Dudek, "Newhall Ranch Resource Management and Development Plan: Wildlife Habitat Buffers and Connectivity White Paper" (November 2008; 2008C)

SECTION 1.0 INTRODUCTION

This paper reviews scientific information regarding wildlife habitat buffers and habitat connectivity (*i.e.*, landscape habitat linkages, wildlife corridors, and wildlife crossings) and relates this information to the Newhall Ranch Resource Management and Development Plan (RMDP). General concepts related to wildlife habitat, the efficacy of buffers, and wildlife movement and dispersal are reviewed to provide the background for a discussion of the RMDP regarding wildlife use of the Newhall Ranch area after implementation of the RMDP and build-out of the Newhall Ranch Specific Plan (Specific Plan), Valencia Commerce Center (VCC), and the Entrada Village (Entrada) planning area (hereafter collectively referred to as the Project area) (**Figure 1**). The effects of implementing the RMDP and build-out of the Specific Plan, VCC, and Entrada planning area on wildlife species are assessed by grouping species into "guilds" relating to their common habitat requirements, role in the ecological setting, and ability to move (*i.e.*, vagility or mobility) through their environment. Particular focus is given to literature regarding urban edge effects on wildlife corridor and habitat linkage use by special-status species (*e.g.*, federally or state-listed threatened or endangered species or California Species of Special Concern) that have been documented or have the potential to occur in the Project area and are addressed in the RMDP Joint Environmental Impact Statement/Environmental Impact Report (EIS/EIR).

Section 2.0 provides a review of wildlife habitat buffers, including documented and potential edge effects on wildlife, the mechanisms of these edge effects, the relationship between edge effects and distance from the urban boundary, the functions of wildlife buffers, and the general design of wildlife buffers to avoid and reduce adverse edge effects.

Section 3.0 provides a review of wildlife habitat connectivity, including wildlife crossings, wildlife corridors, landscape-level habitat linkages, and wildlife connectivity within the Project area after development.

Section 4.0 analyzes different species "guilds" in the context of buffers, corridors, and landscape linkages. Guilds are groups of species that have similar ecological resource requirements and foraging strategies and therefore have similar roles in the ecological community (Lincoln *et al.* 1998). However, a guild can be defined in different ways, depending on the type of role in the ecological community being considered (*e.g.*, by habitat, by trophic level). For this analysis, the guild was defined primarily by the level and kind of mobility exhibited by species, such as aerial versus ground-dwelling versus aquatic. Seven species guilds were identified in the Project area: aquatic, semi-aquatic, high mobility ground-dwelling, moderate mobility ground-dwelling, low mobility ground-dwelling, high mobility aerial, and moderate mobility aerial.

Section 5.0 applies the guild concept to the special-status species that are known to or have potential to occur in the Project area in the context of known and potential edge effects, and to the buffer measures and habitat connectivity that would be in place after development so that the long-term environmental effects of the proposed Project can be evaluated.

Section 6.0 describes the project design features, including preserved open space, mitigation measures incorporated into the Specific Plan EIR, and additional recommended mitigation measures in the RMDP EIS/EIR to address wildlife buffer and habitat connectivity issues.

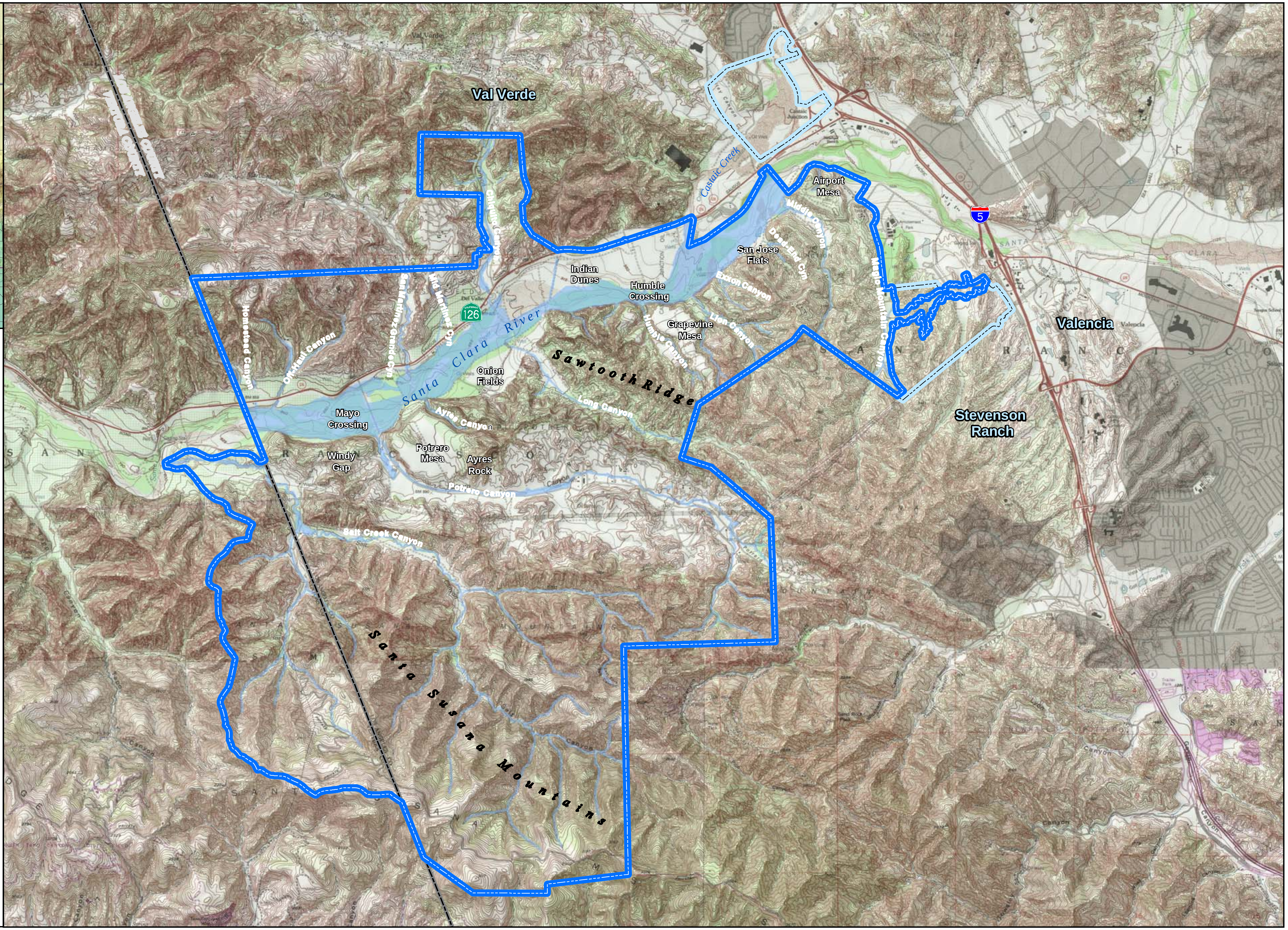
SECTION 2.0 WILDLIFE BUFFERS BACKGROUND

Potential impacts on biological resources as a result of urban development adjacent to natural open space[1] include (1) changes in plant communities resulting from non-native species invasion; (2) increases in native and non-native wildlife species, including mesopredators such as striped skunk (*Mephitis mephitis*), common raccoon (*Procyon lotor*), fox (*Urocyon* and *Vulpes* spp.), and Virginia opossum (*Didelphis virginiana*), which are adapted to urbanized environments, can out-compete native species for available resources, and can increase predation rates, thus reducing the distribution and populations of vulnerable native species (Crooks and Soulé 1999); (3) increases in human activity and domestic animals (*e.g.*, pet, stray, and feral cats and dogs) that can disturb natural habitat areas, alter wildlife behavior, increase predation rates, and generally displace or disrupt wildlife populations; (4) alteration of the natural fire regime through both shortened fire intervals and suppression; (5) increases in noise that alter critical behavioral activities such as reproduction and increase risk of predation; (6) increases in lighting and glare effects on wildlife species in remaining adjacent open space areas; (7) release of pesticides, herbicides, and pollutants into adjacent drainages, creeks, rivers, and wetlands as a result of landscape irrigation and stormwater runoff; and (8) erosion and dust resulting from construction/grading activities.

[1] "Open space" as used here is the generic use of the term meaning undeveloped land rather than the term "Open Area" as defined in the RMDP EIS/EIR for non-preserve undeveloped land set-asides.

