0	0.0	0	0.0	127,179	4.7
Total Critical Habitat Excluding Species Overlap	138,388	10.1	12,961	1.6	1,149	0.2	152,498	5.6
USFWS 10(j) Experimental Population/Reintroduction Areas								
Mexican wolf 10(j) Area Zone 2	516,675	37.9	0	0.0	6,100	1.1	522,775	19.4
Mexican wolf 10(j) Area Zone 3	846,253	62.0	798,531	100.0	532,740	98.9	2,177,350	80.6
Sonoran pronghorn 10(j) Area - overall	846,253	62.0	798,531	100.0	2,868	0.5	1,647,500	61.0
Sonoran pronghorn Reintroduction Area A	0	0.0	2,798	0.4	0	0.0	2,798	0.1
Sonoran pronghorn Reintroduction Area D	0	0.0	11,925	1.5	0	0.0	11,926	0.4
Sonoran Desert Tortoise Habitat								
BLM Category I	7,290	0.5	154,265	19.3	0	0.0	161,555	6.6
BLM Category II	0	0.0	84,623	10.6	200,816	37.3	285,439	16.0
USFWS High Value Potential Habitat	96,138	7.05	114,324	8.38	115,978	8.50	326,440	23.93

NOTES: **10(j)** = section of the ESA authorizing the establishment of experimental populations outside a species' current range, but within its historical range; **BLM** = Bureau of Land Management; **DPS** = Distinct Population Segment; **ESA** = Endangered Species Act; **HDMS** = Arizona Game and Fish Department (AGFD) Heritage Data Management System; **OERT** = AGFD HDMS Online Environmental Review Tool; **USFWS** = US Fish and Wildlife Service.

SOURCES: Surface area values based on digital data of designated critical habitat assigned to species protected under the ESA (USFWS 2017a), USFWS Sonoran pronghorn and Mexican wolf 10(j) Experimental Population/Reintroduction Areas (USFWS 2015a, 2011), and based on digital data of Sonoran desert tortoise habitat as designated by BLM (BLM 2009) and USFWS (USFWS 2015e).

1 **3.14.3.3 Wildlife Connectivity**

2 The ability for wildlife to disperse or move between habitats and across landscapes is a
3 fundamental part of their life history. Connectivity in the landscape is maintained by comparable
4 habitat patches being close together or linked by corridors of suitable habitat that wildlife can
5 use or move through. All wildlife species require connectivity to complete essential aspects of
6 their life history, including dispersal, colonization, and access to resources. For instance, many
7 large mammal species can move tens or even hundreds of miles during seasonal migration or in
8 search of food and other important resources. Conversely, some wildlife move small distances
9 to obtain certain vital resources or to seek mating opportunities within habitat areas. In the long
10 term, connectivity affects the size and genetic viability of subpopulations, which play an
11 important role in the survival and persistence of populations. Human development fragments
12 and isolates naturally connected habitats across the landscape. In addition, the effects of urban
13 expansion on species dispersal may vary substantially across taxa (Perkl 2018). Research
14 demonstrates that deleterious impacts can be minimized or mitigated by focusing on protecting
15 and enhancing connections, corridors, or linkages between habitat areas (AGFD 2018a).

16 It is important to note that the synthesis of information in the efforts and reports completed on
17 wildlife connectivity in Arizona does not necessarily represent an exhaustive mapping of all
18 important wildlife linkages and barriers in the Study Area. Rather, this information should be
19 considered an initial assessment of wildlife movement patterns. This initial assessment will need
20 to be supplemented in the future by further analysis and refinement, including additional expert
21 input, research studies of wildlife movement patterns, and additional linkage delineation based
22 on site-specific data (AGFD 2018a)

23 As part of AGFD's management of wildlife and fisheries, the Arizona SWAP (AGFD 2012a)
24 presents an outline of a Species and Habitat Conservation Guide model that identifies the
25 conservation potential for lands within the state. AGFD decided to include five indicators of
26 wildlife conservation value in the model. Each of those indicators, or submodels, was developed
27 as a separate layer that can be used independently of the model. These five indicators are
28 (AGFD 2012a):

- 29 • The importance of the landscape in maintaining biodiversity – represented by the SGCN
- 30 • The economic importance of the landscape to the State of Arizona – represented by the
31 SERI
- 32 • The economic importance of the water bodies and aquatic systems to the State of Arizona –
33 represented by sport fish
- 34 • Large areas of relatively intact habitats – represented by unfragmented areas
- 35 • The importance of riparian habitat to wildlife – represented by riparian habitat

36 To help identify areas in the landscape that have very little to no development, AGFD created a
37 landscape integrity dataset (Perkl et al. 2013) by weighting and combining many factors that can
38 contribute to a human modification of the landscape (e.g., roads, railroads, airports, canals, and
39 housing). From this dataset, the most intact contiguous areas larger than 5,000 hectares were
40 extracted to represent LIBs. This size threshold was set by AGFD for a patch of habitat to be
41 considered a LIB; if a road segment reduces the size of a LIB so that it is smaller than this
42 threshold value or if that block is isolated by barriers, the functionality of the entire block is
43 compromised (AGFD 2018a).

1 **Figure 3.14-4** (Large Intact Block Clusters) depicts clusters of LIBs which are entirely or
2 partially contained within the Study Area. All of the Options being considered in the Draft Tier 1
3 EIS could influence these LIBs through habitat loss, fragmentation, and isolation. The LIB
4 clusters were delineated in GIS data provided by AGFD (AGFD 2018b). The assignment of LIBs
5 into numbered clusters is part of the AGFD GIS data supporting the discussion of the potential
6 environmental consequences to LIBs from the Build Corridor Alternatives. AGFD determined
7 LIB cluster associations by identifying road segments for which the average annual daily traffic
8 (AADT) is at least 5,000. Canals smaller than the Central Arizona Project (CAP) canal, also
9 were considered as potential breaks, but AGFD concluded that they currently do not represent
10 as much of barrier to movement compared to road segments with high traffic volumes. Traffic
11 density correlates with the barrier effect of roadways on wildlife. For instance, roads with
12 4,000 to 10,000 vehicles per day are considered a strong barrier because noise and movement
13 repel wildlife and individuals trying to cross the road become casualties. Roads with traffic levels
14 beyond 10,000 vehicles per day are considered impermeable to most species (Luell et al.
15 2003).

16 In 2006, an interagency working group in Arizona published Arizona's Wildlife Linkages
17 Assessment (AWLWG 2006a), which identified and mapped large areas of protected habitat
18 and the linkages between those that were threatened by fragmentation and isolation.
19 Subsequently, AGFD and other state and local agencies worked to refine both the habitat areas
20 in need of conservation and the specific wildlife movement corridors that connect these areas.

21 Between 2006 and 2008, AGFD contracted with Paul Beier at Northern Arizona University to
22 model the biologically best corridors in the areas ranked by the AWLWG as the highest priority
23 at the time. Their prioritization was based on the importance of retaining wildlife movements
24 through an area and on the perceived potential for further fragmentation of the area. Therefore,
25 modeling efforts should not be interpreted as an indication that wildlife linkages that were not
26 modeled are any less critical to wildlife movement across Arizona. AGFD used similar methods
27 to supplement the identified linkages in other priority areas between 2010 and 2013; the designs
28 in Pima County were performed through funding from the Pima County Regional Transportation
29 Authority. **Figure 3.14-5** (Detailed and Other Wildlife Linkage Designs – South Section) depicts
30 the detailed linkage designs based on this work for the South Section. **Figure 3.14-6** (Detailed
31 Linkage Designs – Central Section) and **Figure 3.14-7** (Detailed Linkage Designs – North
32 Section) depict the same information for the Central and North Sections, respectively. These
33 figures depict the wildland blocks, which represent the core areas used for modeling
34 connectivity in the Arizona Wildlife Linkages and AGFD Detailed Wildlife Connectivity Designs.

35 Wildlife corridors are permeable, contiguous habitats that help maintain connections among
36 larger areas of similar habitat and that cross areas surrounded by or otherwise fragmented by
37 human infrastructure (Turner et al. 2001). Although wildlife corridors represent a smaller
38 proportion of land across a given landscape, they are critical features that are needed to
39 maintain dispersal patterns, daily movements, and gene flow; to preserve migration routes; or to
40 conserve satellite populations within a metapopulation¹ network.

¹ A metapopulation is a group of populations of the same species that are separated from one another. These spatially separated populations can interact as individual members move from one population to another.

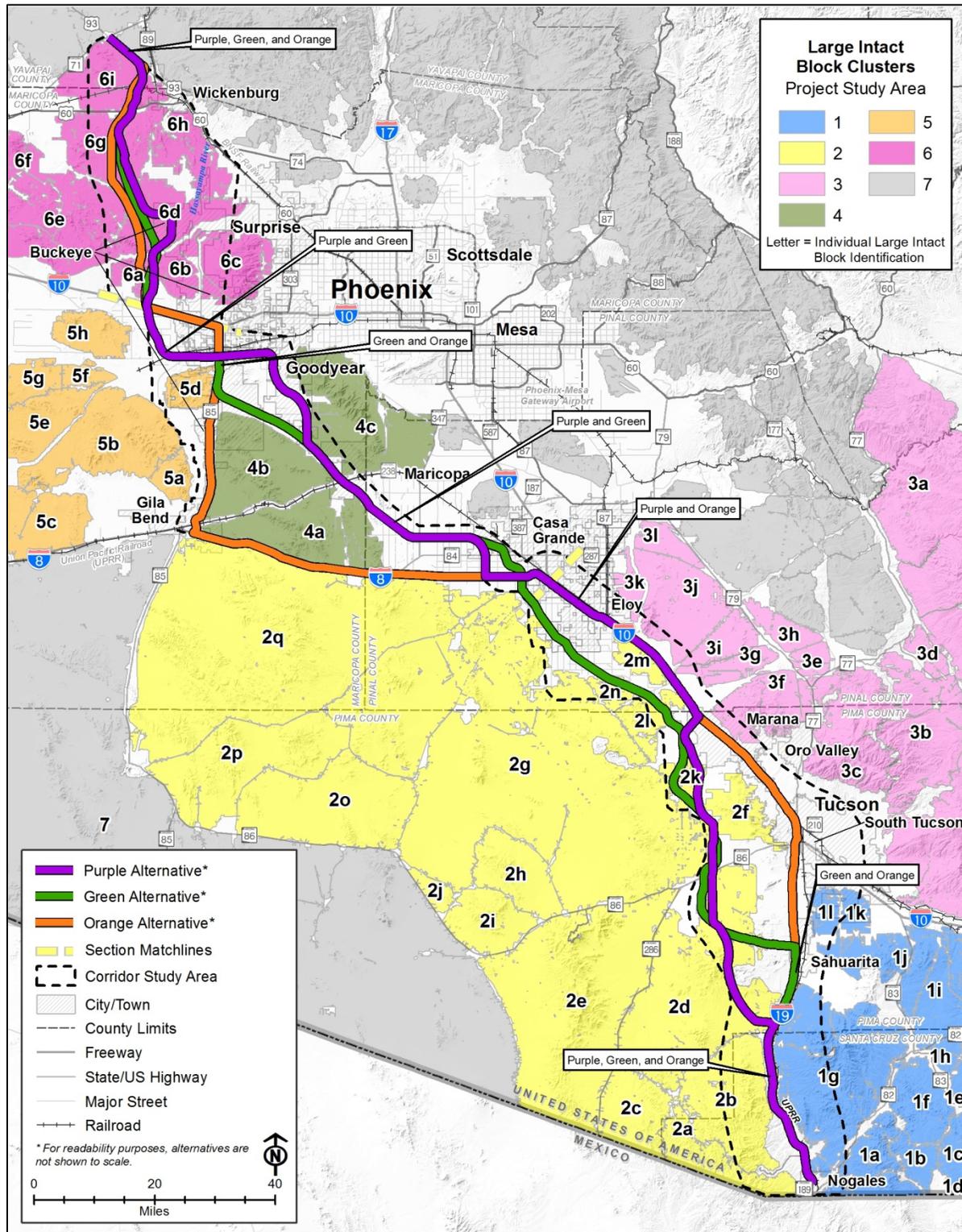


Figure 3.14-4 Large Intact Block Clusters

NOTE: Each number-letter combination corresponds to an individual Large Intact Block (LIB), where the number indicates the LIB cluster it belongs to. LIB Cluster 7 corresponds to the other LIBs that occur beyond the Study Area, and for which no calculations were made.