Legend

- RMDP Boundary
- SCP Boundary
- County Boundary
- 2004 CDFG ACOE Jurisdiction



0 0.25 0.5 1 Miles

APPROXIMATE SCALE IN MILES

IMAGE SOURCE: USGS 24K Quad

FIGURE 1

RMDP Wildlife Habitat Buffers and Connectivity

Project Area

DUDEK

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This discussion primarily addresses factors 1 through 5 listed above through a review of available literature regarding the degree to which these factors affect preserved open space and the degree to which buffers can ameliorate these effects. Factors 6 through 8 are typically addressed through design parameters for lighting, stormwater management, and other Best Management Practices (BMPs) both during construction and for the life of the development. These design parameters are generally accepted source controls for negative effects of lighting/glare and BMPs for stormwater pollution, erosion, and dust during construction. Although these factors can be very important for protecting adjacent biological resources, methods of addressing their potential impacts depend less on the width of a buffer and more on internal project design and implementation factors. For example, several papers demonstrate that riparian buffers *per se* are a poor primary method of conserving these functions (Belt *et al.* 1992; Wegner 1999; Willson and Dorcas 2003). Conservation of these functions is best addressed at the landscape level through implementation of comprehensive watershed management.

The scientific literature reviewed here is summarized in two main topic areas: (1) a discussion of the types of edge effects that may be present within an open space–urban interface; and (2) a review and evaluation of buffers based on studies in the scientific literature. From these summaries, general conclusions are drawn to evaluate the proposed development and efficacy of proposed buffers and related project design features and mitigation measures.

Section 2.1 Review of Edge Effects on Wildlife

Schonewald-Cox and Bayless (1986) addressed the importance of political boundary designations and management in determining edge conditions and found that resulting edge conditions influence the effectiveness of preserve protection more than any processes internal to the preserve. Many subsequent studies of habitat fragmentation have examined the extent to which adverse trends in native species abundance in small habitat fragments are due to increased edge effects versus stochastic (random or chance) effects inherent in small habitat patches, such as vulnerability to environmental fluctuations and loss of genetic variation (*i.e.*, the "island effect"). Bolger *et al.* (1997) argue that reductions in native species diversity, and in fact native species extinctions within habitat fragments, are due to both stochastic island effects and deterministic edge effects. Fagan *et al.* (1999) identify four types of ecological interactions potentially present at habitat edges: (1) class 1 edges can change species interactions by altering species' movement patterns, (2) class 2 edges can change community dynamics by differentially inducing species' mortality, (3) class 3 edges can alter species interactions through cross-boundary subsidies,[2] and (4) class 4 edges can create new opportunities for species interactions. These groupings show that edge effects have far-reaching implications and can be studied and

[2] Fagan *et al.* (1999) describe "subsidies" as species interactions "in which dispersers' interpatch impacts are maintained by their activities in other habitats," explaining that "cross-boundary subsidies arise as populations of some species are maintained at high levels through growth, reproduction, and/or feeding in other habitat but then disperse across patch edges, depressing or otherwise affecting populations of patch residents."

understood only through observation of many aspects of species behavior and interactions. Due to the extent of these potential ecological interactions, Fagan *et al.* (1999) suggest that long-term adverse effects of habitat fragmentation within terrestrial systems are more attributable to edge effects than the stochastic island effects.

Section 2.2 Mechanisms of Edge Effects on Wildlife

Five sources or mechanisms of edge effects on native wildlife were identified above: (1) changes in plant communities, (2) increases in urban-adapted native and non-native wildlife species, (3) increases in human activity and domestic animals, (4) alteration of the natural fire regime, and (5) increases in noise.

Section 2.2.1 Plant Communities, Habitats, and Wildlife Species

The first two sources of edge effects—changes in plant communities and increases in urban-adapted native and non-native wildlife species—are discussed together because they are closed related and the studies reviewed here address them together.

Many studies have been conducted to examine the relationship between urbanization, changes in plant community structure, and native and non-native wildlife at the open space–urban interface (*e.g.*, Beissinger and Osborne 1982; Suarez *et al.* 1998; Marzluff 2001; Crooks *et al.* 2003; Longcore 2003; Blair 2004). A comprehensive review of these studies is beyond the scope of this paper, but several studies of particular relevance to the Project area are reviewed here.

Longcore (2003), for example, examined edge effects within fuel modification zones in native coastal sage scrub habitat in Southern California where vegetation is typically thinned to reduce fuel loads. Thinning has the effect of decreasing the structural diversity in coastal sage scrub and chaparral communities. The Longcore (2003) study documented adverse edge effects within the thinning zone, including the loss of arthropod diversity and increases in exotic species such as Argentine ants (*Linepithema humile*), European earwigs (*Forficula auricularia*), pillbugs (*Armadillidium vulgare*), sowbugs (*Porcellio* spp.), and sowbug killer (*Dysdera crocata*), which, in turn, negatively affect predator species such as coast horned lizard (*Phrynosoma coronatum*), and arachnids such as scorpions and trap-door spiders. Suarez *et al.* (1998) suggest that invasions of Argentine ants along habitat edges and in fragmented habitat patches, and the related decrease in native ants, is a contributing factor in the decline of the coast horned lizard.

Development-related fragmentation of native scrub habitat in Southern California has also been shown to contribute to rapid local native species extirpations, particularly passerine birds and small mammals (Soulé *et al.* 1998; Soulé *et al.* 1992; Crooks *et al.* 2001). In addition to habitat loss and degradation in fragmented habitat patches, Crooks *et al.* (2001) attribute some of the loss of native birds to urban-adapted native and non-native mesopredators (skunk, raccoon, fox, and opossum) that increase in abundance where coyotes (*Canis latrans*) are absent from small, isolated habitat fragments (*i.e.*, the "mesopredator release" effect described by Crooks and Soulé (1999)).

Habitat fragmentation is also related to increases in both native and non-native bird species able to adapt to, or exploit, suburban and urban environments. These species may out-compete resident native species for resources (*e.g.*, habitat, food, nesting locations) or directly prey on the native residents. In a study highly relevant to the discussion of urbanization effects on native bird communities, Rottenborn (1999) surveyed birds in riparian woodlands along a "gradient of urbanization" in the Santa Clara Valley in California and found that species richness and density decreased as the volume of bridges increased and the volume of native vegetation decreased. Rottenborn (1999) also characterized species as being "tolerant" or "sensitive" to urbanization. The "tolerant" species include several birds that are commonly thought of as urban-related, such as rock dove (*Columbia livia*), mourning dove (*Zenaida macroura*), western scrub-jay (*Aphelocoma californica*), American crow (*Corvus brachyrhynchos*), northern mockingbird (*Mimus polyglottos*), and bushtit (*Psaltriparus minimus*), but also include some species less commonly observed in urban areas such as belted kingfisher (*Ceryle alcyon*). Urban "sensitive" species include both year-long resident species, such as California quail (*Callipepla californica*), acorn woodpecker (*Melanerpes formicivorus*), Bewick's wren (*Thryomanes bewickii*), and California thrasher (*Toxostoma redivivum*), as well as migrants such as willow flycatcher (*Empidonax traillii*) and yellow warbler (*Dendroica petechia*). Stralberg (2000) demonstrated increases in urban-associated bird species, including mourning dove, American crow, western scrub-jay, and northern mockingbird; decreases in "chaparral-associated" species, such as Bewick's wren, wrentit (*Chamaea fasciata*), blue-gray gnatcatcher (*Polioptila caerulea*), California thrasher, orange-crowned warbler (*Vermivora celata*), rufous-crowned sparrow (*Aimophila ruficeps*), spotted towhee (*Pipilo maculatus*), and California towhee (unlike the Rottenborn (1999) study); and decreases in migrants, such as ash-throated flycatcher (*Myiarchus cinerascens*), Pacific-slope flycatcher (*Empidonax difficilis*), phainopepla (*Phainopepla nitens*), and black-headed grosbeak (*Pheucticus melanocephalus*) at the edge of urban developments. Miller *et al.* (2003) documented a reduction in bird species richness within riparian habitats in more urbanized surroundings. Local habitat disturbance, typically in the form of recreational trails through riparian habitat, also explained reduced habitat use by riparian bird species, but to a lesser degree. These studies indicate that bird diversity at the open space–urban interface may actually be higher because of increases in urban-tolerant species, but they also show that overall regional species diversity decreases because of urbanization. The Rottenborn (1999) study did not identify minimum buffer distances to counter edge effects, but concludes that broader buffers more effectively maintain riparian bird species richness.

With regard to edge effect mechanisms, habitat degradation at habitat edges may be a contributing factor to decreases in native species. Gates and Gysel (1978), for example, showed that edges may serve as "ecological traps" for open-nesting passerine birds. These species nest in greater abundance near habitat edges even though nest success was significantly higher in nests located farther from the habitat edge. Gates and Gysel (1978) suggest that the structural diversity of habitat near edges attracts nest building, but also increases opportunities for nest predation, parasitism, and hatchling failure. Andrén and Angelstam (1988) made similar observations of ground-nesting birds. Sharp and Kus (2006) found that least Bell's vireos (*Vireo bellii pusillus*) suffer less brown-headed cowbird (*Molothrus ater*) parasitism where high plant cover is present to within at least 37 feet of the nest. Smaller trees (less than 3.1-inch diameter at breast height) between 3.3 and 37 feet from the nest site also decreased the risk of cowbird parasitism. These studies demonstrate that increased permeability to predators and exotic species at the open space–urban interface is likely a primary cause of the adverse edge effects noted above. Permeability may be increased through reductions in plant structure and cover related to increased human activity in the area, especially related to fuel modification activities.

Addressing a related type of adverse edge effect on aquatic environments, Mahoney and Erman (1984) reviewed literature documenting how the presence of urban–riparian edges can increase stream temperatures due to reduced canopy cover and thereby reduce native aquatic invertebrate and fish populations. Riley *et al.* (2005) found that, in northern Los Angeles County, abundance of non-native aquatic species was positively correlated with urban development within the watershed, whereas native species abundance was negatively correlated with urban development. These effects were found to occur at 8% development within the watershed. These studies indicate that, in addition to the changes in vegetation structure and species interactions discussed above, urban–riparian edge conditions may result in similar adverse abiotic effects on native aquatic communities, primarily due to raised temperatures resulting from sedimentation within streams.

While most studies have focused on adverse edge effects along habitat edges, some evidence exists for positive effects along these edges. Anderson *et al.* (1984), for example, found that native riparian bird species richness and density is higher in transitional (ecotonal) habitats compared with adjacent agricultural and pure riparian habitats in all seasons except spring, indicating that the structural diversity present within buffer zones may increase overall species richness and wildlife usage. Because structural diversity was an important element of the edge in this study, this finding is consistent with the general conclusion that habitat degradation along habitat edges is generally detrimental to species abundance and diversity.

Section 2.2.2 Human Activity and Domestic Animals

General human presence and domestic animals have fairly obvious potential adverse effects on native habitats and species along the open space–urban interface. Human activity that results in habitat degradation and harassment of wildlife includes trampling of native vegetation, trash dumping, off-road vehicles, *etc.* Children and poachers may collect native species from open space areas easily accessed from residential areas or public roads. Domestic animals (including pet, stray, and feral cats and dogs) may kill or harass native species along the open space–urban interface and can have a significant impact on local populations. For example, pet cats, as natural hunters, prey on native animal species if provided the opportunity and may significantly impact local native bird and rodent populations. Churcher and Lawton (1987) reported that domestic cats in the village of Bedfordshire, England accounted for at least 30% of the deaths of house sparrows (*Passerculus domesticus*) in the village. Cats have been observed in Stephens' kangaroo rat (*Dipodomys stephensi*) reserves in western Riverside County in Southern California and likely are a significant threat to kangaroo rat populations in proximity to the urban edge in these reserves (Kelly and Rotenberry 1993).

Section 2.2.3 Alteration of Natural Fire Regime

The alteration of fire regimes is an urban edge effect that has not been well studied, although it is generally assumed that fire frequencies along urban edges and roads are increased due to anthropogenic sources, including accidental ignitions and arson. In most cases, fires are quickly suppressed for public safety and to protect property, but in some cases fires become uncontrollable and catastrophic (*e.g.*, during Santa Ana wind conditions in Southern California), in part because past fire suppression has resulted in much greater fuel loads in urbanized environments than would occur under natural regimes. These types of fire regime alteration (suppression and catastrophic and/or frequent fires) can drastically affect plant and animal communities such as California sagebrush scrub through increases or decreases in the natural fire interval to which the plant and animal communities have adapted. Longer-than-natural fire intervals can result in excessive buildup of fuel loads, so that when fires do occur, they are catastrophic. Unnaturally long fire intervals can also result in senescence of plant communities such as chaparral that rely on shorter intervals for rejuvenation. Shorter-than-natural fire return intervals can preclude recovery of the native vegetation between fires, weaken the ecological system, allow for invasion of exotic species, and, in some cases, result in permanent transitions of the vegetation to non-native communities such as annual grassland and weedy communities (*e.g.,* Malanson and O'Leary 1982; Keely 1987; O'Leary *et al.* 1992).

Section 2.2.4 Noise

The impact of noise on wildlife varies among species and depends on the source, duration and schedule of the noise. Dooling (2006) identified at least four potential, and likely related, adverse effects of noise on birds: (1) noise may be annoying and cause them to abandon nests that are otherwise perfectly suitable; (2) noise can be stressful and may raise the level of stress hormones, and interfere with sleep and other activities; (3) intense noise can cause permanent injury to the auditory system; and (4) noise can interfere with acoustic communication by masking important sounds or sound components.

Several studies have demonstrated specific effects of noise on the behavior of several avian species (*e.g.*, Hirvonen 2001; Reijnen *et al.* 1996; Slabbekoorn and Peet 2003; Wood and Yezerinac 2006). Hirvonen (2001) monitored wetland bird populations at target and control areas before, during, and after construction of a two-lane highway with road volumes of 15,000 to 20,000 cars/day through shore pastures in Pernajanlahti Bay east of Helsinki, Finland. Hirvonen (2001) concluded that the conservation value of habitat (based on species-specific indices of population size, species endangerment, and rarity in the particular biogeographical area in question) in the target area declined 25% compared to the control area due to loss of specialist species such as European bittern (*Botarus stellaris*), marsh harrier (*Circus aeruginosus*), crane (*Grus grus*), ruff (*Philomagnus pugnax*), and little gull (*Larus minutus*). The abundance of wading birds declined by 50% during road construction and by 80% after construction in areas near the highway where noise levels exceeded 56 dBA, but not in areas with lower noise levels. Passerine (perching birds) population abundance, however, did not show any directional response to disturbance by the highway regardless of noise level. Whether passerines are affected by traffic noise may be related to their habitat, with open habitat (*e.g.*, grassland) species perhaps more vulnerable than forest, riparian, or shrub species. Slabbekoorn and Peet (2003) found that male great tits (*Parus major*) at noisy locations (42 to 63 dBA) in Leiden in the Netherlands sing at a higher pitch or frequency, preventing their songs from being masked by lower frequency urban noise. Slabbekoorn and Peet (2003) suggested that singing at a higher pitch by this species may reflect a behavioral plasticity that benefits breeding success. Wood and Yezerinac (2006) similarly demonstrated that song sparrows (*Melospiza melodia*) singing at noisy locations exhibited higher-frequency low notes and less amplitude in the low-frequency range (1 to 4 kHz) where most of the anthropogenic noise occurred.

Not only may birds alter the frequency of their song in noisy environments, but also the amplitude or loudness of the song, known as the Lombard effect. Until recently, the Lombard effect had only been demonstrated in highly controlled laboratory settings (Brumm 2004). Brumm (2004) tested this effect in a naturally noisy environment and found that nightingales (*Luscinia megarhynchos*) sing at higher sound levels in noisy environments. Background noise levels in this study range from 40 to 64 dBA, with traffic noise the largest contributor near the loudest territories. Also, the frequency band of the noise spectra coincided with the frequency band of nightingale songs (*i.e.*, the nightingales were not altering frequency to avoid masking as do great tits). Brumm (2004) concluded that the birds try to mitigate the masking effect of noise on their communication such that the transmission distance of the song, which is used for mate attraction and territory defense, is maintained. Although nightingales are able to increase the amplitude of their singing in response to environmental noise, singing louder takes more energy and individuals may be more vulnerable to predation. Individuals that have to sing more loudly may be at a disadvantage.

Hein (1997) identified the 60 dBA noise threshold for impacts on the least Bell's vireo based on the theory of sound masking. Hein (1997) calculated that at a distance of 328 feet, which is diameter of a 1.98-acre territory, approximately 50% of the vireo's song would be masked with a background noise level of 60 dBA equivalent noise level. This level of masking was considered by Hein (1997) to have potential adverse effects on the behavioral activity of the least Bell's vireo, including reproduction, although no empirical data supporting this assumption was cited by Hein. However, as discussed in more detail below in **Section 2.3**, Dudek (2007B) measured noise levels exceeding 60 dBA in regularly occupied least Bell's vireo nesting habitat in the Santa Clara River south of State Route 126 (SR-126) in the Project area, suggesting that this species is tolerant of noise levels exceeding 60 dBA.

The Dudek (2007B) finding is consistent with Hirvonen's (2001) observation that passerine birds were relatively unaffected by traffic noise with regard to their distribution. However, there is other indirect evidence of traffic noise effects on avian reproductive behavior. Forman and Deblinger (2000) cite evidence for road "effect-distances" for forest and grassland bird species. The effect-distance for woodland species may extend several hundred meters from a busy road and for grassland species at least 0.6 mile. For example, they observed no regular breeding by meadowlarks (*Sturnella magna*) or boblinks (*Dolichonyx oryzivorus*) within 0.6 mile of a busy road east of Boston, Massachusetts, while regular breeding was observed at zones of 0.6 mile to 3.1 miles from the road. Forman and Deblinger (2000) suggested that traffic noise interferes with communication during the incubation and fledgling phases of reproduction.