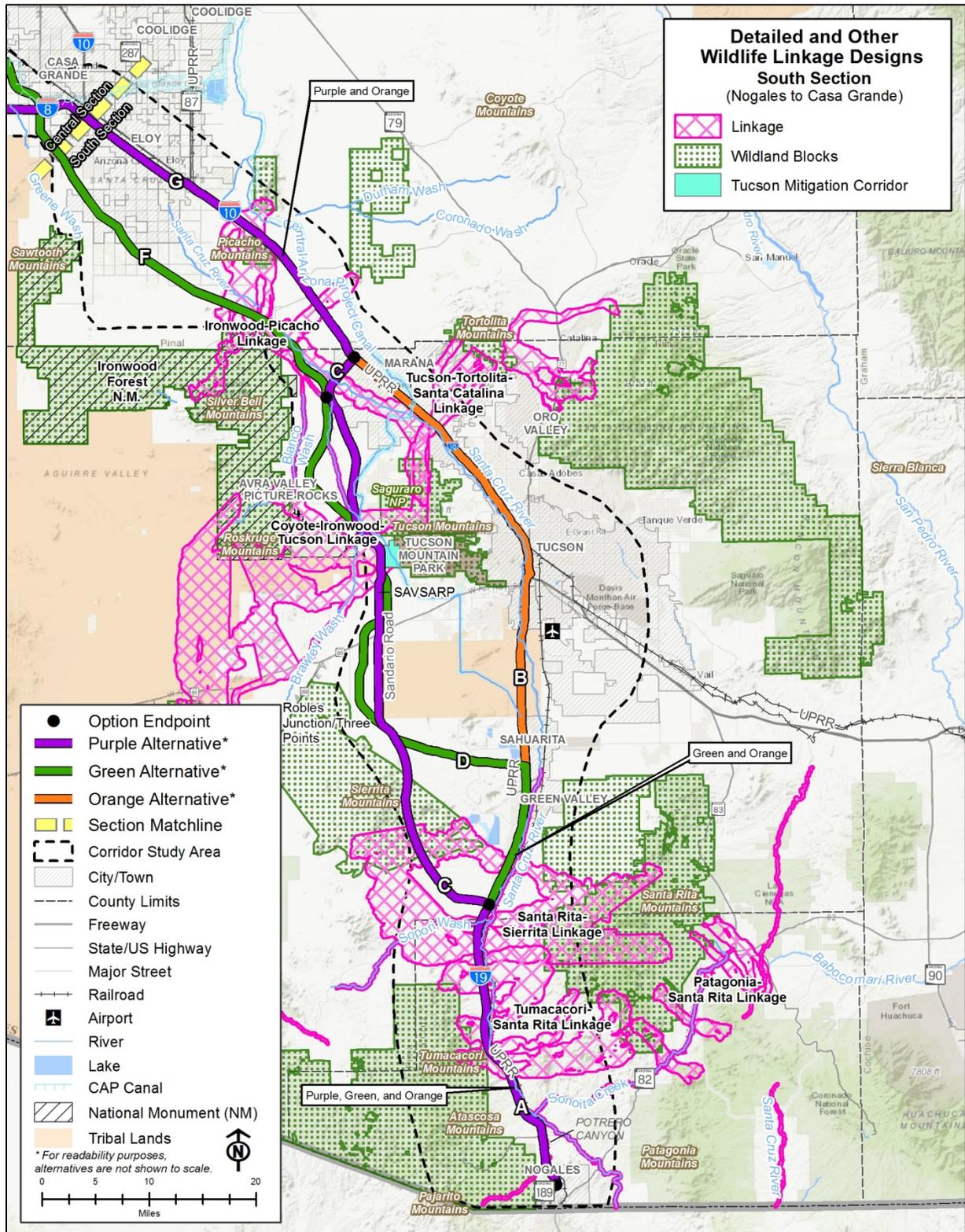


Figure 3.14-5 Detailed and Other Wildlife Linkage Designs – South Section

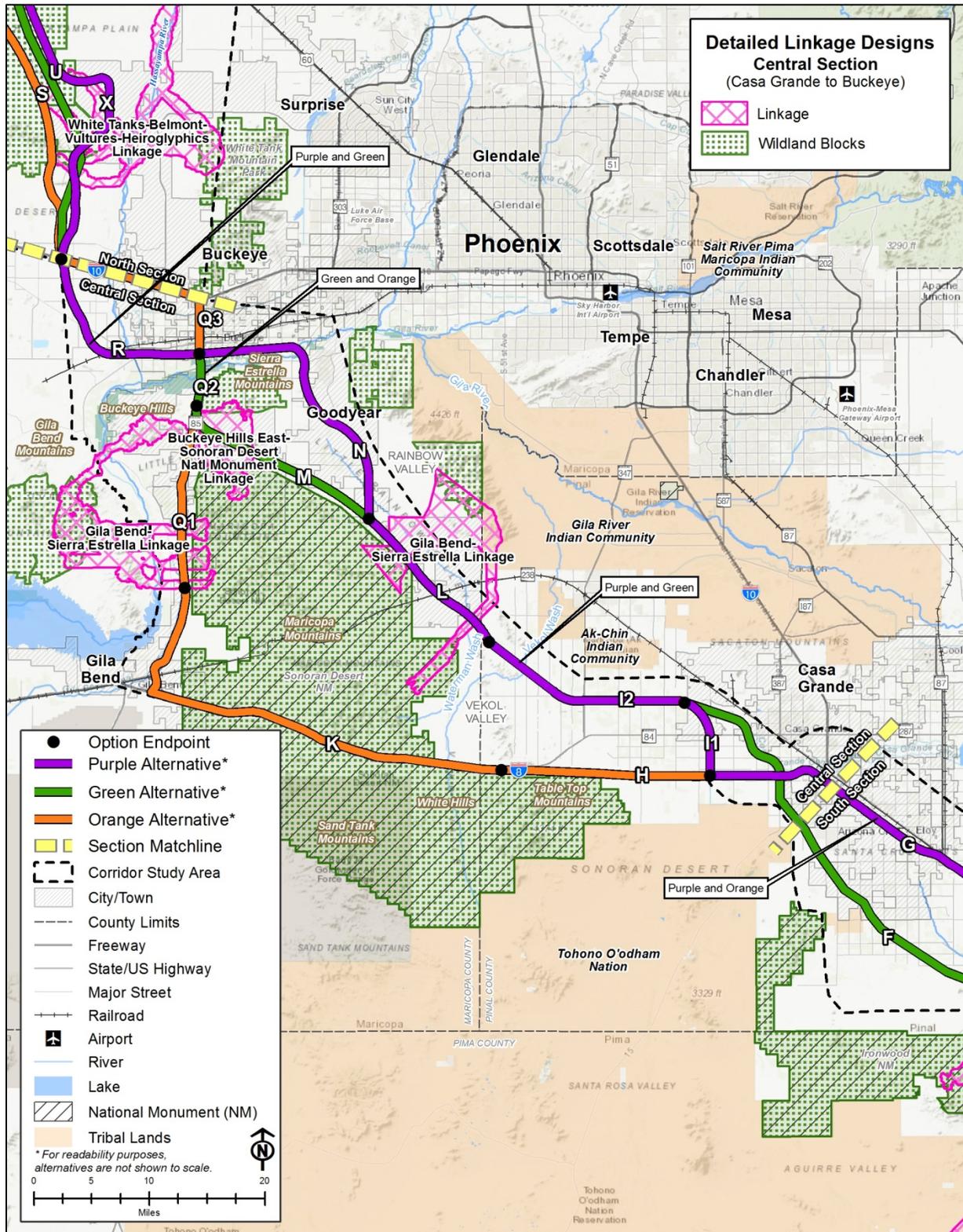


Figure 3.14-6 Detailed Linkage Designs – Central Section

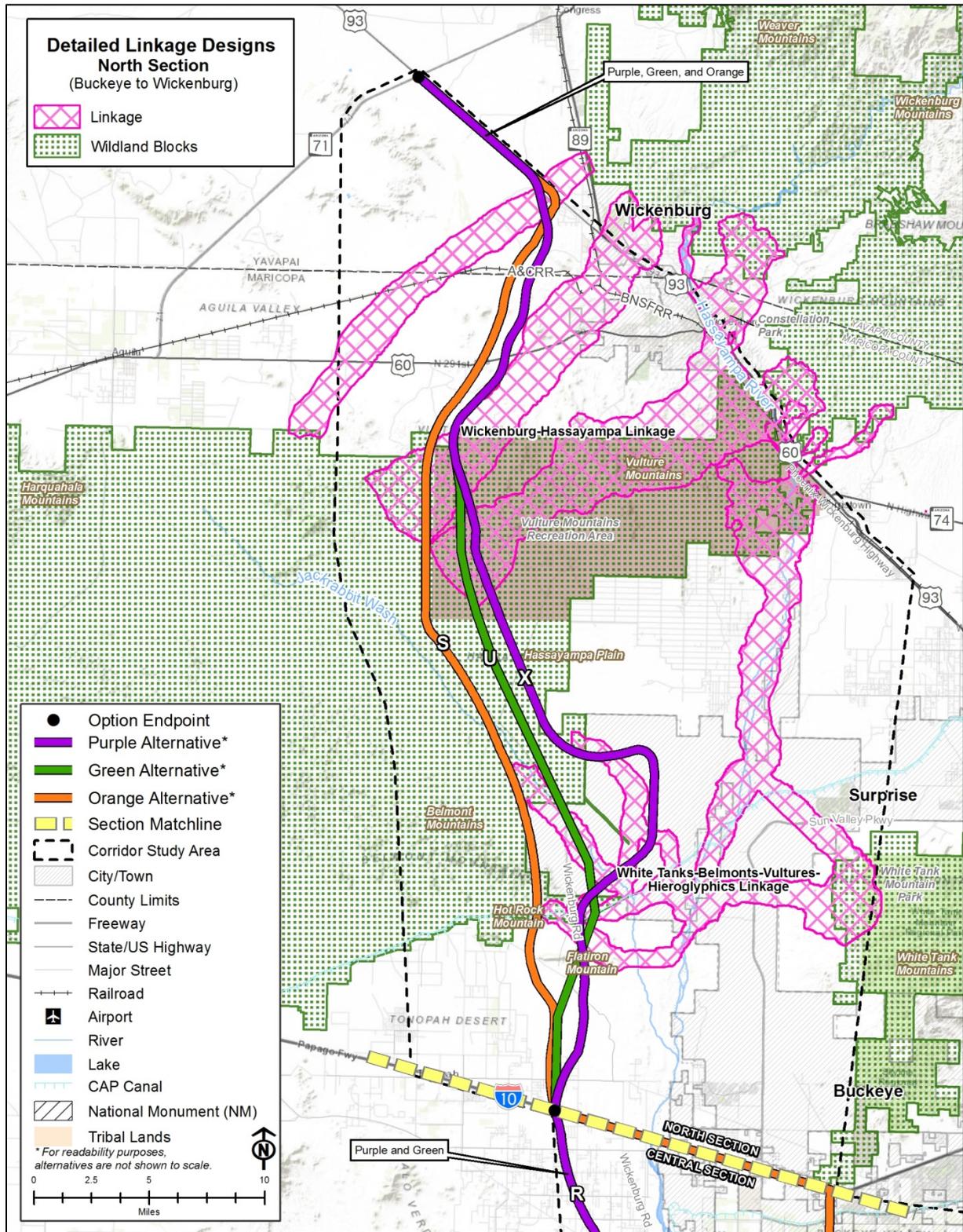


Figure 3.14-7 Detailed Linkage Designs – North Section

1 The designated wildlife corridors crossing the Study Area identified through the Arizona Missing
 2 Linkages Project (Beier et al. 2008a,b, 2006a,b,c,d) are described by project section in
 3 **Table 3.14-5** (Summary of Detailed Linkage Designs and Other Wildlife Corridors in the Study
 4 Area) and the text that follows. Wildlife linkages identified within individual counties in the
 5 County Wildlife Connectivity Assessments, which provide detail beyond the scope of the Tier 1
 6 analysis, will be examined in the Tier 2 analysis. These linkages include the assessments for
 7 Maricopa County (AGFD 2011), Pima County (AGFD 2012c,d), Pinal County (AGFD 2013a),
 8 and Yavapai County (AGFD 2013b). The text also describes some of the major washes and
 9 established wildlife crossings that are important to wildlife movement in the Study Area.
 10 Additional features would need to be identified through on-the-ground studies.

Table 3.14-5 Summary of Detailed Linkage Designs and Other Wildlife Corridors in the Study Area

Wildlife Movement Corridors	South Section	Central Section	North Section
Wildlife Linkages			
Santa Rita-Tumacacori	X		
Patagonia-Santa Rita	X		
Tucson-Tortolita-Santa Catalina	X		
Ironwood-Picacho	X		
Santa Rita-Sierrita	X		
Coyote-Ironwood-Tucson	X		
Gila Bend-Sierra Estrella		X	
Buckeye Hills East – Sonoran Desert National Monument (SDNM)		X	
Wickenburg-Hassayampa			X
White Tanks-Belmont-Hieroglyphic Mountains			X
Other Wildlife Corridors			
Tucson Mitigation Corridor (TMC)	X		

SOURCE: Wildlife linkages data obtained from AWLWG (2008a,b, 2006b,c,d,e); Tucson Mitigation Corridor data obtained from Bureau of Reclamation (Reclamation 2016b).

11 A total of approximately 597,031 acres of LIBs occur within the South Section, represented by
 12 three LIB clusters designated as LIB Clusters 1 through 3. LIB Cluster 1 and LIB Cluster 2,
 13 which are the southernmost blocks, occur on the east and west sides, respectively, of I-19 and
 14 the Santa Cruz River. The northern boundary of LIB Cluster 1 corresponds to the I-10; that of
 15 LIB Cluster 2 corresponds to the I-8. LIB Cluster 3 occurs north and east of Tucson. Major
 16 barriers between the LIBs in the South Section include I-19, I-10, State Route (SR) 86, SR 82,
 17 SR 83, and the cities of Tucson and Casa Grande (**Figure 3.14-4** [Large Intact Block Clusters]).

18 The Tucson-Tortolita-Santa Catalina Mountains Linkage occurs in Pima and Pinal counties and
 19 connects protected lands in three mountainous areas (Tortolita Mountains, Santa Catalina
 20 Mountains, and Tucson Mountains) that are connected across desert valleys by means of two
 21 corridors (Beier et al. 2008c). Major barriers to movement within this linkage include highways
 22 (I-10 and SR 77), the cities of Oro Valley and Marana, and a growing network of residential



- 1 developments and roads (Beier et al. 2006d). Pima County has begun to purchase land within
2 this linkage to preserve connectivity between the Tortolita and Tucson Mountains within this
3 corridor. This includes approximately 5,161 acres described as the Avra Valley/I-10 parcel, most
4 of which occurs within the Tucson-Tortolita-Santa Catalina Mountains Linkage.
- 5 The Santa Rita-Tumacacori Linkage includes a complex of upland and riparian corridors
6 connecting the Santa Rita Mountain Complex and surrounding semidesert grasslands with the
7 Tumacacori-Atascosa-Pajarito Mountain Complex (Beier et al. 2006b). Riparian corridors in the
8 linkage include parts of Sapor Wash, the Santa Cruz River, Sonoita Creek, and Potrero Canyon
9 (Beier et al. 2006b). In the linkage, I-19, the Union Pacific Railroad, and urban development
10 along I-19 are major potential barriers that could inhibit wildlife movement between the two
11 wildland blocks (Beier et al. 2006b). Traffic by undocumented migrants from Mexico and border
12 security efforts to control that traffic also affect animal movement in the linkage (Beier et al.
13 2006b).
- 14 The Patagonia-Santa Rita Linkage, which connects the Santa Rita Mountains and the
15 Patagonia Mountains across Sonoita Creek (Beier et al. 2008b), occurs on private land, national
16 forest land, and state trust land. This linkage consists of four distinct corridors that are
17 approximately 1 to 2 miles wide. The four corridors are linked by a narrower corridor of riparian
18 habitat along Sonoita Creek. The major potential barriers in the linkage include SR 82, SR 83,
19 border security, and expanding urban development in and near Patagonia and Sonoita (Beier et
20 al. 2008b).
- 21 The Ironwood-Picacho linkage connects protected lands managed by the BLM, located at the
22 Ironwood Forest National Monument, the Picacho Mountains, and a block of Sonoran Desert
23 surrounding Durham Wash and Coronado Wash (Beier et al. 2006a). One corridor complex
24 connects the Ironwood Forest National Monument with the Picacho Mountains, and another
25 corridor connects a block of Sonoran Desert with the Ironwood Forest National Monument
26 (Beier et al. 2006a). Major potential barriers to wildlife movement within the linkage include I-10,
27 the Union Pacific Railroad, the CAP canal, the Tucson Canal and irrigation canals, and urban
28 and agricultural development along the I-10 corridor (Beier et al. 2006a).
- 29 The Santa Rita-Sierrita Detailed Linkage includes a large, divided wildlife corridor that connects
30 habitat blocks associated with the Santa Rita and Sierrita Mountains that are separated by the
31 Santa Cruz Valley (AGFD 2012c). Substantial barriers that impede wildlife passage between the
32 two areas include I-19, major roads, a number of mine features, the Union Pacific Railroad, and
33 urban growth in Green Valley (AGFD 2012c).
- 34 The Coyote-Ironwood-Tucson Detailed Linkage includes a series of interconnected corridors
35 joining protected native lands in the Coyote Mountains; the Ironwood Forest National
36 Monument, including part of the Roskrige, Silver Bell, and Sawtooth Mountains; and the
37 Tucson Mountains, including Saguaro National Park (SNP) and its designated wilderness area
38 (AGFD 2012d). The branches of the corridor pass through various features, including steep
39 foothills around the Roskrige Mountains and Avra Valley. Smaller portions of the corridor
40 include Brawley Wash, Blanco Wash, and portions of the Santa Cruz River (AGFD 2012a).
41 Potential impediments to wildlife movement through this linkage include SR 86 and other major
42 roads, and the communities in the local region (i.e., Avra Valley, Picture Rocks, Robles
43 Junction/Three Points, and the Town of Marana) (AGFD 2012d).
- 44 Major xero-riparian features that facilitate movement in the South Section of the Study Area
45 include Brawley Wash, Greene Wash, Robles Wash, and the Santa Cruz River. These features



1 aid wildlife movement north-south through the Avra Valley. Seventeen tributaries, such as
2 Sopori Wash and Sonoita Creek to the east and west, aid movement across the valleys.