The impact of noise on other taxa has not been as well studied as for avian species. However, the impacts on birds identified by Dooling (2006) could apply to other terrestrial species. For example, noise may interfere with communication in toads and frogs that use calls to advertise their location and attract mates (*e.g.*, Barrass and Cohn 1984). Loud noise, such as off-road vehicles, may damage the hearing of some terrestrial species (Berry 1980; Brattstrom and Bondello 1983). Chronic traffic noise could also interfere with the ability of small mammals to hear predators such as hawks and owls (although noise may also interfere with the ability of nocturnal predators such as owls to detect prey).

Section 2.3 Effects on Wildlife Related to Distance from Edge

The previous sections discussed known and potential edge effects on wildlife, but few studies precisely define or quantify the distance at which such edge effects occur (however, see Forman and Deblinger 2000). The Conservation Biology Institute (CBI 2000) reviewed literature primarily on edge effects on wildlife species and concluded that penetration typically occurs from 150 to 600 feet from the open space–urban interface. The distance of edge penetration depends on the type of effect studied and individual site characteristics (*e.g.*, habitat, topography). This section discusses some specific examples of attempts to quantify the penetration distances of edge effects, or the "effect-distance" described by Forman and Deblinger (2000).

It was noted above that pet cats are a significant threat to small native animal species, such as birds and rodents (*e.g.*, Churcher and Lawton 1987; Kelly and Rotenberry 1993). The literature relevant to the potential effect-distance for domestic house cats into preserves, however, is variable. Kays and DeWan (2004), for example, demonstrated that domestic cats rarely leave the residential yard area, having an average home range of 0.6 acre, with 80% of hunts occurring within the yard or the immediate 33-foot surrounding area. Conversely, Kelly and Rotenberry (1993) reported that cats can range up to 1 mile from human dwellings into Stephens' kangaroo rat reserves in western Riverside County. In this case, it was not clear whether the cats were pets, strays, or feral.

A controlling factor for how far and effectively domestic pets, as well as stray and feral animals and native mesopredators, can penetrate into open space areas is the local population of top predators such as coyotes. Areas that lack coyotes due to severe habitat fragmentation may experience a "mesopredator release" effect described by Crooks and Soulé (1999). They suggested that declines of coyotes in urbanized habitat fragments contribute to an increased abundance of mesopredators such as domestic cat, raccoon, opossum, and fox that are principal predators of birds and small mammals. Crooks and Soulé (1999) showed that declines in coyote numbers were related to increased mesopredator populations, which in turn were associated with declines in avian populations. The strength of the mesopredator release effect is likely related to local conditions. For instance, CBI (2000) hypothesized that the movement range of domestic cats is dependent on the health of the coyote population in the surrounding area and that where coyotes are present, cats are likely to still have impacts within 100 to 200 feet of the open space–urban interface. Cats that range farther than 100 to 200 feet from the urban edge are more likely to be killed by coyotes than those that stay close to the residential yard. Thus, even in the presence of coyotes it is still possible within highly fragmented landscapes or complex urban-wildlife edges for domestic cats to have serious effects on native bird and small mammal populations within a few hundred feet of urbanization.

Nest parasitism and predation are substantial edge effects that affect riparian birds. Gates and Gysel (1978) found significant effects of increased nest predation, parasitism, and hatchling failure present about 50 feet from the habitat edge. Askins (1995) found that brown-headed cowbirds and nest predators are most active within 328 to 656 feet of the habitat edge. Peterson *et al.* (2004) found that, in two rivers in northern San Diego County, three of the four primary predators of least Bell's vireo nests appear to be urban-related edge species, including western scrub-jay, Virginia opossum, and Argentine ants, with the fourth the gopher snake (*Pituophis melanoleucus*). Because the main predators of the vireo are primarily edge species, adequate buffering and management within the urban–riparian edge are considered critical for protection of this species.

Suarez *et al.* (1998) found that Argentine ants can be present up to 0.6 mile from the open space–urban interface, but were most abundant within 328 feet in fragmented upland habitat patches in coastal San Diego County, California. They suggested that Argentine ant invasions were related to urban run-off that collects in canyons between urban development areas, as well as with invasive plant species. Subsequent studies of microhabitat conditions and Argentine ant presence indicate that controlling moisture regimes at the open space–urban interface can help control invasions by this species (Menke and Holway 2006).

With regard to invasive plant species, CBI (2000) reviewed several studies indicating penetration distances into open space areas varying from 15 to 1,640 feet. The majority of these studies indicated that most invasions are strongly evident within approximately 100 feet of the open space–urban interface, are reduced between 100 and 328 feet, and then become generally absent beyond 328 feet. Additionally, chemical pollutants may drift into adjacent preserves during spray applications. CBI (2000) reviewed studies indicating that drift generally travels from 5 to 65 feet.

The effects of altered fire regimes were discussed above in **Subsection 2.2.3**. Because of the unpredictable behavior of fires along open space–urban interfaces, there is no predictable edge distance for which fires are more or less a risk. The behavior of a fire depends on a number of factors such as wind and humidity conditions, topography, vegetation and other landscape features (*e.g.,* roads), and logistics for firefighters.

The effect-distance for traffic noise impacts on birds may extend fairly far from roads into adjacent habitat. As described above, Forman and Deblinger (2000) reported that the effect-distance may extend several hundred meters from a busy road for both woodland species and grassland species such as boblink and meadowlark, for which no regular nesting was observed within 0.6 mile of a busy highway in Massachusetts. There are some data for the least Bell's vireo in the Santa Clara River that, on the other hand, indicating that vireos nest relatively close to a busy highway (SR-126). Dudek (2007B) monitored noise levels across 24-hour periods at six locations at various distances from the centerline of SR-126: 110, 120, 430, 540, 630, and 1,650 feet. Average noise levels ranged from 51 dBA at 1,560 feet to 69 dBA at 110 feet. The location at 120 feet from SR-126 was located in close proximity to a cluster of least Bell's vireo nest/territory locations regularly recorded from 1998 to 2007 (Guthrie 1998A, 1999C, 2000C, 2001B, 2002C, 2003B, 2004H, 2005B, 2006A; Bloom Biological, Inc. 2007A). The vireo survey data indicate that the vireo regularly nests in this area. The average noise level at this location was 61 dBA, with a range of 57 dBA at 12:00 a.m. to 1:00 a.m. to 66 dBA at 6:00 a.m. The location at 630 feet from SR-126 also was in close proximity to vireo locations and had an average noise level of 55 dBA, with a range of 51 dBA at 10:00 a.m. to 62 dBA at 6:00 a.m. Although these data cannot address whether there are any negative impacts of traffic noise on the vireo (*e.g.*, behavioral disturbances, reduced reproductive success, higher predation rates), they do indicate that the vireo successfully establishes breeding territories in areas that exceed the theoretical noise threshold of 60 dBA for adverse impacts to this species suggested by Hein (1997). These data also contrast the findings of Forman and Deblinger (2000) of a lack of nesting by grassland species within 0.6 mile of a busy highway in Massachusetts, demonstrating that noise impacts on wildlife species are variable and that generalizing among species and site-specific conditions is difficult and should be done with caution. It is likely that birds select nesting habitat based on several factors, including habitat structure, prey abundance, and other critical resources necessary to meet their life history requirements. Noise may be a factor in habitat selection and, all things being equal, quiet areas likely are superior to noisy areas. However, if suitable nesting habitat is a limited resource, such as riparian habitats being scarcer than grassland habitats, riparian species may nest in relatively noisy areas when suitable quieter areas are not available. Alternatively, other habitat suitability factors (*e.g.*, prey or protection from predators) may outweigh the negative impacts of noise. Species that successfully nest in relatively noisy areas, as suggested by the vireo data for areas of Santa Clara River adjacent to SR-126, may be relatively unaffected by noise or otherwise may have the behavioral plasticity, such as singing at higher frequencies or intensities, to compensate for the effects of noise (*e.g.*, Slabbekoorn and Peet 2003; Wood and Yezerinac 2006).

Section 2.4 Wildlife Buffer Functions

Given the preceding discussion regarding edge effects and penetration or edge-effect distances, it is clear that buffer areas between the urban edge and core wildlife habitat will be important for protecting wildlife resources in the Project area. For the Santa Clara River within the Project area, for example, protection of special-status species that depend on the riparian/wetland/aquatic systems to meet all or part of their life history requirements (*e.g.*, shelter, food, reproduction) is a primary concern. Buffers can provide several functions that contribute to protection of these species. Species for which the riparian/wetland/aquatic system provides for all of their life history requirements (*e.g.*, fish) benefit most from buffers mainly designed to protect the species' habitat from adverse edge effects such as increased stream temperatures due to reduced canopy cover (note: it is assumed that issues such as water quality and sedimentation are not strictly edge impacts and are addressed through project design features). For other species that are semi-aquatic and rely on terrestrial habitats for critical periods of their life cycles, such as western spadefoot toad (*Spea hammondii*), arroyo toad (*Bufo californicus*), two-striped garter snake (*Thamnophis hammondii*), and southwestern pond turtle (*Emys marmorata pallida*), the buffer may both protect their aquatic habitat and provide transitional and/or terrestrial habitat that supports the non-aquatic aspects of their life history, such as foraging, nesting (southwestern pond turtles), aestivation, and hibernation. Some riparian-nesting birds, such as the least Bell's vireo, also forage in upland shrub habitats adjacent to riparian breeding habitat. Thus, buffers along riparian/wetland/aquatic habitats can function just for protection of the habitat for some species such as fish or for both protection of the riparian/wetland/aquatic habitat and as transitional/terrestrial habitat that are important for other species such as amphibians, reptiles, and birds. Habitat buffers also are important for upland native species to address the edge effects discussed above in **Sections 2.2** and **2.3**, such as habitat degradation and increased non-native and urban-related species, predation from domestic animals and mesopredators, Argentine ants, *etc*.

Section 2.5 Wildlife Buffer Design Considerations

The edge effect of urbanization on native avian and small mammal species appears to be most pronounced where some degree of habitat fragmentation occurs (Soulé *et al.* 1992; Crooks *et al.* 2001). Therefore, contiguous and connected large, core habitat areas are desirable for maintaining regional native species populations. Partial fragmentation or irregularities along the open space–urban interface (*e.g.*, narrow habitat peninsulas), or partial or full fragmentation within development areas should be avoided to the extent feasible. In principle, the less habitat fragmentation within a preserve, and the less irregularity along the border of an open space preserve, the less edge effects are likely to occur. Buffer issues and management requirements are reduced with less edge effect. However, where open space–urban interface exists, buffers are an integral part of the open space preserve.

Schonewald-Cox and Bayless (1986) suggested that buffers should be designed to account for multiple variables present along the boundary of a preserve, including species distributions, movement of individuals, and vulnerability of the preserve to impacts. Kelly and Rotenberry (1993) build on this concept and recommend a scientifically-based buffer analysis to develop a "buffering protocol" for a particular preserve, including the following:

1. Identification and ranking (if possible) of those external forces likely to impact the sensitive population(s) or community (communities) in question;

2. An empirical non-specific approach: Census sensitive species at set distances from preserve boundaries, under varying impact conditions, to estimate penetration and impact of negative external forces of the protected population(s);

3. Mechanistic hypothesis testing: Study of the most significant forces (*e.g.*, alien predators or competitors, trespass, runoff, light, noise, vibration) to quantify impacts; and

4. Adoption of mitigation management practices that maximize buffering but minimize future costs. (Public policies affecting conservation programs are subject to sudden change so it is important to minimize reliance on the future availability of funding for management.)

Various guidelines for buffers for different taxa and habitat types are available in the literature. Fischer and Fischenich (2000), for example, conducted a review of the literature regarding the effectiveness of riparian buffers in protecting native plant and animal communities as part of a U.S. Army Corps of Engineers (Corps) Ecosystem Management and Restoration Research Program. Their review suggests that the diversity of plant species is protected with minimum 98-foot-wide to 148-foot-wide buffers, reptiles and amphibians with minimum 328-foot-wide to 541-foot-wide buffers, mammals with minimum 164-foot-wide buffers, invertebrates with minimum 98-foot-wide buffers, and fish with minimum 98-foot-wide to 1,640-foot-wide buffers.

The California Department of Fish and Game (CDFG 2001) issued guidelines on development buffers adjacent to riparian habitat. The guidelines identify buffers for three categories of streams: mainstem streams, main tributaries, and secondary tributaries. These categories are not defined in the guidelines, but an example considers the Sacramento River to be a mainstem stream. Several first-order tributaries and some downstream segments of second-order streams are considered “main tributaries” (presumably because these stream segments support well-developed riparian vegetation communities), and most second-order streams are considered “secondary tributaries.” For mainstem streams, CDFG recommends a minimum 150-foot buffer width (as measured from the top of bank) or 75 feet from the edge of riparian habitat, whichever is greater. For main tributaries, either a 100-foot-wide minimum buffer or a buffer that includes the riparian vegetation plus 50 feet is recommended for conservation. Secondary tributaries require either a 50-foot-wide minimum buffer or a buffer that includes the riparian vegetation plus 25 feet, whichever is greater. The Santa Clara River would be considered a mainstem stream; first-order tributaries such as Potrero Creek would be considered “main tributaries” and second-order tributaries considered “secondary tributaries.” These buffers are recommended to be used in combination with stormwater management designs that retain project-generated water and release it through detention ponds to mimic natural conditions.

CBI (2000) evaluated various buffer widths from 15 feet to 300 feet for effectiveness in controlling several edge effects on San Fernando Valley spineflower (*Chorizanthe parryi* var. *fernandina*): invasive animals, increased fire frequency, invasive plants, vegetation clearing, increased water supply, trampling, and chemicals. Although the CBI (2000) study focused on an upland plant species, buffer widths for riparian and upland habitats for wildlife species should be similar because the focus of the CBI study was on the edge-effect distance into habitat areas with and without management. CBI (2000), for example, suggested that an unmanaged 100-foot-wide buffer should be highly effective against chemical effects and moderately effective against invasive plants, vegetation clearing, increased water supply, and trampling. Effects that are controlled at a moderate level at a 100-foot-wide buffer would improve to a high level of control with a buffer 200 feet wide. A minimum 100-foot-wide buffer would have relatively low effectiveness for invasive animals and increased fire frequency because of the higher penetration level of these effects. Invasive animals and increased fire-frequency effects would only reach moderate levels of control with a 200-foot-wide buffer because of their higher penetration level. CBI (2000) also suggested that management measures can improve buffer effectiveness at given widths for certain kinds of impacts. For example, a buffer between 80 feet wide and 100 feet wide is moderately effective against invasive plants, but that this buffer can be managed to be highly effective by restoring disturbed areas within a preserve and adjacent to the urban boundary to reduce disturbance gaps where invasives can propagate. As noted above, these conclusions were made for spineflower management but should in principle apply to buffers related to riparian/wetland/aquatic and upland habitat wildlife species. However, as recommended by Kelly and Rotenberry (1993), each buffer area should be evaluated with regard to its particular edge impacts or forces and management should be tailored to those potential impacts.

The variability of buffer recommendations by the Corps (Fischer and Fischenich 2000), CDFG (2001), and CBI (2000) underscore Kelly and Rotenberry's (1993) recommendation that buffers must take into consideration the biological resources being protected (*e.g.,* species or habitat type or function), site conditions, and the external forces exerting pressure on the protected resources.

SECTION 3.0 WILDLIFE HABITAT CONNECTIVITY BACKGROUND

Terrestrial wildlife (*i.e.*, species that depend on land for all or part of their life history stages) occupy environments that generally provide beneficial elements necessary for their life histories, including shelter, forage, and reproduction. The distribution of species within an environment may also be limited by conditions such as barriers to dispersal or pressure from the same species (intraspecific competition) or other species (interspecific competition). Therefore, terrestrial wildlife select habitats based on behavior and genetic tolerance that are favorable for their survival and reproduction (Krebs 2001).

A fundamental concept and central tenet of conservation biology theory is that a lack of habitat connectivity and contiguity (usually referred to as habitat fragmentation and isolation) may cause extinction of local populations as a result of two processes: (1) reduction in total habitat area that reduces effective population sizes; and (2) insularization of local populations that affects dispersal and immigration rates (Wilcox and Murphy 1985; Wilcove *et al.*1986). Wilcox and Murphy (1985) further point out that immigration may be impeded by conversion of natural vegetation communities providing habitat between occupied or potential habitat patches, thus increasing the probability of extinction. It is this latter point that is the crux of the habitat linkage problem. That is, isolation of habitat patches accompanied by intervening inhospitable land cover (*e.g.,* urban development, roadways) is thought to increase the probability of permanent extinction of local populations. Because of complex community-level interactions (*e.g.,* mutualistic species, habitat guilds, keystone species), the loss of one or a few species from a habitat patch as a direct result of habitat fragmentation (primary extinctions) also may result in multiple "secondary" extinctions within the habitat patch (Wilcox and Murphy 1985).