3 The Bureau of Reclamation (Reclamation) established the 2,514-acre Tucson Mitigation
4 Corridor (TMC) in 1990 west of Tucson Mountain Park (Reclamation 2016a). The western
5 portion of the TMC occurs within the Coyote-Ironwood-Tucson Linkage. The purchase and
6 protection of these lands was a commitment made by Reclamation with USFWS and AGFD as
7 a conservation measure developed for the Tucson Aqueduct EIS (Reclamation 2016a). The
8 Master Management Plan agreed to by these agencies prohibits any future development within
9 the area except for existing wildlife developments or habitat improvements (Reclamation
10 2016a). This prohibition is intended to preserve habitat from urbanization while maintaining an
11 open wildlife movement corridor (Reclamation 2016a).

12 In order to maintain a functional wildlife movement corridor, Reclamation installed a series of
13 seven CAP canal siphons, which are concrete pipe sections that travel underneath desert
14 washes (Reclamation 2016a). In March 2016, two desert bighorn sheep were observed using
15 one of the siphon crossings within the TMC to move from the Ironwood Forest National
16 Monument to the Tucson Mountain District of SNP (Reclamation 2016a). AGFD biologists
17 believe these sheep are dispersing from populations in the Silver Bell and Waterman
18 Mountains, directly south of the Silver Bell Mountain Range (AGFD 2018a). Mule deer and
19 javelina also have been observed using the siphon crossings (Popowski and Krausman 2002).
20 Bobcat (*Lynx rufus*), coyote (*Canis latrans*), gray fox (*Urocyon cinereoargenteus*), American
21 badger (*Taxidea taxus*), desert cottontail (*Sylvilagus audubonii*), black-tailed jackrabbit (*Lepus
22 californicus*), and Harris' antelope squirrel (*Ammospermophilus harrisi*) activity have been
23 documented at camera sites located in the designated wildlife crossings within or just outside
24 the TMC (Haynes et al. 2010). In addition, a mountain lion (*Puma concolor*) was observed
25 crossing Sandario Road, east of the Southern Avra Valley Storage and Recovery Project, which
26 suggests the potential for lion movement in and out of the Tucson Mountains (Haynes et al.
27 2010).

28 Pima County has targeted an additional 1,896 acres adjacent to the southern boundary of the
29 TMC parcel in the Brawley Wash/Black Wash area for purchase. If Pima County can purchase
30 this land, land on either side of the CAP canal would be preserved from development. The CAP
31 canal is crossed by two roadway bridges in this area (West Manville Road, north of Mile Wide
32 Road, and West Milky Way Drive, south of the TMC) that could facilitate wildlife movement
33 between Ironwood Forest National Monument and the Tucson Mountain District of SNP. The
34 land is suitable for installing wildlife specific crossings at a later date. In addition, to support
35 federally recognized species, the City of Tucson has designated an Avra Valley Habitat
36 Conservation Plan Permit Area that sets aside 21,000 acres of city-owned land in the Avra
37 Valley of Pima County for limited development (City of Tucson 2014).

38 Approximately 335,802 acres of LIBs occur within the Central Section, represented by two LIB
39 clusters designated as LIB Clusters 4 and 5. LIB Cluster 5 is bounded by I-10 to the north and
40 I-8 to the south and includes habitat adjacent to the Gila River. LIB Cluster 4 is east of LIB
41 Cluster 5 and east of Gila Bend. Major barriers between LIBs in the Central Section include I-8;
42 SR 238; and SR 85, which isolates LIB Cluster 4 from LIB Cluster 5 (**Figure 3.14-4** [Large Intact
43 Block Clusters]).

44 The Gila Bend-Sierra Estrella Linkage connects protected lands in four areas: the Gila Bend
45 Mountains, the SDNM, the Sierra Estrella Mountains, and the Buckeye Hills (Beier et al. 2008a).
46 The linkage consists of two separate corridor complexes. One corridor complex connects the

1 SDNM to the Gila Bend Mountains across the Gila River lowlands and Buckeye Hills. The other
2 connects the SDNM to the Sierra Estrella Mountains (Beier et al. 2008a). Major barriers in these
3 corridors include SR 85, irrigation canals, and agricultural and urban development (Beier et al.
4 2008a).

5 The Buckeye Hills East-SDNM Linkage, which is approximately 4.3 to 6.2 miles long, connects
6 the Buckeye Hills and Gila River corridor to the north with the Maricopa Mountains in the SDNM
7 to the south (AGFD 2018a). Although the linkage is relatively free of development and barriers
8 to wildlife movement, it includes unimproved roads, dispersed off-road vehicle recreation, and
9 utility lines (AGFD 2018a).

10 The primary natural corridors in the Central Section include Waterman Wash, Vekol Wash, and
11 the Gila River. Waterman Wash and Vekol Wash aid the north-south movement of wildlife
12 through Rainbow Valley to the Gila River. The east-west oriented tributaries to these two
13 washes aid movement of wildlife across Vekol Valley and Rainbow Valley. The Gila River aids
14 movement east-west along the Buckeye Hills and north-south through the lowlands bounded by
15 the Maricopa and Gila Bend Mountains.

16 Currently, the greatest potential for wildlife mobility from the Maricopa Mountains to a
17 neighboring mountain range is through Rainbow Valley to the Estrella Mountains.

18 A total of approximately 403,140 acres of LIBs occur within the North Section, represented by
19 one LIB cluster designated as LIB Cluster 6, which occurs west of Phoenix and north of I-10. To
20 the north, LIB Cluster 6 is bound by US 60, US 93, and SR 71 at the northern end of the Study
21 Area (**Figure 3.14-4** [Large Intact Block Clusters]). The CAP canal, which occurs within LIB
22 Cluster 6 and is a major barrier to wildlife movement in the North Section, includes mitigation for
23 wildlife connectivity.

24 The Wickenburg-Hassayampa linkage connects wildland blocks in the Wickenburg, Weaver,
25 Hieroglyphic, Buckhorn, and Sheep Mountains to wildland blocks in the Vulture, Harquahala,
26 and Big Horn Mountains via three separate corridor areas (Beier et al. 2006c). Major potential
27 barriers within the wildlife corridors include US 60, the Phoenix-Wickenburg Highway, US 93,
28 the Burlington Northern Santa Fe Railroad, the proposed Wickenburg bypass, and expanding
29 urban development in and near Wickenburg (Beier et al. 2006c).

30 The White Tanks-Belmont-Hieroglyphic Mountains Linkage connects wildland blocks between
31 the White Tank Mountains and surrounding core wildlife wildland blocks in the Belmont
32 Mountains, Big Horn Mountains, Vulture Mountains, Hieroglyphic Mountains, and Hassayampa
33 River (AGFD 2018a). The purpose of these wildlife corridors is to conserve the current
34 ecological integrity and long-term viability of wildlife populations in the White Tank Mountains by
35 ensuring the habitat network can provide robust resistance to the pressures of development and
36 climate change (AGFD 2018a). The primary barriers or impairments within the corridor arms
37 include Sun Valley Parkway, North Wickenburg Road/135th Ave, US 60, rural roadways, the
38 CAP canal, livestock fencing along the CAP canal, rural housing units, and the potential for
39 future urban development (AGFD 2018a).

40 The principal natural corridors in the North Section include the Hassayampa River, Jackrabbit
41 Wash, Coyote Wash, Star Wash, and Daggs Wash. These aid the north-south movement of
42 wildlife from highlands near Wickenburg to the lowlands near the Gila River. The Hassayampa
43 River also functions as an important transition from a riparian to xero-riparian corridor in the
44 vicinity of Wickenburg.

1 Reclamation maintains a number of wildlife crossings where the CAP canal would otherwise
 2 block the north-south movement of terrestrial wildlife across the Hassayampa Plain. There are
 3 eight crossing features along the CAP canal within the North Section. Two of the wildlife bridges
 4 were placed between the Belmont Mountains and Hot Rock Mountain, and the Belmont
 5 Mountains and Flatiron Mountain, respectively, while a third was placed just north of the White
 6 Tank Mountain Regional Park to facilitate movement of terrestrial wildlife across the canal.
 7 Siphons under the Hassayampa River and Jackrabbit Wash also preserve movement
 8 opportunities for wildlife along these washes. Five concrete wash overchute structures designed
 9 for drainage purposes, although not optimal in design, also provide opportunities for wildlife to
 10 cross the CAP canal at Coyote Wash and Daggs Wash. Three of the concrete overchutes occur
 11 west of the Hassayampa River; the other two occur to the east. Recent and ongoing monitoring
 12 of CAP canal crossing structures by Reclamation personnel have recognized that concrete
 13 overchutes are used for crossing purposes by wildlife, including mule deer, kit fox (*Vulpes*
 14 *macrotis*), American badger, skunks (Mephitidae family), mountain lion, and desert bighorn
 15 sheep, (Thomas Bommarito, personal communication).

16 **3.14.4 Environmental Consequences**

17 This section includes an analysis and comparison of the three Build Corridor Alternatives and
 18 the No Build Alternative as well as the individual Corridor Options. This section also analyzes a
 19 CAP Design Option for Options C and D located in the vicinity of the TMC.

20 This CAP Design Option is within the South Section of the Purple and Green Alternatives. It
 21 includes a deviation to the east from the Sandario Road alignment to parallel the CAP canal.
 22 This option, which is described further in **Chapter 2** (Alternatives Considered), would introduce
 23 negligible differences in impacts to most biological resources, with the exception of wildlife
 24 connectivity. When differences occurred for a biological resource, they were noted in the
 25 appropriate tables or text discussions.

26 **3.14.4.1 Biotic Communities**

27 **Build Corridor Alternatives**

28 **Biotic Communities**

29 **Table 3.14-6** (Acres of Biotic Communities within the Build Corridor Alternatives and Percent of
 30 Total Biotic Community Area within the Study Area) summarizes the number of acres of each
 31 biotic community within the 2,000-foot-wide corridor for each Build Corridor Alternative as well
 32 as for the No Build Alternative.

33 Calculated using the entire 2,000-foot-wide corridor, the Orange Alternative would encompass
 34 approximately 33 percent fewer acres in the Semidesert Grassland than either the Purple or the
 35 Green Alternative, and approximately 25 percent fewer acres in the Lower Colorado River
 36 Desertscrub. Within the Arizona Upland Desertscrub, the Orange Alternative would include
 37 approximately 63 percent more acres than the Purple Alternative and 58 percent more acres
 38 than the Green Alternative. All three Build Corridor Alternatives would have identical impacts on
 39 Mohave Desertscrub. Within the 2,000-foot-wide corridor, the acreage within the Orange
 40 Alternative is 2 percent less than the Green Alternative and 3 percent less than the Purple
 41 Alternative. Note that the overall footprint of the Orange Alternative, and to a lesser extent that
 42 of the Purple Alternative, would be reduced compared to the Green Alternative because these
 43 two alternatives would be partially co-located along existing transportation routes.

1
2
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Table 3.14-6 Acres of Biotic Communities within the Build Corridor Alternatives and Percent of Total Biotic Community Area within the Study Area

Build Corridor Alternative	Semidesert Grassland	Arizona Upland Desertscrub	Lower Colorado River Desertscrub	Mohave Desertscrub
Purple Alternative (Options A, C*, G, I, L, N, R, X)	14,043 3.2% (14,088) (3.2%)	8,185 0.9% (8,312) (0.9%)	42,820 3.4% (42,887) (3.4%)	570 24.8% (570) (24.8%)
Green Alternative (Options A, D*, F, I2, L, M, Q2, R, U)	14,024 3.2% (14,024) (3.2%)	9,412 1.0% (9,513) (1.0%)	40,888 3.2% (40,947) (3.3%)	570 24.8% (570) (24.8%)
Orange Alternative (Options A, B, G, H, K, Q, S)	9,488 2.2%	22,326 2.4%	31,290 2.5%	570 24.6%
No Build Alternative	0 0%	105 <0.1%	64 <0.1	0 0%

* Acreage for the alternative using the CAP Design Option instead of the regular option (designated by an asterisk) is in parentheses.

NOTES: Bold letters under option indicate the Options that are co-located with existing routes.

4 Impacts for the No Build Alternative were analyzed using currently programmed projects. These
5 projects include widening projects along existing routes (including I-10 in Tucson and Picacho
6 as well as US 93 in Wickenburg). Because these improvements would occur on existing
7 facilities, the overall impact to biotic communities would be negligible.

8 Riparian Habitats and Important Bird Areas

9 In addition to crossing major biotic communities, the Corridor Options also cross several unique
10 habitat types, including several riparian areas. Several IBAs coincide with riparian areas.
11 **Table 3.14-7** (Acres of Riparian and IBA Habitats within the Build Corridor Alternatives and
12 Percent of Total Riparian and IBA Habitat Area within the Study Area) summarizes the potential
13 impacts to riparian areas and IBAs for each of the three proposed Build Corridor Alternatives.
14 Acreage values for the No Build Alternative were all equal to zero and therefore are not included
15 in the table.

16 The Green Alternative would have the greatest potential impact to overall riparian habitat
17 because it parallels the Santa Cruz River to a greater extent than the rest of the Build Corridor
18 Alternatives. However, even though the Purple Alternative has less acreage with impacts to the
19 overall riparian habitat than the Green Alternative, it may have the greatest impact to perennial
20 riparian areas, given the new crossing of the Gila River. The Orange Alternative would have the
21 least potential impact to riparian habitat and IBAs. For all Build Corridor Alternatives, the actual
22 impacts to riparian habitat would be much less than the impacts analyzed here for the 2,000-
23 foot corridor because the final 400-foot corridor would be designed to avoid riparian habitat
24 wherever possible.



1 Species of Economic and Recreational Importance

2 Direct impacts to SERI and their habitat would be similar to the impacts on other wildlife species
3 within the Study Area. All of the Build Corridor Alternatives would result in the loss of potential
4 habitat. In addition, under all of the alternatives, there is the potential for increased mortality of
5 SERI due to animal-vehicle collisions. Because the Orange Alternative would be co-located
6 along existing transportation corridors, it would have the least potential direct impact on habitat
7 for SERI. The Purple Alternative also would be co-located along existing highways, but not to
8 the same extent as the Orange Alternative. As a result, its potential impact would be less than
9 that of the Green Alternative, but still greater than the potential impact of the Orange Alternative.