Habitat fragmentation has been linked with reduced bird species diversity, even on adjacent non-fragmented habitats (Rottenborn 1999), as discussed above. Several studies in coastal San Diego County have demonstrated species losses related to habitat fragmentation and isolation. Soulé *et al.* (1998) found very high rates of extinction in a study of the distribution of "chaparral-dependent" native birds (the analysis included coastal sage scrub species) in isolated canyon habitat fragments. Soulé *et al.* (1998) attributed this loss to the focal species' generally low vagility and inability to traverse urban environments. Similarly, Soulé *et al.* (1992) found that fragmentation caused rapid extinctions with predictable sequences of species loss in a suite of species including plants, birds, and rodents in coastal sage scrub habitat, and Bolger *et al.* (1997) found fewer rodent species in fragments isolated for longer periods of time and at greater isolation distances in coastal San Diego. Lower arthropod diversity was also observed by Bolger *et al.* (2000) in older and smaller habitat fragments in the same region.

Wildlife connections also likely play a critical role in sustaining "metapopulations," which are characterized as partially isolated local populations of the same species, but connected by pathways for dispersal (immigration/emigration) (Levins 1969). Local populations, or demes, within a metapopulation are subject to stochastic events and fluctuate depending on the rate of dispersal between demes and the local rate of extinction. Patches subject to local extirpations may be recolonized by dispersal from other source patches provided habitat connectivity remains for the species. Truly or functionally isolated local populations risk permanent extinction by a variety of causes, including simple population dynamics, loss of genetic integrity, or stochastic environmental impacts.

Natural environments are typically heterogeneous and form a mosaic across a landscape. Plant community distributions in particular follow distinct patterns based on abiotic conditions (*e.g.*, soil, slope aspect, elevation) and biotic conditions (*e.g.*, competition, soil microbial ecology, parasitism). Terrestrial wildlife typically occupy favorable patches within a landscape matrix and may move between patches through less favorable habitats. However, terrestrial wildlife species are more likely to follow pathways between habitat patches that contain elements of their preferred habitat (Rosenberg *et al.* 1997). Disjunct habitat patches that are used by terrestrial wildlife to negotiate through landscape mosaics have been likened to "stepping-stones," and some researchers (*e.g.*, Bennet 2003) have suggested that in some cases and for some species, stepping-stone habitat is as effective as continuous corridors. However, such stepping-stone patches must be traversable and not be behaviorally-limiting to the species. Behavior has been shown to be a primary condition that determines the propensity of a particular species to utilize a corridor. Such limitations include movement behavior, environmental cues (*e.g.*, olfactory cues), perceived risk of predation, susceptibility to disturbance, and human activity (*e.g.*, Aars and Ims 1999; Brinkerhoff *et al.* 2005; Fernandez-Juricic *et al.* 2005). Behavioral models and empirical observations suggest that species movement behaviors have profound effects on their distribution and abundance within a landscape (Russell *et al.* 2003). For example, various mammals and other taxa may be able to traverse relatively long distances across generally unsuitable but natural habitat, but behaviorally will avoid crossing paved and unpaved roads (see Trombulak and Frissell 2000 for a review of the ecological effects of roads). Therefore, for a corridor to function properly it must not pose physical or behavioral obstacles to the movement behavior of a particular species. Additionally, Rosenberg *et al.* (1997) found that the rate of animal movement through a landscape matrix depends on the quality of habitat for that species. Terrestrial wildlife tend to move more slowly through areas with higher-quality habitat components than those areas with lower-quality habitat components. Risk of predation, disturbance, and human activity are also limiting factors for species movement and dispersal.

There is a distinction between short-term individual movements, such as foraging within an organism's home range, long-term dispersal (one-time emigration and immigration events between populations), and migration (seasonal or periodic movements). Corridors and habitat linkages may allow for both long- or short-term movements, dispersal, and migration depending on the life history requirements and ability of a particular species to travel through a landscape (also called its vagility). The habitat requirements that allow for dispersal and migration likely are similar, the difference being that dispersal is usually a one-way movement related to emigration/immigration, and migration is a seasonal or periodic movement (Lincoln *et al.* 1998).

For the purpose of this discussion two kinds of dispersal are defined, based on Pielou (1979); diffusion and jump dispersal. Diffusion is the gradual movement or expansion of populations (as opposed to individuals) across a landscape over several generations (*i.e.*, intergenerational) and may be applicable to non-migratory small mammals or birds re-occupying recovering burned sites, for instance. Jump dispersal (hereafter simply called dispersal) is a one-time, long-distance movement within the lifetime of an organism across otherwise relatively unsuitable landscapes or across suitable habitat already occupied by conspecifics (members of the same species). An example of jump dispersal is a juvenile mountain lion (*Puma concolor*) dispersing across other individual's home ranges or rural developed areas to establish a new home range.

These two types of movement—diffusion and dispersal—are discussed in the context of three main types of habitat connections (wildlife crossings, corridors, and habitat linkages) in the following subsections to provide a framework for later applications to the Project area. These habitat connections thus increase in scale from intersections of wildlife movement pathways with development (crossings), to linear pathways between areas (corridors), and ultimately to landscape-level connections (linkages).

Section 3.1 Wildlife Crossings

Wildlife crossings are locations where wildlife must pass through physically constrained environments (*e.g.*, roads, development) during movement within home ranges or during dispersal or migration between core areas of suitable habitat. Development and roads may transect or interrupt an existing natural crossing, creating dangerous or impassable barriers that impede the natural movement of a species and possibly subject it to higher risks of injury and mortality from adverse human interactions, such as increased vehicle collisions at roadways where no safe wildlife passage is provided (Meese *et al.* 2007).

It is important to identify the natural passageways that target animals use to locate crossings when designing wildlife crossings. Often artificial crossings are seldom used by wildlife when more natural alternative crossings exist. For example, Tull and Krausman (2001) found that while 22% of radio-collared mule deer locations were in a designed crossing, there were indications that the deer crossed at other points along a canal. Tull and Krausman (2001) attributed the other crossings to the absence of significant urbanization along a canal, and suggested that as development encroached along the canal the designed crossing would play a more important role.

Post-development drainages are a typical – but by no means the only – pathway for wildlife movement across roads. Structures where roads and drainages intersect are often constricted or confined in some way and provide funnel points for movement, such as road under-crossings, beneath bridges, or through large culverts. Wildlife crossings are used differently or at different frequencies depending on the species and the conditions at the crossing. Although most existing structures, such as culverts or bridges under roads, were not originally designed to accommodate wildlife passage, they were retrofit or redesigned to encourage wildlife use by restoring or maintaining native vegetation and “soft-bottom” natural substrates within the crossing, natural lighting, using fences to guide larger species toward the crossing, locating crossings at pre-existing animal passages, and improving habitat adjacent to the crossing to provide cover and protection for wildlife (Carr *et al.* 2003; Meese *et al.* 2007). Some recommended design standards for different kinds of wildlife crossings are available from Ruediger and DiGiorgio 2007), as summarized in **Table 1**.

Table 1
Crossing Structure Type and Size – Alternative by Species[1]

Crossing Structure	Round Culvert	Concrete Box Culvert	Multi-Plate Steel Arch	Open-Space Bridge, Bridge Extension	Overpass
Black Bear	10'+	10'h+ x 20'w+	10'h+ x 20'w+	10'h+ x 20'w+	75'w+
Mountain Lion	10'+	10'h+ x 20'w+	10'h+ x 20'w+	10'h+ x 20'w+	75'w+
Bobcat	48"+	48"h+ x 48"w+	*structures for larger animals will be adequate for smaller animals		
Coyote	48"+	48"h+ x 48"w+	*structures for larger animals will be adequate for smaller animals		
Small Carnivores – badger, raccoon, skunk, weasel, and fox. Also accommodates smaller mammals, reptiles, and amphibians.	36"+	36"+	*structures for larger animals will be adequate for smaller animals		
Deer	10'+	10'h+ x 20'w+	10'h+ x 20'w+	10'h+ x 20'w+	75'w+

Adequate for Passage
Best for Passage

1 Adapted from Ruediger and DiGiorgio (2007). Information in this table was established from current studies, including recommendations from biologists and engineers with extensive wildlife crossing experience. This table is a general guide to designing and choosing appropriate structures for many target species. Other factors, such as terrain, engineering feasibility, cost, and site-specific conditions are always a consideration. The table is meant only as a broad guideline to assist in the selection of wildlife crossings. (Ruediger and DiGiorgio 2007)

Although there are some general recommendations for the dimensions of crossing structures, as shown in **Table 1**, the specific factors that contribute most to the effectiveness and design criteria of structures used as wildlife crossings, such as bridges and box culverts, are still under debate. Among these factors, in addition to structural dimensions, are the use of fencing, existing landscapes, proximity to natural habitat edges and water features, the probability of human disturbance, and the intended species. Views differ regarding the most effective placement of wildlife crossings and whether structural features or location and landscape features are more important in determining ultimate success.