10 Impacts to wildlife mortality, including SERI mortality, are more difficult to predict. Nevertheless,
11 it is reasonable to assume that the Orange Alternative would have the smallest impact (the least
12 increase in wildlife mortality), given this alternative’s co-location along existing highways.

13 Estimating the relative magnitude of wildlife mortality and the relative impacts due to vehicle
14 collisions under the Purple and Green Alternatives within the Central and North Sections and
15 making comparisons between the two alternatives are more problematic tasks in a Tier 1 level
16 of analysis. The impacts of the Build Corridor Alternatives on recreation, an important
17 component of SERI, are discussed in Section 3.4.

18 **Table 3.14-7 Acres of Riparian and IBA Habitats within the**
19 **Build Corridor Alternatives and Percent of**
20 **Total Riparian and IBA Habitat Area within the Study Area**

Build Alternative	Riparian Areas	Important Bird Areas
Purple Alternative (Options A, C*, G, I, L, N, R, X)	663 26.9% (643) (26.1%)	1,357 1.4% (1,457) (1.5%)
Green Alternative (Options A, D*, F, I2, L, M, Q2, R, U)	1,302 52.8% (1,230) (49.9%)	1,032 1.1% (1,128) (1.2%)
Orange Alternative (Options A, B, G, H, K, Q, S)	611 24.8%	573 0.6%

* Acreage for the alternative using the CAP Option instead of the regular option (designated by an asterisk) is in parentheses.

21 Invasive Species

22 The greatest potential indirect impact during construction would be the introduction of invasive
23 species, particularly for Options that are on undeveloped land. Surrounding lands also would be
24 impacted as invasive species gradually disperse from the roadway. The spread of invasive
25 species entails negative impacts to native species, including interspecific competition and
26 altered fire regimes. In the South and Central Sections where there already is considerable
27 urban development, many of the noxious and invasive species are well established in the Study
28 Area. Thus there is a greater chance that they could begin colonizing the new road ROW and
29 surrounding habitats. The Corridor Options in the North Section and in the northeast part of the



1 Central Section (Purple and Green Alternatives) are in relatively undisturbed areas where the
2 presence of invasive species may not be as prolific. As a result the establishment and spread of
3 invasive species may take longer to occur, but may have a greater impact on native species.

4 **No Build Alternative**

5 The No Build Alternative, as described in **Chapter 2** (Alternatives Considered), is used as a
6 baseline for comparison with the Build Corridor Alternatives. The No Build Alternative would not
7 implement any of the Build Corridor Alternatives for development of I-11. Impacts for the No
8 Build Alternative were analyzed using currently programmed projects. These projects include
9 widening projects along existing routes (I-10 in Tucson and Picacho as well as US 93 in
10 Wickenburg).

11 **Biotic Community**

12 The No Build Alternative would have minimal direct impact to biotic communities. The only
13 impacts would be associated with the identified projects within the Central and North Sections
14 (as described above). The numbers of acres potentially affected by the No Build Alternative are
15 105 acres of Arizona Upland Desertscrub and 64 acres of Lower Colorado River Desertscrub.

16 **Riparian and Important Bird Areas**

17 The No Build Alternative would have no impact on riparian areas or IBAs.

18 **Species of Economic and Recreational Importance**

19 The No Build Alternative would have no measurable increased impact on SERI.

20 **3.14.4.2 Special-Status Species**

21 **Build Corridor Alternatives**

22 **Endangered Species Act Species**

23 **Aquatic and Riparian ESA-listed Species**

24 The biotic communities and riparian areas that fall under this habitat association include:

- 25 • North American Warm Desert Lower Montane Riparian Woodland and Shrubland
- 26 • North American Warm Desert Riparian Woodland and Shrubland
- 27 • North American Arid West Emergent Marsh
- 28 • North American Warm Desert Riparian Mesquite Bosque
- 29 • North American Warm Desert Wash
- 30 • Invasive Southwest Riparian Woodland and Shrubland
- 31 • Open Water.

32 Within the Study Area, aquatic and riparian exists for 10 ESA-listed species: Chiricahua leopard
33 frog, southwestern willow flycatcher, western yellow-billed cuckoo, Yuma Ridgeway's rail Gila
34 topminnow, Sonora chub, northern Mexican gartersnake, Huachuca water-umbel, and two
35 highly mobile mammal species, the jaguar and ocelot habitat (**Table 3.14-3** [Distribution of ESA

1 Protected Species within the Study Area] and **Table 3.14-4** [Total Surface Area Covered by
2 ESA Critical Habitat, 10(j) Experimental Population Areas or other Protected Populations within
3 the Study Area]). Habitat associated with these 10 species is predominately located within
4 Options A, B, C, N, and Q2 and includes the Santa Cruz and Gila rivers, and other designated
5 washes and associated floodplains (**Appendix E14, Table E14-19** [Potential Occurrences of
6 ESA Protected Species per Corridor Option] and **Table E14-20** [Total Surface Area Covered by
7 Critical or other Protected Habitat within the 2,000-foot-wide Corridor]).

8 Because all of the Build Corridor Alternatives in the South Section are located along the existing
9 I-19 alignment (Options A and B), all Build Corridor Alternatives in the South Section have the
10 potential to impact ESA protected species and sensitive habitats associated with the Santa Cruz
11 River. I-19 (Option A and B) is located west and adjacent to the floodplain of the river. In
12 addition to direct impacts to the riparian habitat these species occupy, the operations of co-
13 locating I-19 and I-11 have the potential to impact ESA species by increasing air, noise, and
14 light pollution, which further degrade habitat quality and add stress to species' biological life
15 cycles, which include breeding, feeding, and resting periods. However, if the I-19 does require
16 widening in this area, every attempt will be made to avoid impacts to riparian habitat by
17 widening the roadway to the west and away from the Santa Cruz River, if at all possible.

18 Within the Central Section, all three Build Corridor Alternatives would span the perennial Gila
19 River with bridges (Options N and Q2). Some permanent floodplain tree habitat removal would
20 be required; however, habitat modifications would be localized in nature, as small in size as
21 feasible, and short in duration. Potential impacts from all three Build Corridor Alternatives would
22 occur at two possible Gila River locations (approximately 7 miles apart), which are similar in
23 design (bridged roadway over riparian floodplains). The Orange and Green Alternatives would
24 be co-located along the existing SR 85 bridge (Option Q2). The Purple Alternative would add an
25 additional roadway crossing (Option N) upstream of the existing SR 85 bridge crossing. Adding
26 a second Gila River bridge crossing would increase the potential for impacts on ESA species
27 and habitat quality by increasing noise, air, and light pollution in the vicinity of the Gila River.
28 The Orange and Green Alternatives would result in fewer potential impacts to ESA species and
29 habitat quality.

30 Impacts to Chiricahua leopard frogs should be avoided, minimized, and mitigated by
31 implementing measures to address impacts related to invasive species and habitat
32 modifications and to address wildlife movements and landscape connectivity impacts. Impacts
33 to Gila topminnow should be addressed by avoiding increases of sediment or delivering
34 pollutants to the stream course and by avoiding reductions in surface flow to available aquatic
35 habitats. Impacts to southwestern willow flycatcher, western yellow-billed cuckoo, and Yuma
36 Ridgeway's rail, and their respective designated and proposed critical habitat should be
37 avoided, minimized, or mitigated according to the mitigation strategies summarized in
38 **Table 3.14-11** (General Mitigation Strategies Applicable to all Corridor Options) and
39 **Table 3.14-12** (Specific Mitigation Strategies for each Corridor Option).

40 Within the North Section, all three Build Corridor Alternatives avoid perennial waters and
41 associated riparian habitats.

42 Sonoran Desert and Mountainous Area ESA-listed Species

43 The biotic communities that fall under this habitat association consist of Lower Colorado River
44 Desertscrub, Arizona Upland Desertscrub, Semidesert Grassland, Mohave Desertscrub, and
45 Madrean Evergreen Woodland. All three Build Corridor Alternatives impact previously disturbed

1 and undisturbed lands of the Sonoran Desert (see **Table 3.14-6** [Acres of Biotic Communities
2 within the Build Corridor Alternatives and Percent of Total Biotic Community Area within the
3 Study Area] and **Table 3.14-7** [Acres of Riparian and IBA Habitats within the Build Corridor
4 Alternatives and Percent of Total Riparian and IBA Habitat Area within the Study Area]) which
5 are considered habitat for plant and animal ESA-listed species. These species include PPC, as
6 well as ocelot and jaguar, which prefer large habitat blocks. Both the ocelot and jaguar use
7 areas within more mountainous terrain and other areas with denser vegetation, such as areas
8 along larger drainages. Mountainous terrain within the South Section of the Study Area is
9 avoided by all three Build Corridor Alternatives, while Option S in the North Section of the Study
10 Area goes through the eastern portion of the Belmont Mountains. Pre-Tier 2 analyses would
11 develop specific project mitigation measures to minimize habitat fragmentation effects to the
12 species. These mitigation measures would include incorporation of potential wildlife roadway
13 crossings into interstate designs.

14 Tree and cactus removal and minor habitat modifications would occur in upland habitats and
15 floodplain habitat during construction; however, habitat modifications would be localized in
16 nature, as small in size as feasible, and short in duration (less than 5 years). Impacts to
17 Semidesert Grassland within the Sonoran Desert may require substantial compensatory
18 mitigation due to the likely presence of PPC and its habitat within this biotic community.
19 Destruction of grassland habitat for construction of I-11 would be a permanent impact to
20 grassland plant species, including PPC, within the anticipated 400-foot roadway footprint.
21 Dispersal of noxious and invasive weeds into Semidesert Grassland following construction of I-
22 11 may negatively impact ESA-listed species such as PPC, and CCA species such as the
23 Sonoran desert tortoise, due to competition and altered fire regimes.

24 Although all three Build Corridor Alternatives dissect PPC habitat, the Orange Alternative is
25 likely to have fewer impacts to this species, as it is co-located with the I-19 through PPC habitat.
26 I-19 may or may not need to be widened in this area and some impacts to this species have
27 already occurred within the roadway prism. The Purple and Green Alternatives, on the other
28 hand, dissect high-quality, densely occupied PPC habitat which is likely to impact hundreds of
29 Pima pineapple individuals. In order to avoid a potential “Jeopardy” decision by the USFWS for
30 this species, substantial mitigation and compensation will need to occur within these two Build
31 Corridor Alternatives. Impacts to PPC and its habitat can be minimized by reduction of the
32 construction footprint through quality PPC habitat, detailed surveys of suitable habitat prior to
33 the Tier 2 process, and the implementation of long-term control of noxious and invasive weeds.
34 See the additional mitigation strategies summarized in **Table 3.14-11** (General Mitigation
35 Strategies Applicable to All Corridor Options) and **Table 3.14-12** (Specific Mitigation Strategies
36 for Each Corridor Option).

37 ESA Section 7 consultations for PPC will need to occur during Tier 2 analysis. The consultations
38 will include studies to locate the new roadway facility to further reduce impacts to this species.
39 Recent research suggests that translocation of this species is not very successful, and therefore
40 translocation is not included as a mitigation strategy.

41 Habitat Conservation Plans

42 Several HCPs cover areas within the Study Area. HCPs are formal agreements between a local
43 jurisdiction (e.g., Pima County or the City of Tucson) that provide specific conservation
44 measures for the protection of one or more ESA-listed species, but that also allow specific types
45 of development within the area covered by the Conservation Plan. One or more plans being
46 developed by the City of Tucson as well as Pima County’s Multi-Species Conservation Plan

1 could be affected by any or all of the Build Corridor Alternatives. However, the Purple and
2 Green Alternatives, which dissect Avra Valley, are likely to have the greatest impacts to parcels
3 that have been set aside as conservation areas under the Avra Valley portion of the City of
4 Tucson HCP. The extent of any impact on HCPs would be determined based on more detailed
5 alignment definition during Tier 2.

6 Critical and Protected Habitat

7 Critical habitat for several species occurs within all three Build Corridor Alternatives (see
8 **Table 3.14-4** (Total Surface Area Covered by ESA Critical Habitat, 10(j) Experimental
9 Population Areas or other Protected Populations within the Study Area) and **Appendix E14**).
10 None of the Build Corridor Alternatives would cross designated or proposed critical habitat for
11 the Chiricahua leopard frog, Mexican spotted owl, or Sonora chub.

12 Within the South Section, I-19 is adjacent to the Santa Cruz River. All of the Build Corridor
13 Alternatives, which share the designated Option A, have the potential to impact critical habitat
14 and proposed critical habitat, associated with the Santa Cruz River, for the southwestern willow
15 flycatcher and western yellow-billed cuckoo. Options C and D have the potential to impact
16 currently undeveloped grasslands, thereby posing a possibly significant threat to species such
17 as PPC via habitat loss and degradation, which includes impacts from noxious weed invasions
18 and altered fire regimes. Proximity impacts associated with the potential widening of I-19 (co-
19 located I-11 facility), such as additional air, light, and noise pollution, have the potential to
20 impact habitat. The only critical habitat for the Chiricahua leopard frog occurring within the Study
21 Area consists of two small stock ponds approximately 0.6 mile to the east of Option C.

22 Mexican spotted owl and jaguar habitat occurs at higher elevations predominately located in the
23 mountainous and forested portions of the Study Area east and west of I-19 and north of I-10. All
24 three of the Build Corridor Alternatives avoid those types of habitats. Depending of the results of
25 wildlife movement studies that will be conducted prior to the Tier 2 process, wildlife connectivity
26 between these higher elevation areas (sky islands) used by the jaguar and ocelot may need to
27 be enhanced with species-specific wildlife crossings designed for I-11. See the Section 3.14.4.3,
28 Wildlife Connectivity, for more impact discussions that relate to mobility of both general wildlife
29 and special-status species.

30 Within the Central Section, all three Build Corridor Alternatives would cross the Gila River over
31 bridges in similar locations. The Gila River contains proposed critical habitat for the yellow-billed
32 cuckoo, and habitat for the southwestern willow flycatcher and Yuma Ridgeway's rail. Some
33 floodplain tree habitat will be permanently removed; however, it is assumed that habitat
34 modifications would be localized in nature, as small in size as feasible, and short in duration.
35 Option N would add an additional roadway crossing over the Gila River approximately 7 miles
36 upstream of the existing SR 85 bridge. Proposed critical habitat for the yellow-billed cuckoo has
37 the potential to be degraded between the two bridges and their associated roadways. Runoff of
38 irrigation water into the Gila River at the proposed crossing is an important source of water that
39 helps to sustain the marshes and Yuma Ridgeway's rail habitat at that location. Irrigation runoff
40 also may supply marsh habitat downstream of the crossing. Loss of irrigation water resulting
41 from replacement of croplands by I-11 would need to be evaluated in more detail during the Tier
42 2 analysis.