Several studies have shown that structural dimensions beyond the height and width of the crossing and related factors play primary roles in the success of providing adequate wildlife crossings between habitat fragmented by roads and highways. Reed *et al.* (1975) found openness to be a significant factor in determining relative effectiveness of structures in terms of use by deer and other species. In this study, the openness factor (or index) was a structural variable used as a measurement of ambient light in a structure and was calculated by the following equation: width times height divided by length (in meters) (Reed *et al.* 1975). Later studies also applied the openness index as one measurement for the effectiveness of wildlife movement at highway underpasses. For example, Donaldson (2005) found that the length of a structure should be short enough to result in an openness factor of at least 0.25 to discourage white-tailed deer from turning around at structure crossings. This study also determined that effective underpasses were easily accessible with level approaches and had clear lines of site to habitats on the far side (Donaldson 2005). Another study determined that use of crossing structures by raccoons and domestic cats and dogs was positively correlated with passage length, while use by mule deer was negatively correlated with the same factor (Ng *et al.* 2004). The importance of structural dimensions has been illustrated for both large predator and prey species. In Banff National Park, structural dimensions, including openness and width, were determined to be most significant only for ungulates while playing a less significant attribute for carnivores (Clevenger and Waltho 2000). However, later studies indicated structural passage by grizzly bears, wolves, elk, and deer to be strongly influenced by wildlife crossings that were high, wide, and short in length, and that black bears and cougars favored more constricted crossing structures (Clevenger and Waltho 2003).

Others have argued against the ultimate value that structural dimensions hold with respect to wildlife crossings. Many studies have identified several other factors as the most significant in contributing to the effectiveness of crossing structures. Beier and Loe (1992) have emphasized that the critical features of a wildlife corridor are not physical traits, such as its length or width or vegetation, but rather how well a particular piece of land fulfills several functions, including allowing wide-ranging animals to travel, migrate, and meet mates; plant propagation; genetic interchange; movement of populations due to environmental changes and natural disasters; and allowing recolonization of habitats from which populations have been locally extirpated. Beier and Loe (1992) argue that these functions (rather than some minimum width) should be used to evaluate the suitability of land as a wildlife corridor. The Ng *et al.* (2004) study, discussed above, also identified correlations with several other factors. Coyote use of wildlife crossings showed a significant positive correlation with human activity and a negative correlation with developed habitat. For bobcats, the relationship between passage use and percentage of natural habitat was positive (Ng *et al.* 2004). Riley *et al.* (2006) contend that, to counteract genetic isolation, corridors across freeways could conceivably include more natural habitat so that home ranges could extend across freeways and rates of genetic exchange might be increased. Several studies have also indicated that fencing plays a significant factor in determining success. Although some species may use underpass or overpass systems without fences, some form of fencing does appear to be necessary for most species (Jackson and Griffin 2000). Ungulates commonly seek to avoid underpasses and will generally use them only if other access across the highway is barred (Ward 1982).

While the debate about the efficacy of wildlife crossings continues, at least three concepts are clear: (1) Protecting suitable habitat in the vicinity of crossing points is especially important; (2) consideration must be given to passage dimensions (Ng *et al.* 2004); and (3) if fence and passage systems are not designed for use by a broad range of wildlife, a project that facilitates passage for one species might constitute an absolute barrier for another (Jackson and Griffin 2000).

Section 3.2 Wildlife Corridors

Rosenberg *et al.* (1995) distinguish between habitat and wildlife corridors. Habitat provides for the life history components of survivorship, reproduction, and movement. Wildlife corridors are linear landscape elements that provide for species movement and dispersal between two or more habitats, but do not necessarily contain sufficient habitat for all life history requirements of a species, particularly reproduction (Rosenberg *et al.* 1995, 1997). For this reason, while corridors may provide for dispersal of most species, they may not provide for diffusion of populations over a longer time scale. The main prerequisite for corridors is that they increase animal movement between habitat patches. The mechanisms related to the efficacy of corridors are varied and species-specific (Soulé and Gilpin 1991; Beier and Loe 1992; Rosenberg *et al.* 1995; Haddad and Tewksbury 2005). Additionally, even if the corridor itself does not provide habitat functions, it is expected to at least maintain plant and animal populations, gene flow between the constituent subpopulations, and biodiversity (Haddad 1999). This ebb and flow of genetic diversity should occur if organisms are traversing corridors that physically connect geographically patchy populations (Beier and Loe 1992). Aars and Ims (1999), for example, showed that root voles (*Microtus oeconomus*) on small experimental plots separated by 165-foot-long corridors exhibited greater-than-expected allele transport between patches, indicating that corridor linkages facilitated short-term mating excursions. Recent studies using large-scale experimental plots have indicated that connected patches retain higher plant species diversity than isolated patches (Damschen *et al.* 2006). Damschen *et al.* (2006) suggest that if the integrity of plant communities is maintained by connectivity, then presumably terrestrial wildlife utilizing those connected patches would also benefit. Connectivity has clearly demonstrable beneficial functions to population source-population source areas by providing a physical conduit for maintaining specific genetic diversity, species richness, and community integrity. However, corridors but may also connect population sources to “sink habitat” that can result in the net reduction of a population; *i.e.*, the sink habitat either does not support the full life history of the species or populations are more vulnerable to risk factors.

Section 3.3 Wildlife Landscape Habitat Linkages

Landscape habitat linkages (or simply linkages) are large open space areas on a landscape-scale that contain natural habitat and provide connection between at least two larger adjacent open spaces that can provide for both diffusion and dispersal of many species. Linkages can form contiguous tracts of habitat when adjacent to other open space areas. Large open space networks can be formed in this way to connect and conserve habitat through entire regions (Bennett 2003).

Linkages can form large tracts of natural open space and serve both as "live-in" or "resident" habitat and as connections to the larger landscape (*e.g.*, large core habitat areas). Linkages are capable of sustaining certain communities of species in self-contained, functioning ecosystems, thus supporting both plant and animal populations and allowing for gene flow through diffusion of populations over a period of generations, as well as allowing for jump dispersal between neighboring habitats. Linkages may vary in their function depending on the species, serving more as landscape-scale dispersal corridors than habitat for larger or more vagile species, particularly those with large home ranges such as mountain lions. They are, nonetheless, capable of supporting at least a portion of these species populations. Linkages may also serve as migratory routes for ungulates, for example, and thus provide a more natural and sustainable landscape environment for large predators and their prey compared to wildlife corridors through which species are expected to move quickly through (see **Section 3.2**).

As used here, linkages are defined as providing a large enough area to at least support a natural habitat mosaic and viable populations of smaller terrestrial species, such as rodents, smaller carnivores (raccoons, skunks, fox, and weasels (*Mustela* spp.)), passerine birds, amphibians, reptiles, and invertebrates.

SECTION 4.0 WILDLIFE GUILDS

It is useful to group species with similar habitat requirements, home ranges, and mobility (vagility) into guilds in order to discuss the relative abilities of the species within the different guilds to move through the landscape, particularly through wildlife crossings, corridors, and linkages (Singleton and Lehmkuhl 1999). Species within these guilds can then be discussed in the context of a post-development open space system.

Table 2 describes seven different guilds of species identified for the Project area based on groups of species with shared life histories, similar vagility, and home range characteristics: (1) aquatic, (2) semi-aquatic, (3) high mobility ground-dwelling, (4) moderate mobility ground-dwelling, (5) low mobility ground-dwelling, (6) high mobility aerial (birds, bats, and invertebrates), and (7) moderate mobility aerial (birds and invertebrates). **Table 2** also lists the special-status species assigned to the guilds known to occur or potentially to occur in the Project area.

Table 2
Species Guilds

Guild	Vagility	Home Range	Dispersal Ability	Special-Status Species Documented or Potentially Occurring in Project Area[1]
Aquatic	Exclusively aquatic; vagility depends on aquatic system such as river, pond, or lake	Exclusively aquatic, home range variable but maximum defined by aquatic system and species characteristics	Beyond Project area, but variable depending on distribution of aquatic and upland habitats	**Arroyo chub** **Santa Ana sucker** **Unarmored threespine stickleback** **Undescribed snail**
Semi-Aquatic	Generally limited to vicinity of aquatic environments for breeding, some terrestrial habitat use and movement are essential elements of life history (*e.g.*, foraging, aestivation, hibernation)	Aquatic and terrestrial habitats that may extend beyond Project area	Beyond Project area, but variable depending on distribution of aquatic and terrestrial habitats	**Arroyo toad** California red-legged frog **Western spadefoot toad** South coast garter snake **Southwestern pond turtle** **Two-striped garter snake**
High Mobility Ground-dwelling	May be influenced by development and topography; able to traverse some fragmented areas	Beyond Project area	Beyond Project area	**Mule deer** **Black bear** **Mountain lion**
Moderate Mobility Ground-dwelling	Prefer to move within habitat; some species able to utilize agricultural areas	Within Project area	Beyond Project area	**American badger** Ringtail **San Diego black-tailed jackrabbit**
Low Mobility Ground-dwelling	Closely tied to preferred habitat; movement likely limited by where habitat is fragmented and isolated by urban development	Specific habitats within Project area	Typically Within Project area	**Coast horned lizard** Coast patch-nosed snake **Coastal western whiptail** Rosy boa San Bernardino ringneck snake **Silvery legless lizard** **San Diego desert woodrat** Southern grasshopper mouse