43 No critical habitat for ESA-protected species occurs in the North Section.

44 Mexican wolf and the Sonoran pronghorn have USFWS 10(j) Experimental Populations/
45 Reintroduction Areas associated with Sonoran Desert habitats (see **Table 3.14-4** [Total Surface

1 Area Covered by ESA Critical Habitat, 10(j) Experimental Population Areas or other Protected
2 Populations within the Study Area] and **Appendix E14, Table E14-19** [Potential Occurrences of
3 ESA Protected Species per Corridor Option] and **Table E14-20** [Total Surface Area Covered by
4 Critical or other Protected Habitat within the 2,000-foot-wide Corridor]). Within the Study Area,
5 over 2 million acres and 1.6 million acres of future reintroduction areas have been assigned for
6 the Mexican wolf and the Sonoran pronghorn, respectively. Connectivity between these large
7 swaths of land is paramount to future success of reintroduced populations. See Wildlife
8 Connectivity for more impact discussions that relate to mobility of both general wildlife and
9 special status species.

10 The Sonoran desert tortoise (*Gopherus morafkai*), which has a USFWS CCA under ESA and is
11 a BLM sensitive species, has BLM designated Category I and II habitats within the Study Area.
12 In addition, the USFWS has provided GIS data depicting the modelled locations and extent of
13 USFWS-defined predicted High Value Potential Habitat based on specific spatial criteria. BLM
14 and USFWS tortoise habitat digital maps were both used in this analysis. Sonoran desert
15 tortoise habitat acreages are discussed in **Table 3.14-4** [Total Surface Area Covered by ESA
16 Critical Habitat, 10(j) Experimental Population Areas or other Protected Populations within the
17 Study Area] and **Appendix E14, Table E14-20** (Total Surface Area Covered by Critical or other
18 Protected Habitat within the 2,000-foot-wide Corridor). Potential impacts to the Sonoran desert
19 tortoise include direct mortality, as well as impacts to suitable habitat due to habitat
20 fragmentation, habitat conversion, and altered fire regimes. The introduction of invasive plants
21 also can alter the ecosystem by increasing the frequency, duration, and magnitude of wildfires.
22 If vegetation the tortoise uses for forage, cover, and sheltering sites is lost, the species will no
23 longer have the ability to adequately fulfill its life cycle needs and may suffer delayed fatalities
24 from starvation, exposure, or predation.

25 In the North Section, all Build Corridor Alternatives would potentially impact Sonoran desert
26 tortoise. In the Central and South sections, selecting Options that follow existing roadways
27 would minimize impacts to Sonoran desert tortoise. The overarching conservation goal of the
28 CAA for the tortoise is to provide a clear conservation benefit to the species by working with the
29 agencies involved and contribute to avoid potential ESA listing through reduction of threats in
30 Arizona. As such, prior to project design and Tier 2 NEPA review, detailed habitat assessments
31 should be made for the Sonoran desert tortoise within the Tier 1-identified 2,000-foot corridor to
32 map suitable habitat for this species and develop design recommendations that help avoid and
33 minimize impacts to it (see **Table 3.14-11** [General Mitigation Strategies Applicable to All
34 Corridor Options] for detailed tortoise mitigation strategies).

35 Other Sensitive Species

36 As stated above, other sensitive species include non-ESA-listed species deemed sensitive by
37 BLM, USFS, USFWS, or the counties; species protected under the Bald and Golden Eagle
38 Protection Act, AGFD SGCN; and plant species protected under the Arizona Native Plant Law.
39 In **Appendix E14**, Biological Technical Memorandum, **Table E14-21** (Distribution of Other
40 Sensitive Species within the 2,000-foot-wide Corridor) lists the sensitive species recorded for
41 each I-11 Option based on GIS data or inferred by range and habitat.

42 In addition to being considered habitat for several ESA-protected species, riparian and aquatic
43 areas and Sonoran Desert and mountainous areas also are considered important habitat for
44 other sensitive plant and animal species. As discussed in **Appendix E14 (Table E14-21**
45 **[Distribution of Other Sensitive Species within the 2,000-foot-wide Corridor])**, other sensitive
46 species analyzed include 3 amphibians, 21 birds (including bald and golden eagles), 3 fish,

1 2 invertebrates, 13 mammals (including 8 bats), 21 plants (including Tumamoc globeberry, and
2 12 reptiles. In habitats that are shared by ESA-listed species and other sensitive species, such
3 as riparian areas, impacts to sensitive species would be similar to those experienced by ESA-
4 listed species. However, sensitive species also occur in areas in which ESA-listed species are
5 not present. Thus, all biotic communities impacted by Build Corridor Alternatives are habitat for
6 different sensitive species, and mitigation measures must therefore be developed during Tier 2
7 studies. Construction of I-11 would result in substantial negative impacts to biotic communities
8 (see **Table 3.14-6** [Acres of Biotic Communities within the Build Corridor Alternatives and
9 Percent of Total Biotic Community Area within the Study Area] and **Table 3.14-7** [Acres of
10 Riparian and IBA Habitats within the Build Corridor Alternatives and Percent of Total Riparian
11 and IBA Habitat Area within the Study Area]). These impacts on biotic communities would
12 require a combination of avoidance, minimization, and/or other species-specific mitigation
13 measures to mitigate any negative impacts to sensitive species.

14 Impacts associated with construction of a freeway facility include the potential for mortality and
15 injury from roadway/vehicle interactions, and the direct removal of potential habitats for
16 amphibians, birds, fish, invertebrates, mammals, and reptiles. Additional impacts to animal
17 species include increased habitat degradation due to the increased noise, air, and light pollution
18 from new or improved roadway facilities.

19 Migratory Bird Treaty Act

20 The Green and Purple Alternatives increase accessibility into adjacent lands in Pima, Pinal, and
21 Maricopa counties and may increase accessibility to wildlife refuges and IBAs used by migratory
22 birds and other sensitive wildlife.

23 Habitat for migratory birds varies by species. Many species use Sonoran Desert habitats,
24 agricultural and floodplain habitats, and/or open water habitats. The Green and Purple
25 Alternatives would have the most potential to impact nesting birds, as these alternatives would
26 have the greatest amount of ground disturbance compared to the Orange Alternative, which is
27 more co-located with existing facilities. Impacts to migratory birds, can be mitigated with
28 standard construction techniques and species-specific mitigation measures developed during
29 the Tier 2 analysis. Where possible, the design of I-11 should minimize tree plantings (versus
30 low-growing shrubs) within the median of the new roadways to reduce the attractiveness of
31 those roadways to migratory birds, thus reducing the bird mortality associated with highway
32 operation. Minimizing highway lighting also can reduce potential impacts to nocturnal birds that
33 prey on insects attracted to lights.

34 Special-Status Species End-to-End Considerations

35 Besides the No Build Alternative, the Orange Alternative would have the least impacts to the
36 habitats of sensitive species (Options A, B, G, H, K, Q, and S). Habitat for numerous special-
37 status species occurs in all 20 of the I-11 Options. **Appendix E14** provides a more robust
38 discussion on special-status species analysis. Impacts to ESA-listed species and their critical
39 habitat will require ESA Section 7 consultation with the USFWS during the Tier 2 analysis.

40 In general, the Green Alternative consists mostly of new Corridor Options; the Orange
41 Alternative consists mostly of existing interstate and highway Corridor Options; and the Purple
42 Alternative consists of a mix of existing and new Corridor Options.

43 The Green and Purple Alternatives both increase accessibility into adjacent lands in Pima,
44 Pinal, and Maricopa counties and may increase accessibility to wildlife refuges and IBAs. All of



1 the Build Corridor Alternatives, due to their proximity, have the potential to impact habitats of
2 ESA-listed species, including critical habitat, associated with the Santa Cruz River floodplain
3 (Options A, B, and C) (**Appendix E14, Table E14-19** [Potential Occurrences of ESA Protected
4 Species per Corridor Option] and **Table E14-20** [Total Surface Area Covered by Critical or other
5 Protected Habitat within the 2,000-foot-wide Corridor]). Option C crosses the Santa Cruz River
6 floodplain outside designated critical habitat areas.

7 All the Build Corridor Alternatives would have similar impacts on the Gila River aquatic and
8 riparian habitats (Options Q2 and N), which are considered habitat (including proposed critical
9 habitat) for the yellow-billed cuckoo, Yuma Ridgeway's rail, and southwestern willow flycatcher
10 (**Appendix E14, Table E14-19** [Potential Occurrences of ESA Protected Species per Corridor
11 Option] and **Table E14-20** [Total Surface Area Covered by Critical or other Protected Habitat
12 within the 2,000-foot-wide Corridor]). Option N would add an additional roadway crossing over
13 the Gila River approximately 7 miles upstream of the existing SR 85 bridge. Proposed critical
14 habitat for the yellow-billed cuckoo could be degraded between these two transportation
15 facilities.

16 Species found in the upland land classifications of the Sonoran Desert would be impacted the
17 most by the Green Alternative (Options A, D, F, I2, L, M, Q2, R, and U) because this alternative
18 uses the most non-located Corridor Options and would have the highest acreage of impacts
19 converted from natural land uses to transportation facilities.

20 **No Build Alternative**

21 The No Build Alternative, as described in **Chapter 2** (Alternatives Considered), is used as a
22 baseline for comparison with the Build Corridor Alternatives. The No Build Alternative would not
23 implement any of the Build Corridor Alternatives for development of I-11. The analysis of
24 impacts for the No Build Alternative assumed the construction of currently programmed projects,
25 which include widening projects along existing routes (I-10 in Tucson and Picacho as well as
26 US 93 in Wickenburg).

27 **Endangered Species Act Species**

28 Any potential impacts to ESA-protected species that might occur under the No Build Alternative
29 will be assessed as part of the National Environmental Policy Act (NEPA) analysis for those
30 projects.

31 **Critical and Protected Habitat**

32 Impacts to critical habitat for ESA and other protected habitats may occur with the No Build
33 Alternative. Impacts associated with future projects (No Build Alternative) will be assessed
34 during project-specific NEPA analysis and will require species-specific ESA Section 7
35 Consultation.

36 **Other Sensitive Species**

37 Impacts to special-status species may occur with the No Build Alternative. Impacts associated
38 with future projects (No Build Alternative) will be assessed during project-specific NEPA
39 analysis and will require species-specific mitigation measures to be developed and implemented
40 during construction.



1 Migratory Bird Treaty Act

2 Impacts to species protected under the MBTA may occur with the No Build Alternative. Impacts
3 associated with future projects (No Build Alternative) will be assessed during project specific
4 NEPA analysis and will require species-specific mitigation measures to be developed and
5 implemented during construction.

6 **3.14.4.3 Wildlife Connectivity**

7 **Build Corridor Alternatives**

8 Corridor Options representing a new alignment would directly fragment LIBs by introducing a
9 new linear facility where a roadway does not currently exist. **Figure 3.14-4** (Large Intact Block
10 Clusters) shows large areas of relatively intact and undeveloped habitat within the Study Area.
11 LIB portions that would be adjacent to I-11 rather than directly intersected by I-11 also are
12 expected to experience increased isolation as a result of guardrails, steep shoulders, and traffic,
13 which are physical barriers to wildlife movement. In addition to fragmentation, habitat
14 degradation will occur within LIB portions adjacent to I-11 due to increased disturbances, such
15 as noise and light pollution, and the spread of invasive species, all of which have effects that
16 occur beyond the road itself and contribute to isolation.

17 **Table 3.14-8** (LIB Fragmentation by Build Corridor Alternative) shows which LIBs are
18 fragmented by the alternatives, and the number and size of the LIB fragments resulting from the
19 construction of the Build Corridor Alternatives. Surface areas are provided in hectares to
20 facilitate comparison with the AGFD 5,000 hectare threshold under which a habitat block is no
21 longer considered functional in terms of wildlife connectivity (AGFD 2018a). **Table 3.14-9** (Total
22 Surface Area of Fragments Lost from Existing LIBs by Build Corridor Alternative) indicates, for
23 each Build Corridor Alternative, the total surface area represented by LIB fragments that no
24 longer fulfill the required 5,000-hectare threshold following construction of the alternatives.

25 LIBs affected by the Build Corridor Alternatives that become smaller in surface area as a result
26 of the direct fragmentation of currently undeveloped land consist of LIBs within LIB Clusters 2, 4,
27 and 6. LIBs that would experience the isolating effects of adjacent new roadways include LIB 4a
28 and LIB 4b, which would experience increased isolation from LIB 4c as a result of the Purple
29 and Green Alternatives. While LIBs beyond the I-11 corridor (LIB Cluster 7) and LIBs within the
30 corridor but beyond the footprint of the alternatives (LIB Clusters 1, 3, and 5) will not be
31 physically divided by I-11, they are still expected to experience the effects of increased isolation
32 due to the reduced dispersal opportunities of wildlife species with large ranges.

33 Based on parameters such as traffic volume, footprint, truck use, and speed limit, and according
34 to wildlife movement data collected by AGFD, already-existing roadways such as I-10, I-8, and
35 I-19 represent near-total barriers to wildlife (AGFD 2018a). Therefore, when co-located with
36 existing roadways where widening will be required, the I-11 corridor provides a potential
37 opportunity to improve wildlife connectivity through the implementation of mitigation components
38 such as wildlife overpasses and underpasses.



Table 3.14-8 LIB Fragmentation by Build Corridor Alternative

Large Intact Block Cluster (LIB)	LIBs Fragmented by Alternatives	Total Area (Hectares)	Area of Resulting LIB Fragments (Hectares)		
			Purple Alternative	Green Alternative	Orange Alternative
2*	2D	858,548	638,301 220,247	714,434 139,270 4,807 33 4	
	2F	21,159	21,073 86 (20,599) (560)	21,073 86 (20,599) (560)	
	2G	451,786		451,537 219 30	
	2K	5,415	4,656 728 27 3 <1 <1	5,104 243 65 3	
	2L	15,699		12,373 3,237 49 23 14 3	
	2N	6,563		6,093 470	
4	4C	74,030	73,900 92 23 15	73,923 92 15	
6	6A	7,410	7,403 7	6,912 496 2	5,659 1,751
	6B	13,709	13,609 100	13,645 64	
	6D	28,436	21,898 6,538	27,511 655 177 93	
	6E	86,421			83,948 2,415 49 9
	6G	42,849	29,005 13,821 17 6 <1	27,334 15,515	21,709 21,123 17 <1
	6I	34,479	29,712 4,757 4 4 2	29,712 4,757 4 4 2	28,719 5,760

* Surface Areas for the CAP Design Option are in parentheses under the acreages for the regular alternative.

NOTE: The surface areas of the resulting fragments of the single LIB that would be entirely lost as a result of fragmentation are indicated in bold.

Table 3.14-9 Total Surface Area of Fragments Lost from Existing LIBs by Build Corridor Alternative

		Total Surface Area of Fragments Lost from Existing LIBs by Alternative (Hectares)		
Large Intact Block Clusters	LIBs Fragmented by Alternatives	Purple Alternative	Green Alternative	Orange Alternative
2*	2D, 2F, 2G, 2K, 2L, 2N,	5,500 (5,974)	9,286 (9,760)	
4	4C	130	107	
6	6A, 6B, 6D, 6E, 6G, 6I	4,897	6,254	4,241
	Total:	10,527 (11,001)	15,647 (16,121)	4,241

* Surface areas for the CAP Design Option are in parentheses under the surface areas for the regular Build Corridor Alternative.

1 A highway can represent both a physical and psychological barrier for wildlife movement.
 2 Individual animals that attempt to cross can be injured or killed by traffic or can be affected by
 3 turning back, delaying their progress, or speeding their movement (van Langevelde et al. 2009).
 4 Wider roads and higher traffic volumes increase the barrier effect and decrease connectivity
 5 within the landscape (van Langevelde et al. 2009). Highways are a barrier for mammals,
 6 reptiles, amphibians, and many ground-dwelling insects (van Langevelde et al. 2009). Deer, elk,
 7 and other large ungulates may pass through a ROW fence to enter the ROW, but then often
 8 struggle to get back out due to the traffic volume and limited space within the ROW. This
 9 increases the risk for vehicle/wildlife collisions, wildlife and human injuries or fatalities, and
 10 property damage.

11 Failure to adequately ensure safe wildlife passage across highways can lead to various
 12 deleterious impacts to wildlife. Migration patterns, dispersal movements, and daily or seasonal
 13 activities can be disrupted within the corridor itself. Increased mortality or decreased passage
 14 across a road could lead to one or more of the following:

- 15 • A local population decline
- 16 • Decreased genetic diversity within a population
- 17 • Increased likelihood of a local population dying out (local extinction or extirpation),
- 18 • Reduced ability to adapt to ecological shifts associated with climate change
- 19 • A decrease in regional biodiversity in habitat patches that have become more isolated from
- 20 each other

21 These problems can be of societal significance when protected natural areas such as national
 22 parks experience loss of species due to habitat fragmentation.

23 Purple Alternative

24 The Purple Alternative would intersect and therefore directly impact three of the six LIB clusters
 25 in the Study Area: LIB Clusters 2, 4, and 6. A total of nine LIBs would be fragmented by the
 26 Purple Alternative. Of these LIBs, LIB 2k would be reduced to six fragments, none of which
 27 fulfills the AGFD 5,000-hectare requirement (**Table 3.14-8** [LIB Fragmentation by Build Corridor
 28 Alternative]). Thus, LIB 2k would no longer qualify as a LIB. All other LIBs that are fragmented

1 by the three Build Corridor Alternatives produce at least one fragment that fulfills the
 2 5,000-hectare threshold, indicating that following fragmentation, all LIBs other than LIB 2k would
 3 still qualify as LIBs based on the surface area requirement. In terms of connectivity, under the
 4 Purple Alternative, the loss of functional land represented by the loss of LIB fragments that are
 5 at least 5,000 hectares in surface area would be somewhere between the loss under the Green
 6 Alternative and the loss under the Orange Alternative (**Table 3.14-9** [Total Surface Area of
 7 Fragments Lost from Existing LIBs by Build Corridor Alternative]).

8 The Purple Alternative would create new highway infrastructure that would affect habitat quality
 9 (e.g., LIB integrity) and create impediments to wildlife movement that currently do not exist
 10 within Pima County, the Santa Rita-Sierrita Detailed Linkage, the TMC, the Buckeye Hills East-
 11 SDNM Linkage, the Gila Bend-Sierra Estrella Linkage, the Wickenburg-Hassayampa Linkage,
 12 and the White Tanks-Belmont-Hieroglyphic Mountains Linkage.

13 Implementing the CAP Design Option would enable the alignment to match the CAP, thereby
 14 allowing the design of I-11 to parallel the existing wildlife crossings in the TMC area; this would
 15 reduce the barrier effect of the I-11 infrastructure. Design options for this section of roadway are
 16 unknown at this time. However, mitigation for the TMC corridor includes additional land
 17 purchases for wildlife connectivity.

18 The Purple Alternative would contribute to the isolation of LIBs where the alternative is co-
 19 located with existing high-traffic highways (greater than 5,000 AADT), and where widening
 20 would be needed. However, in these roadway segments, the potential does exist to improve
 21 wildlife connectivity by implementing wildlife crossing mitigation during the process of upgrading
 22 these highways to the proposed I-11. Thus, wildlife movement through the following linkages
 23 could potentially be improved:

- 24 • Ironwood-Picacho Linkage
- 25 • Santa Rita-Tumacacori Linkage
- 26 • Coyote-Ironwood-Tucson Detailed Linkage

27 The Patagonia-Santa Rita Linkage does not intersect any of Build Corridor Alternatives and
 28 would not be impacted by changes to I-19 under Option A because it is far enough away.
 29 Therefore, there would be no impact to wildlife movement within this linkage corridor.

30 The Purple Alternative would introduce new highway infrastructure in the Avra Valley, Vekol
 31 Valley, Rainbow Valley, and Hassayampa Plain that would compromise the quality of wildlife
 32 corridors and linkages in these areas by increasing the cascade of effects described in the
 33 previous section. The Green Alternative also would introduce more new highway infrastructure
 34 than both the Purple and Orange Alternatives. The only new fracture zone included in the
 35 Orange Alternative is through the Hassayampa Plain. Thus, of the three alternatives, the
 36 Orange Alternative would have the lowest expense and the lowest requirements for complex
 37 wildlife connectivity mitigations because it relies on already existing roadways more than the
 38 Green and Purple Alternatives.

39 Green Alternative

40 The Green Alternative would intersect and therefore directly impact four of the six LIB clusters in
 41 the Study Area: LIB Clusters 2, 4, 5, and 6. A total of 12 LIBs would be fragmented by the
 42 Green Alternative, compared to 4 LIBs and 9 LIBs for the Orange and Purple Alternatives,
 43 respectively. Of these LIBs, none would be completely reduced to fragments below the AGFD

1 5,000-hectare requirement (**Table 3.14-8** [LIB Fragmentation by Build Corridor Alternative]). In
2 terms of connectivity, under the Green Alternative, the loss of functional land represented by the
3 loss of LIB fragments that are at least 5,000 hectares in surface area would be greater than the
4 loss under the Orange and Purple Alternatives (**Table 3.14-9** [Total Surface Area of Fragments
5 Lost from Existing LIBs by Build Corridor Alternative]). Under the Green Alternative, this loss
6 would be approximately 3.6 times and 1.4 times larger than that caused by the Orange
7 Alternative and the Purple Alternative, respectively. Thus, the Green Alternative would cause
8 the most fragmentation of LIBs.

9 The Green Alternative would create new highway infrastructure that would affect habitat quality
10 (e.g., LIB integrity) and create impediments to wildlife movement that currently do not exist
11 within the following:

- 12 • Ironwood-Picacho Linkage
- 13 • Santa Rita-Sierrita Detailed Linkage
- 14 • Santa Rita-Tumacacori Linkage
- 15 • Tucson Mitigation Corridor
- 16 • Coyote-Ironwood-Tucson Detailed Linkage
- 17 • Buckeye Hills East-SDNM Linkage
- 18 • Gila Bend-Sierra Estrella Linkage
- 19 • Wickenburg-Hassayampa Linkage
- 20 • White Tanks-Belmont- Hieroglyphic Mountains Linkage

21 Implementing the CAP Design Option would enable the alignment to parallel the CAP, thereby
22 allowing the design of I-11 to match the existing wildlife crossings in the TMC area. This would
23 reduce, but not eliminate, the barrier effect of the I-11 infrastructure. Design options for this
24 section of roadway are unknown at this time; however, mitigation for the TMC corridor includes
25 additional land purchases for wildlife connectivity. The Green Alternative would contribute to the
26 isolation of LIBs where it is co-located with existing high-traffic highways (greater than
27 5,000 AADT) and where widening would be needed. However, in these roadway segments,
28 there is potential to improve wildlife connectivity if wildlife crossing mitigation is implemented in
29 the process of upgrading these highways to the proposed I-11. The Patagonia-Santa Rita
30 Linkage does not intersect any of the Build Corridor Alternatives, and changes to I-19 under
31 Option A would not impact the linkage because it is far enough away. Therefore, there would be
32 no impact to wildlife movement within this linkage corridor.

33 Overall, the Options under the Green Alternative are primarily situated in areas without existing
34 major highways, which would introduce more new highway infrastructure and therefore more
35 fragmentation of wildlife habitat and wildlife corridors within wildlife linkages than either the
36 Purple Alternative or the Orange Alternative. The Green Alternative has the greatest potential to
37 disrupt wildlife linkages and connectivity compared to the Purple and Orange Alternatives. For
38 instance, in the North Section, while the Green Alternative is shorter and less convoluted than
39 the other alternatives, it impacts the Wickenburg-Hassayampa and the White Tanks-Belmont-
40 Hieroglyphic Mountains wildlife linkages to a greater extent. In contrast, the Orange Alternative
41 traverses the fewest linkage areas where roadways do not currently exist and therefore would
42 have the least impact on wildlife linkages.



1 However, all of these Options could create a blockage at or near the interface of the wildlife
2 linkages and the wildland blocks that these linkages connect where high-traffic roadways do not
3 currently exist. All of the Options also could impair wildlife movement across the CAP canal.
4 While the Green Alternative, followed by the Purple Alternative, creates more new barriers to
5 wildlife movement, the Orange Alternative creates the fewest new barriers and provides a
6 limited opportunity to reduce the barrier effect of existing roadways.

7 Orange Alternative

8 The Orange Alternative would intersect and therefore directly impact four of the six LIB clusters
9 within the Study Area: LIB clusters 2, 4, 5, and 6. A total of four LIBs would be fragmented by
10 the Orange Alternative. Of these LIBs, none would be completely reduced to fragments below
11 the AGFD 5,000-hectare requirement (**Table 3.14-8** [LIB Fragmentation by Build Corridor
12 Alternative]). In terms of connectivity, under the Orange Alternative, the loss of functional land
13 represented by the loss of LIB fragments that are at least 5,000 hectares in surface area would
14 be the smallest compared to the losses under the Green and Purple Alternatives (**Table 3.14-9**
15 [Total Surface Area of Fragments Lost from Existing LIBs by Build Corridor Alternative]). The
16 loss under the Orange Alternative would be approximately 2.4 times and 3.6 times smaller than
17 the losses under the Purple Alternative and Green Alternative, respectively. Thus, the Orange
18 Alternative would cause the least fragmentation of LIBs.

19 The Orange Alternative would create new highway infrastructure that would affect habitat quality
20 (e.g., LIB integrity) and create impediments to wildlife movement that currently do not exist
21 within the Wickenburg-Hassayampa Linkage and the White Tanks-Belmont-Hieroglyphic
22 Mountains Linkage. The Orange Alternative would contribute to the isolation of LIBs where it is
23 co-located with existing high-traffic highways (greater than 5,000 AADT), and where widening
24 would be needed. However, in these roadway segments, there is potential to improve wildlife
25 connectivity if wildlife crossing mitigation is implemented in the process of upgrading these
26 highways to the proposed I-11. Thus, wildlife movement through the following linkages could
27 potentially be improved:

- 28 • Ironwood-Picacho Linkage
- 29 • Santa Rita-Sierrita Detailed Linkage
- 30 • Santa Rita-Tumacacori Linkage
- 31 • Tucson-Tortolita-Santa Catalina linkage
- 32 • Coyote-Ironwood-Tucson Detailed Linkage
- 33 • Gila Bend-Sierra Estrella Linkage

34 The Patagonia-Santa Rita Linkage does not intersect any of the Build Corridor Alternatives and
35 would not be impacted by changes to I-19 under Option A because it is far enough away.
36 Therefore, there would be no impact to wildlife movement within this linkage corridor.

37 Overall, the Corridor Options are co-located along existing major highways to a greater extent
38 under the Orange Alternative than under the Purple or Green Alternative. As a result, the
39 Orange Alternative is the alternative that creates the fewest impediments to wildlife movement
40 as a result of new roadway infrastructure.

41 For instance, while the Purple and Green Alternatives impact the Coyote-Ironwood-Tucson
42 linkage by creating new highway infrastructure that traverses the linkage, the Orange Alternative



1 would only impact this linkage through potential expansion of the already-existing I-10, which
2 occurs along a relatively small portion of the east edge of the linkage. In the North Section,
3 where new highway infrastructure would be required, the overall environmental impact to wildlife
4 corridors and linkages would be smaller under the Orange Alternative than under the Purple or
5 the Green Alternative. However, each of these alternatives could create a blockage at or near
6 the interface of the wildlife linkages and the wildland blocks that these connect, where high-
7 traffic roadways do not currently exist. All of them also could impair wildlife movement across
8 the CAP canal due to their proximity to existing CAP canal wildlife crossings.

9 Wildlife Corridors End-to-End Considerations

10 Overall, the Orange Alternative is co-located along existing major highways to a greater extent
11 than either the Purple or the Green Alternative. The Green Alternative is primarily situated in
12 areas without existing major highways and therefore would introduce more new highway
13 infrastructure within wildlife corridors than either the Purple or the Orange Alternative.

14 The overall environmental impact to wildlife corridors and linkages would be smaller under the
15 Orange Alternative than under the Purple or Green Alternative. Since the Orange Alternative
16 relies on co-location with existing roadways more than the other alternatives, it could offer a
17 limited opportunity to build wildlife crossings on existing roads when new construction is needed
18 to upgrade the existing roadway to the proposed I-11. However, each of these Build Corridor
19 Alternatives could create a blockage at or near the interface of the wildlife linkages and the
20 wildland blocks these connect, where high-traffic roadways do not currently exist, as well as
21 impair wildlife movement across the CAP canal due to their proximity to existing CAP canal
22 wildlife crossings. In addition, mitigation under the Orange Alternative might initially be more
23 effective because wildlife may have already acclimated to structures where they can cross the
24 highway.

25 No Build Alternative

26 The No Build Alternative, as described in **Chapter 2** (Alternatives Considered), is used as a
27 baseline for comparison with the Build Corridor Alternatives. The No Build Alternative would not
28 implement any of the Build Corridor Alternatives for development of I-11. Impacts for the No
29 Build Alternative were analyzed using currently programmed projects. These projects include
30 widening projects along existing routes (I-10 in Tucson and near the Town of Picacho and
31 US 93 in Wickenburg).

32 Therefore, the No Build Alternative is anticipated to have the least effect on wildlife connectivity
33 and the modeled linkages and natural corridors in the region (**Table 3.14-10** [Summary of
34 Potential Impacts on Biological Resources]).

35 Summary

36 The Orange Alternative overall has the least potential direct impacts on biological resources. In
37 contrast, the Green Alternative would cause the most deleterious impacts to biotic communities,
38 IBAs, SERI, and special-status species compared to the other alternatives based on its greater
39 impacts to riparian areas and to wildlife connectivity. The Green Alternative also has the
40 greatest potential to increase the spread of invasive species compared to the other alternatives.

Table 3.14-10 Summary of Potential Impacts on Biological Resources

Topics	No Build Alternative	Purple Alternative	Green Alternative	Orange Alternative
Biotic Communities ⁽¹⁾	<ul style="list-style-type: none"> Minimal impacts to biotic communities associated with programmed projects. Acres potentially affected are 105 acres of Arizona Upland Desertscrub and 64 acres of Lower Colorado River Desertscrub. 	<ul style="list-style-type: none"> 65,618 acres within the Build Corridor Alternative The Purple Alternative would be co-located along portions of I-19, I-10, and I-8, but to a lesser extent than the Orange Alternative. As a result, it would likely have a larger footprint than the Orange Alternative but a smaller footprint than the Green Alternative in the South and Central Sections. 	<ul style="list-style-type: none"> 64,894 acres within the Build Corridor Alternative. All three Build Corridor Alternatives would have similar acreages of habitat loss in the North Section; however, the Green Alternative would likely result in the largest amount of habitat loss in the South and Central Sections. 	<ul style="list-style-type: none"> 63,674 acres within the Build Corridor Alternative. The Orange Alternative would be co-located along existing highway corridors in the South and Central Sections and as a result would likely have a substantially smaller footprint and less impact on biotic communities than either the Purple or the Green Alternative.
Riparian Areas ⁽²⁾	<ul style="list-style-type: none"> No impacts identified; Existing conditions and baseline trends would continue. 	<ul style="list-style-type: none"> 663 acres within the Build Corridor Alternative. 	<ul style="list-style-type: none"> 1,302 acres within the Build Corridor Alternative. 	<ul style="list-style-type: none"> 611 acres within the Build Corridor Alternative, so the least potential impact to riparian areas of all the alternatives.
IBAs ⁽²⁾	<ul style="list-style-type: none"> No impacts identified; Existing conditions and baseline trends would continue. 	<ul style="list-style-type: none"> 1,357 acres of IBAs within the Build Corridor Alternative. All three Build Corridor Alternatives include IBAs under Option A. The Purple Alternative has a new crossing of the Gila River and then parallels the river, incorporating portions of the IBAs within the 2,000-foot-wide corridor. 	<ul style="list-style-type: none"> 1,032 acres of IBAs within the Build Corridor Alternative. All three Build Corridor Alternatives include IBAs under Option A. The Green Alternative crosses the Gila River along the existing SR 85 alignment. 	<ul style="list-style-type: none"> 573 acres of IBAs within the Build Corridor Alternative. All three Build Corridor Alternatives include IBAs under Option A. The Orange Alternative crosses the Gila River along the existing SR 85 alignment.

Table 3.14-10 Summary of Potential Impacts on Biological Resources (Continued)

Topics	No Build Alternative	Purple Alternative	Green Alternative	Orange Alternative
SERI	<ul style="list-style-type: none"> No impacts identified. Existing conditions and baseline trends would continue. 	<ul style="list-style-type: none"> The Purple Alternative would be co-located along portions of I-19, I-10, and I-8, but to a lesser extent than the Orange Alternative. As a result, it would likely have a larger footprint than the Orange Alternative, but a smaller footprint than the Green Alternative in the South and Central Sections. 	<ul style="list-style-type: none"> The Green Alternative would likely have less of an impact on SERI than the Orange Alternative in the South and Central Sections, but greater impacts than the Purple Alternative. Within the North Section, impacts, based upon total habitat loss, would be similar. 	<ul style="list-style-type: none"> Each of the Build Corridor Alternatives would result in loss of potential habitat and impact species movement within the vicinity of the I-11 Corridor. Because the Orange Alternative would be co-located along existing transportation corridors within the South and Central Sections, that alternative would have the least potential direct impact on SERI.
Invasive Species	<ul style="list-style-type: none"> No impacts identified. Existing conditions and baseline trends would continue. 	<ul style="list-style-type: none"> There will be an increased threat of noxious and invasive species spreading and impacting native species, especially along new alignments in rural, undeveloped areas. In the North Section, all Build Corridor Alternatives would have similar impacts. 	<ul style="list-style-type: none"> There will be an increased threat of noxious and invasive species spreading and impacting native species, especially along new alignments in rural, undeveloped areas. In the North Section, all Build Corridor Alternatives would have similar impacts. 	<ul style="list-style-type: none"> The Orange Alternative in the South and Central Sections would be co-located along the existing highway where many noxious and invasive species have already become established. As such, the Orange Alternative would likely have the least impact of the three Build Corridor Alternatives. In the North Section all Build Corridor Alternatives would have similar impacts.

Table 3.14-10 Summary of Potential Impacts on Biological Resources (Continued)

Topics	No Build Alternative	Purple Alternative	Green Alternative	Orange Alternative
Threatened and Endangered Species	<ul style="list-style-type: none"> No impacts identified; programmed transportation projects would be subject to environmental review. 	<ul style="list-style-type: none"> None of the Build Corridor Alternatives would impact critical habitat for the Chiricahua leopard frog, southwestern willow flycatcher, and western yellow-billed cuckoo associated with the Santa Cruz River. A new crossing of the Gila River would be required in an area that provides potential habitat for several threatened or endangered species that utilize riparian and aquatic areas. Option C of this alternative is likely to impact large swaths of semidesert grassland occupied by PPC. In order to avoid a Jeopardy decision by USFWS for this species, a substantial amount of compensatory mitigation will be required. 	<ul style="list-style-type: none"> None of the Build Corridor Alternatives would impact critical habitat for the Chiricahua leopard frog, southwestern willow flycatcher, and western yellow-billed cuckoo associated with the Santa Cruz River. The existing SR 85 crossing of the Gila River provides potential habitat for several threatened or endangered species that utilize riparian and aquatic habitat. No new crossing of the Gila River would be required. Option D of this alternative is likely to impact large swaths of semidesert grassland occupied by PPC. In order to avoid a Jeopardy decision by USFWS for this species, a substantial amount of compensatory mitigation will be required. 	<ul style="list-style-type: none"> None of the Build Corridor Alternatives would impact critical for the Chiricahua leopard frog, southwestern willow flycatcher, and western yellow-billed cuckoo associated with the Santa Cruz River. The existing SR 85 crossing of the Gila River provides potential habitat for several threatened or endangered species that utilize riparian and aquatic habitat. No new crossing of the Gila River would be required. Option B of this alternative also will impact semidesert grassland occupied by PPC; however, this alternative is co-located with the existing I-19 roadway, which may or may not require widening. New ground disturbance will be less for this option than for the other alternatives, and will be less likely to result in a possible Jeopardy decision by USFWS.

Table 3.14-10 Summary of Potential Impacts on Biological Resources (Continued)

Topics	No Build Alternative	Purple Alternative	Green Alternative	Orange Alternative
Other Sensitive Species	<ul style="list-style-type: none"> No impacts identified; programmed transportation projects would be subject to environmental review. 	<ul style="list-style-type: none"> The Purple Alternative would be co-located along portions of I-19, I-10, and I-8, but to a lesser extent than the Orange Alternative. As a result, it would likely have a larger footprint than the Orange Alternative, but a smaller footprint and less of a potential impact to other sensitive species than the Green Alternative in the South and Central Sections. 	<ul style="list-style-type: none"> All three Build Corridor Alternatives would have similar acreages of habitat loss in the Northern Section; however, the Green Alternative would likely result in the largest amount of habitat loss and potential impacts to other sensitive species in the South and Central Sections. 	<ul style="list-style-type: none"> As the Orange Alternative contains the most co-located options and the least acreage impacts to biotic communities, it will have the least potential to impact other sensitive species.
Wildlife Connectivity	<ul style="list-style-type: none"> Existing conditions and baseline trends would continue. Programmed transportation projects would be subject to environmental review. 	<ul style="list-style-type: none"> In the South Section, all Build Corridor Alternatives cross or parallel a number of linkage corridors. The Purple Alternative crosses through one wildland block within the South Section. A portion of the Purple Alternative is co-located with I-10, which would minimize the creation of new barriers to wildlife movement. In the Central Section, the Purple Alternative crosses the Gila Bend-Sierra Estrella Linkage, which connects two large wildland blocks located on the Gila River Indian 	<ul style="list-style-type: none"> In the South Section, all Build Corridor Alternatives cross or parallel a number of linkage corridors. The Green Alternative crosses through one wildland block within the South Section and has the greatest number of new crossings of potential wildlife corridors. In the Central Section, the Green Alternative crosses the Gila Bend-Sierra Estrella Linkage isolating two large wildland blocks located on the Gila River Indian Community and the SDNM. The Green Alternative (Option M) 	<ul style="list-style-type: none"> In the South Section, all Build Corridor Alternatives cross or parallel a number of linkage corridors. The Orange Alternative crosses through only one wildland block, which is located within the Tohono O’odham Nation but also is on the existing I-19 alignment. The Central Section of this alternative is co-located with I-8 and crosses a large wildland block within the SDNM. In the North Section, all three Build Corridor Alternatives are similar and cross through large

Table 3.14-10 Summary of Potential Impacts on Biological Resources (Continued)

Topics	No Build Alternative	Purple Alternative	Green Alternative	Orange Alternative
		<p>Community and the SDNM.</p> <ul style="list-style-type: none"> In the North Section all three Build Corridor Alternatives are similar and cross through large habitat blocks and the Wickenburg-Hassayampa Linkage. The Purple Alternative also crosses the Vulture Mountains Recreation Area. 	<p>then runs through the SDNM wildland block.</p> <ul style="list-style-type: none"> In the North Section, all three Build Corridor Alternatives are similar and cross through large habitat blocks and the Wickenburg-Hassayampa Linkage. The Green Alternative also crosses the Vulture Mountains Recreation Area. 	<p>habitat blocks and the Wickenburg-Hassayampa Linkage. The Orange Alternative is outside of the Vulture Mountains Recreation Area.</p> <ul style="list-style-type: none"> Overall, the Orange Alternative has the most co-located segments and therefore the least potential impacts to wildlife connectivity.
Indirect Effects	<p>Programmed transportation improvements plus projected population and employment growth could:</p> <ul style="list-style-type: none"> Continue historical trends where construction added to the fragmentation and destruction of biotic communities. Generally increase development pressure that will further degrade and fragment wildlife habitat. 	<p>Land development induced by I-11 could:</p> <ul style="list-style-type: none"> Introduce or exacerbate the introduction of unwanted or invasive plant or wildlife species into new areas. Impacts associated with new alignments would take longer to occur and have potentially greater indirect negative impacts to native species than impacts associated with co-located alignments. Cause or increase gradual changes in species composition, diversity, genetic makeup, and/or health due to impacts to habitat, habitat fragmentation, or genetic isolation. 	<p>Similar to the Purple Alternative, except:</p> <ul style="list-style-type: none"> Increased potential for indirect effects to biotic communities due to a greater portion of the alternative being on a greater amount of new alignment as compared with the Purple and Orange Alternatives. Greater potential for increased wildlife mortality, including SERI, due to wildlife/vehicle collisions than the Purple or the Orange Alternative because of the greater amount of new alignment. Greater potential for possible disruption of mating or feeding by 	<p>Similar to the Purple Alternative, except:</p> <ul style="list-style-type: none"> This alternative has the most co-located highway segments, which may or may not require widening. Most of these highway segments are already considered impermeable to most wildlife due to high traffic volumes; therefore selection of this alternative would provide some limited opportunities to improve wildlife connectivity by adding wildlife crossings to the design. Least potential for increased wildlife mortality, including SERI, due to wildlife/vehicle

Table 3.14-10 Summary of Potential Impacts on Biological Resources (Continued)

Topics	No Build Alternative	Purple Alternative	Green Alternative	Orange Alternative
		<ul style="list-style-type: none"> • Change the quantity and quality of habitat and the resources that species rely on for food, hunting/ scavenging, and breeding due to the introduction of contaminants or pollutants from runoff or changes in hydrology. • Within the North Section, the Purple Alternative might have the least amount of indirect on biotic communities and wildlife habitat due to its location within the Douglas Ranch planned development. • Potential for increased wildlife mortality, including SERI, due to wildlife/vehicle collisions on segments of new alignment. • Possible disruption of mating or feeding by wildlife species within the immediate vicinity of the highway due to the introduction of increased noise or light pollution from the highway as well as to induced development due to the highway. 	<p>wildlife species within the immediate vicinity of the highway than the Purple or the Orange Alternative due to the introduction of increased noise or light pollution from the highway as well as due to induced development resulting from the highway.</p>	<p>collisions than the Purple or Green alternatives.</p> <ul style="list-style-type: none"> • Least potential for possible disruption of mating or feeding by wildlife species within the immediate vicinity of the highway than the Purple or the Green Alternative due to the introduction of increased noise or light pollution from the highway as well as due to induced development resulting from the highway.

Table 3.14-10 Summary of Potential Impacts on Biological Resources (Continued)

Topics	No Build Alternative	Purple Alternative	Green Alternative	Orange Alternative
Cumulative Effects	<p>Past, present, and reasonably foreseeable projects could:</p> <ul style="list-style-type: none"> • Cause localized, incremental effects in locations with planned corridor improvements and increased development. 	<p>Past, present, and reasonably foreseeable projects could:</p> <ul style="list-style-type: none"> • Create substantial habitat loss, fragmentation, and isolation effects corridor-wide and this is of greatest concern near threatened and endangered species habitats and along wildlife corridors as land is developed. • Within the North Section, the Purple Alternative might have a somewhat lesser cumulative effect on biotic communities and wildlife habitat due to its location within the Douglas Ranch planned development. 	<p>Similar to the Purple Alternative, except:</p> <ul style="list-style-type: none"> • Potential incremental effects could be somewhat greater than the Purple Alternative due to a greater amount of new alignment. 	<p>Similar to the Purple Alternative, except:</p> <ul style="list-style-type: none"> • Potential incremental effects would be greater than the No Build Alternative and less than the Purple or the Green Alternative.

- (1) This is the total number of acres within the 2,000-foot-wide corridor. The actual construction footprint would be approximately one-fourth (25 percent) of the total area shown for each Build Corridor Alternative. In areas where the Build Corridor Alternative would be co-located with existing highway facilities, the acreage of impact would likely be further reduced.
- (2) The acres presented for riparian areas and IBAs represent the total number of acres within the 2,000-foot-wide corridor.

I-10 = Interstate 10, I-11 = Interstate 11, I-19 = Interstate 19, I-8 = Interstate 8, IBA = Important Bird Areas, PPC = Pima pineapple cactus, SDNM = Sonoran Desert National Monument, SERI = Species of Economic and Recreational Importance, SR = State Route, USFWS = US Fish and Wildlife Service.

1 **3.14.5 Potential Mitigation Strategies**

2 This Tier 1 analysis provides an overview of potential impacts from the construction and
 3 operation of a new I-11 transportation facility within one of the Build Corridor Alternatives.
 4 Specific project design, construction methods, and facility alignment within a Build Corridor
 5 Alternative have not been determined; therefore, specific methods to avoid, minimize, or
 6 mitigate project-related impacts cannot be developed. However, **Table 3.14-11** (General
 7 Mitigation Strategies Applicable to All Corridor Options) outlines the general mitigation
 8 strategies, by type of resource that would be implemented for all the Corridor Options.
 9 **Table 3.14-12** (Specific Mitigation Strategies for Each Corridor Option) identifies more specific
 10 mitigation strategies for each Corridor Option in addition to the general strategies. These
 11 strategies would be refined during the Tier 2 process.

Table 3.14-11 General Mitigation Strategies Applicable to All Corridor Options

General Mitigation Strategies Applicable to all Options	
Noxious and Invasive Species	ADOT will participate, support, and commit to long-term noxious weed management efforts in the I-11 Corridor. To effectively combat noxious and invasive weeds, a coordinated effort across federal, state and local levels is required. Noxious and invasive weed control on BLM or US Forest Service (USFS) lands would occur in accordance with previously approved environmental assessments. Long-term management of noxious and invasive weeds would be necessary to minimize indirect and cumulative effects to the PPC and its habitat.
	To avoid the introduction of noxious and invasive species seeds, and to avoid noxious and invasive species seeds from entering/leaving the sites, all construction equipment must be washed and free of all attached plant/vegetation and soil/mud debris prior to entering/leaving the construction sites.
	All disturbed soils that are not paved and that will not be landscaped or otherwise permanently stabilized by construction will be seeded using species native to the project vicinity.
Native Plants	Protected native plants within the project limits will be impacted by I-11; therefore, it will be determined if AZDA notification is needed for compensation purposes. If notification is needed, ADOT will send the notification prior to the start of construction.
Wildlife Connectivity	ADOT will coordinate with the AGFD, BLM, and other stakeholders to determine wildlife connectivity data needs and study design. ADOT will then fund and facilitate implementation of identified studies prior to the initiation of the Tier 2 process, due to the timeline required (likely 2 to 4 years) to collect and analyze sufficient data before draft design plans begin to limit the mitigations possible. ADOT and the stakeholders will identify the crossing structures, design features, and supporting mitigation or conservation necessary to facilitate the movement of wildlife through the roadway barrier, and will incorporate the solutions into subsequent I-11 projects.
	ADOT will establish partnering opportunities with key landowners (e.g., private, BLM, Reclamation, Maricopa County, Pinal County, and Pima County) and appropriate municipal, county, state, and federal agencies prior to and during the Tier 2 process for long-term planning strategies.

Table 3.14-11 General Mitigation Strategies Applicable to All Corridor Options (Continued)

General Mitigation Strategies Applicable to all Options	
Wildlife Connectivity (continued)	Prior to the Tier 2 analysis, ADOT will evaluate the Wildlife Connectivity Assessment reports from Pima, Pinal, Maricopa and Yavapai counties to identify and, if possible, avoid I-11 impacts on the diffuse, landscape, and riparian wildlife movement areas identified in each report.
	Structures designed to enhance wildlife connectivity, such as wildlife overpasses and underpasses, and fencing to funnel wildlife to these structures, would be evaluated by ADOT in association with AGFD, designed, and constructed taking species-specific needs into consideration.
ESA-listed Species	ADOT will avoid or minimize impacts to designated or proposed critical habitat. If impacts to critical habitat cannot be avoided, consultation with the USFWS will occur during the Tier 2 analysis.
	Prior to the Tier 2 process, ADOT will conduct a thorough habitat assessment in all areas that have potential habitat for ESA-listed species. If suitable habitat occurs within the construction footprint, ADOT will avoid or minimize impacts. Additionally, pre-construction surveys will be completed for all ESA-listed species, or it will be assumed that the species occurs on site. For the southwestern willow flycatcher, western yellow-billed cuckoo, and Yuma Ridgeway's rail, surveys during two breeding seasons will be conducted prior to the Tier 2 process. During the Tier 2 process, ADOT will conduct consultation with USFWS.
	Potential mitigation measures to avoid or minimize impacts to ESA-listed species will be determined through consultation with USFWS during the Tier 2 process, but could include breeding season restrictions, translocation of individuals, minimization of vegetation removal, minimization of the project footprint, etc.
	During the Tier 2 process, if impacts to ESA-listed species or habitat are determined likely to occur, compensatory mitigation will be negotiated with USFWS.
Sonoran Desert Tortoise	ADOT will continue to honor its commitments within the Candidate Conservation Agreement for the Sonoran Desert Tortoise in Arizona (USFWS 2015e).
	Prior to the Tier 2 process, ADOT will conduct habitat suitability surveys within agency-mapped tortoise habitat that may be impacted by I-11.
	ADOT will partner with state and federal agencies during the Tier 2 and design process, and will use data obtained from habitat suitability studies to inform design features to minimize impacts to the Sonoran Desert Tortoise and its habitat.
	Any future I-11 segments selected for construction that are located within Sonoran desert tortoise habitat will follow ADOT's existing mitigation strategies. ADOT has developed comprehensive Sonoran desert tortoise mitigation that includes, but is not limited to, education of contractors and ADOT staff on tortoise awareness, pre-construction surveys, relocation of tortoises, on-site monitoring of construction activities, and best management practices designed to reduce potential tortoise mortalities during construction.

ADOT = Arizona Department of Transportation, AZDA = Arizona Department of Agriculture, BLM = Bureau of Land Management, ESA = Endangered Species Act, PPC = Pima pineapple cactus, Reclamation = Bureau of Reclamation, USFS = US Forest Service, USFWS = US Fish and Wildlife Service.

Table 3.14-12 Specific Mitigation Strategies for Each Corridor Option

Option	Resources*	Mitigation Strategy
A	Southwestern willow flycatcher, western yellow-billed cuckoo, and their critical habitat; Gila topminnow; and Northern Mexican gartersnake	Avoid widening I-19 to the east along the Santa Cruz River and impacting habitat; conduct pre-construction surveys where appropriate; and consult with the USFWS, as needed.
	Jaguar and its critical habitat; ocelot	Minimize the construction footprint to the extent possible, and improve or construct wildlife crossings that jaguar and ocelots will use.
	PPC	Minimize construction footprint through quality PPC habitat; survey suitable habitat 1 year prior to Tier 2 process to inform design; implement long-term control of noxious weeds; and negotiate compensatory mitigation with USFWS, as needed.
	Santa Cruz River	Avoid or minimize impacts to this major riparian corridor. The need for potential additional wildlife crossings would be assessed and implemented where warranted to preserve wildlife movement. Coordinate with relevant agencies to implement modifications that will enhance wildlife movement.
	Tumacacori-Santa Rita Linkage	Avoid or minimize impacts to linkages. Assess whether recommendations provided in the specific or the county linkage reports can be used to improve or construct wildlife crossings in these linkages. Coordinate with relevant agencies to implement modifications that will enhance wildlife movement.
	Santa Rita-Sierrita Linkage	
B	PPC	Minimize construction footprint through quality PPC habitat; survey suitable habitat 1 year prior to Tier 2 process to inform design; implement long-term control of noxious and invasive weeds; and negotiate compensatory mitigation with USFWS, as needed.
	Yellow-billed cuckoo	Avoid widening the I-19 or I-10 into the Santa Cruz River floodplain; conduct pre-construction surveys in suitable habitat during two breeding seasons; implement seasonal restrictions and consult with USFWS, as needed.
	Santa Cruz River	Avoid or minimize impacts to this major riparian corridor. The need for potential additional wildlife crossings would be assessed and implemented where warranted to preserve wildlife movement. Coordinate with relevant agencies to implement modifications that will enhance wildlife movement.
	Santa Rita-Sierrita Linkage	Avoid or minimize impacts to linkages. Assess whether recommendations provided in the specific or the county linkage reports can be used to improve and construct wildlife crossings in these linkages. Coordinate with relevant agencies to implement modifications that will enhance wildlife movement.
	Tucson-Tortolita-Santa Catalina Linkage	
	Coyote-Ironwood-Tucson Linkage	

Table 3.14-12 Specific Mitigation Strategies for Each Corridor Option (Continued)

Option	Resources*	Mitigation Strategy
C, D, CAP Design Option, I-10 Connector	PPC	Minimize construction footprint through quality PPC habitat; survey suitable habitat 1 year prior to Tier 2 process to inform design; implement long-term control of noxious weeds; and negotiate compensatory mitigation with USFWS, as needed.
	Chiricahua leopard frog	Avoid critical and occupied habitat that is adjacent to the southern end of this option.
	Santa Rita-Sierrita Linkage	Avoid or minimize impacts to linkages. Assess whether recommendations provided in the specific or the county linkage reports can be used to improve and construct wildlife crossings in these linkages. Coordinate with relevant agencies to implement modifications that will enhance wildlife movement.
	Coyote-Ironwood-Tucson Linkage	
	TMC	Avoid, minimize, or mitigate impacts to the TMC. Coordinate with the Reclamation, AGFD, and other relevant agencies to improve and design wildlife crossings in and near the TMC. Specific mitigation related to the TMC includes: (1) relocating and reclaiming Sandario Road; (2) conducting wildlife studies prior to the Tier 2 process; (3) aligning I-11 wildlife crossing structures to match the existing CAP canal siphons (7 crossings total); (4) creating an additional wildlife crossing near the TMC, depending on the results of wildlife studies; (5) acquiring property (at a 1:1 ratio) to support additional wildlife connectivity corridors within Avra Valley for the number of acres of the TMC that will be impacted by I-11; and (6) implementing design restrictions, such as no interchanges in the TMC or immediate area, and minimizing the width of I-11 to limit the I-11 footprint in the TMC area (see Chapter 4 [Preliminary Draft Section 4(f) Evaluation] for more detail on these mitigation strategies).
F	Yellow-billed cuckoo	Avoid or minimize impacts to the Santa Cruz River along Option F; conduct pre-construction surveys during two breeding seasons; implement seasonal restrictions; and consult with USFWS, as needed.
	Coyote-Ironwood-Tucson Linkage	Avoid or minimize impacts to linkages. Assess whether recommendations provided in the specific or the county linkage reports can be used to improve and construct wildlife crossings in these linkages. Coordinate with relevant agencies to implement modifications that will enhance wildlife movement.
	Ironwood-Picacho Linkage	
G	Ironwood-Picacho Linkage	Avoid or minimize impacts to this linkage. Assess whether recommendations provided in the specific or the county linkage reports can be used to improve and construct wildlife crossings in this linkage. Coordinate with relevant agencies to implement modifications that will enhance wildlife movement.
H, I1, and I2		No specific mitigation strategies needed for these Options.
K, L	Gila Bend-Sierra Estrella Linkage	Avoid or minimize impacts to this linkage. Assess whether recommendations provided in the specific or

**Table 3.14-12 Specific Mitigation Strategies for Each Corridor Option
(Continued)**

Option	Resources*	Mitigation Strategy
		the county linkage reports can be used to improve and construct wildlife crossings in this linkage. Coordinate with relevant agencies to implement modifications that will enhance wildlife movement.
M	Buckeye Hills East-SDNM Linkage	Avoid or minimize impacts to this linkage. Assess whether recommendations provided in the specific or the county linkage reports can be used to improve and construct wildlife crossings in this linkage. Coordinate with relevant agencies to implement modifications that will enhance wildlife movement.
N	Yellow-billed cuckoo and its proposed critical habitat; southwestern willow flycatcher; and Yuma Ridgeway's rail	Minimize the footprint of the bridge crossing the Gila River to the extent possible; conduct pre-construction surveys in suitable habitat during two breeding seasons; implement seasonal restrictions; and consult with the USFWS, as needed.
	Gila River	Avoid or minimize impacts to this major riparian corridor. The need for potential additional wildlife crossings to preserve wildlife movement would be assessed. Coordinate with relevant agencies to implement modifications that will enhance wildlife movement.
Q1	Gila Bend-Sierra Estrella Linkage	Avoid or minimize impacts to this linkage. Assess whether recommendations provided in the specific or the county linkage reports can be used to improve and construct wildlife crossings in this linkage. Coordinate with relevant agencies to implement modifications that will enhance wildlife movement.
Q2	Yellow-billed cuckoo and its proposed critical habitat; southwestern willow flycatcher; and Yuma Ridgeway's rail	Minimize the footprint of bridge widening or new bridge construction on the SR 85 crossing the Gila River to the extent possible; conduct pre-construction surveys in suitable habitat during two breeding seasons; implement seasonal restrictions; and consult with USFWS, if species are present, as needed.
	Gila River	Avoid or minimize impacts to this major riparian corridor. The need for potential additional wildlife crossings to preserve wildlife movement would be assessed. Coordinate with relevant agencies to implement modifications that will enhance wildlife movement.
Q3, R	Yellow-billed cuckoo	Minimize construction in the Gila River floodplain to the extent possible; conduct pre-construction surveys in suitable habitat during two breeding seasons; implement seasonal restrictions; and consult with the USFWS, if species are present, as needed.
S, U, X	White Tanks-Belmonts-Vultures-Hieroglyphics Linkage	Avoid or minimize impacts to linkages. Assess whether recommendations provided in the specific or the county linkage reports can be used to improve and construct wildlife crossings in these linkages. Coordinate with relevant agencies to implement modifications that will enhance wildlife movement.
	Wickenburg-Hassayampa Linkage	

NOTE: Resources that share the same mitigation strategies are grouped together.



1 **3.14.6 Future Tier 2 Analysis**

2 ADOT will continue to work with agencies prior to and during the Tier 2 process to conduct
3 surveys needed to identify occupied habitat for ESA-listed species at the time of the Tier 2
4 project and to develop specific conservation measures to avoid, minimize, or mitigate impacts to
5 listed species. It is acknowledged that ESA-listed species could change over time.

6 ADOT will continue to work with federal and state agencies as well as affected municipalities
7 during the Tier 2 process to evaluate potential impacts to other sensitive species listed by these
8 entities. ADOT will work with Tribal agencies during the Tier 2 process to avoid or minimize
9 effects to tribally sensitive species.

10 ADOT will continue to work with stakeholders and partners, such as AGFD and BLM, prior to
11 and during the Tier 2 process to develop and fund appropriate studies to evaluate wildlife
12 movement and roadway mortality. Sufficient time (at least 2 to 4 years) will be given to ensure
13 the studies acquire adequate data for guiding the development of mitigation measures. Future
14 studies in support of Tier 2 impact analysis would focus on refining information relating to
15 specific impact areas within known wildlife linkages and corridors identified now and in the
16 future.

17 Tracking studies using camera traps, satellite telemetry, track plates, or other methods will
18 identify spatial and temporal use patterns of target species within the Study Area. Collision
19 studies will be utilized along co-located Corridor Options of I-11 to identify sites where
20 overpasses or underpasses could be installed. ADOT would implement on-the-ground mitigation
21 based on recommendations generated by these studies, such as constructing wildlife crossings
22 where previous crossings by wildlife has been documented and building culverts of a specific
23 size and design for wildlife occurring in specific locations in the Study Area. Also existing
24 culverts, bridges, and other roadway features that are in place along co-located highways
25 should be monitored to identify the species that use these and the degree to which these
26 existing features are effective at maintaining movement across the highway barriers.



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