Table 2 (Continued)

Guild	Vagility	Home Range	Dispersal Ability	Special-Status Species Documented or Potentially Occurring in Project Area[1]
High Mobility Aerial (Birds, Bats, Invertebrates)	Flight; essentially unlimited movement; passerine bird migration may be limited by urbanization or influenced by habitat structure such as riparian or woodland; bat presence and movement limited by availability of roosting sites.	All or portions of life history contained within Project area such as breeding and nesting, over-wintering, migration foraging, *etc*.	Beyond Project area	**Allen's hummingbird (nesting)** **American peregrine falcon** **Black-crowned night heron (rookery)** **California condor** **California horned lark** **Chipping sparrow (nesting)** **Cooper's hawk (nesting)** **Costa's hummingbird (nesting)** **Golden eagle (nesting and wintering)** Grasshopper sparrow **Hermit warbler (nesting)** **Lawrence's goldfinch** **Least Bell's vireo (nesting)** **Loggerhead shrike** **Long-eared owl (nesting)** **Merlin (wintering)** **Northern harrier (nesting)** **Nuttall's woodpecker (nesting)** **Oak titmouse (nesting)** **Prairie falcon (nesting)** **Rufous hummingbird (nesting)** **Sharp-shinned hawk** **Short-eared owl** **Southwestern willow flycatcher (nesting)** **Summer tanager (nesting)** **Tricolored blackbird (nesting colony)** **Turkey vulture** **Vermilion flycatcher (nesting)** **Western burrowing owl (burrow sites)** **Western yellow-billed cuckoo (nesting)**

Table 2 (Continued)

Guild	Vagility	Home Range	Dispersal Ability	Special-Status Species Documented or Potentially Occurring in Project Area[1]
				White-tailed kite (nesting) **Yellow warbler (nesting)** **Yellow-breasted chat (nesting)** **Yellow-headed blackbird** **Fringed myotis** Long-legged myotis **Pallid Bat** **Pocketed free-tailed bat** **Townsend's big-eared bat** **Western mastiff bat** **Western red bat** Western small-footed myotis **Yuma myotis** **Monarch butterfly**
Moderate Mobility Aerial (Birds and Invertebrates)	Flight; movement may be limited by habitat fragmentation and isolation by urban development; resident or short-distance dispersal	Specific habitats within Project area	Beyond Project area; but dispersal is limited	Bell's sage sparrow (nesting) Black-chinned sparrow Coast (San Diego) cactus wren **Coastal California gnatcatcher** **Southern California rufous-crowned sparrow** **San Emigdio blue butterfly**

[1] Species **in bold** are known to occur on site; all other species have potential to occur on site based on their known geographic range and available suitable habitat.

Section 4.1 Aquatic Guild

The aquatic guild includes species entirely dependent on aquatic environments for their life histories, including fish and the undescribed snail (genus *Pyrgulopsis*) that occurs in the Middle Canyon Spring. The Santa Clara River represents the most significant aquatic feature within the Project area and is known to provide habitat for Santa Ana sucker (*Catostomus santaanae*), unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*), and arroyo chub (*Gila orcutti*). Aquatic species are generally sensitive to hydrologic and geomorphic alterations or degradation of water quality, but also water temperatures. Therefore riparian buffers and BMPs that can maintain hydrology, geomorphology, water quality, and the appropriate range of water temperatures will be important for the continued persistence of these species within the Project area after build-out.

Section 4.1.1 Aquatic Guild Buffer

Several studies have examined the function of riparian buffers for aquatic species. Belt *et al.* (1992) indicate that riparian buffers, in the context of forest logging, have five functions: (1) trapping sediments or nutrients, (2) moderating stream temperatures, (3) providing food and cover, (4) providing large organic debris, and (5) moderating cumulative watershed effects. In the context of the Santa Clara River and Project area, riparian buffers are most needed to protect the ecological processes listed as functions 2 through 5. The effectiveness of buffer strips in moderating stream temperature depends not on width but on “angular canopy density,” which is a measure of canopy density actually capable of shading the stream. Studies reviewed by Belt *et al.* (1992) regarding food production found that a 98-foot-wide buffer was adequate to maintain macroinvertebrate diversity, while a 33-foot-wide buffer was inadequate. Data regarding the quantity of large organic debris in stream systems are lacking, but this factor is generally regarded as important in fish ecology. Buffer strips 98 feet wide were found to supply 85% of large organic debris, whereas 33-foot-wide buffers provided less than 50% of large organic debris. Wegner (1999) conducted a comprehensive review of over 140 articles and books on the subject of riparian buffer width, extent, and vegetation, and concluded that aquatic habitat preservation (defined as including maintenance of temperature controls) and inputs of large woody debris and other organic matter can be maintained with 33-foot-wide to 98-foot-wide native buffers.

Mahoney and Erman (1984) analyzed the effectiveness of various buffer treatments on the transport of sediments in streambeds and also provided a review of previous literature regarding streamside buffers. Adverse effects of sedimentation were found to be adequately reduced through retention of a 33-foot-wide to 66-foot-wide vegetated streamside buffer. In their own experiments, Mahoney and Erman (1984) found that the amount of transportable sediment was significantly higher in streams that had a buffer less than 98 feet wide when compared with control streams. Streams with a 98-foot-wide buffer showed no significant difference in transportable sediment when compared with control streams with full protection.

As required by the Specific Plan EIR, the buffer between aquatic and riparian habitat and urban development adjacent to the River Corridor Special Management Area (SMA) would be a minimum of 100 feet wide between the top river-side of bank stabilization and development, unless, through Planning Director review in consultation with the staff biologist, it is determined that a lesser buffer would adequately protect the riparian resources within the River Corridor SMA, or that a 100-foot-wide buffer is infeasible for physical infrastructure planning. The buffer area may be used for public infrastructure, such as flood control access; sewer, water and utility easements; abutments; trails; and parks—all subject to findings of consistency with the Specific Plan. This buffer would preserve much of the existing streamside vegetation that serves to control sedimentation except in those areas where structures such as bridge footings, outfall structures, and viewing platforms will be placed. Based on a review of the scientific literature, this 100-foot-wide buffer will be adequate to protect habitat for the aquatic guild fish species.

Specific buffer issues for the undescribed snail include hydrologic alterations, invasive species, and human and domestic animal disturbances. These buffer issues are addressed in more detail in **Sections 5.0** and **6.0**.

Section 4.1.2 Aquatic Guild Connectivity

Species within the aquatic guild present in the Santa Clara River system could travel throughout the River during periods of continuous flow or be transported during flood events to downstream areas. Native fish species such as Santa Ana sucker, unarmored threespine stickleback, and arroyo chub are adapted to surviving typical Southern California stream cycles of winter storm floods and reduced summer flows. These native fish may persist in aquatic refugia of backwaters, ponds, and shallow streams during the summer dry months, and repopulate wider areas after winter floods. Additionally, artificially persistent flows such as those from wastewater treatment plant or fish hatchery outflows may sustain populations of these native fish (Swift *et al.* 1993), although under artificial flow conditions they may be more susceptible to impacts by non-native fishes that are adapted to more consistent hydrologic conditions. Flow conditions that emulate the natural cyclical conditions are probably more conducive to maintaining the native fish populations.

The area within the River Corridor SMA (the main stem of the Santa Clara River) will remain intact after build-out of the Project area, and therefore the ability of these species to move through the Santa Clara River will not be substantially impaired. During construction of bridges over the River several measures will be implemented to ensure that habitat connectivity is maintained (See **Section 6.2**). Planned flood control structures in the ephemeral tributary drainages will mostly preclude aquatic guild species from using those areas during times of high flow when aquatic environments within these tributaries normally would be accessible. However, these drainages are not expected to provide important long-term habitat for species in this guild because of their ephemeral nature (see ENTRIX 2007).

Section 4.2 Semi-Aquatic Guild

The semi-aquatic guild includes species requiring both aquatic and terrestrial habitats for critical portions of their life history and includes several species known to be present in the Project area: western spadefoot toad, southwestern pond turtle, and two-striped garter snake. This guild also includes the arroyo toad, for which tadpoles, but no juveniles or adults, have been observed on site. Arroyo toads occur upstream of the Project area, and high-quality habitat for the species within the Santa Clara River and adjacent uplands is present on site. While semi-aquatic guild species are typically found near perennial and/or ephemeral waters, they require terrestrial habitats for parts of their life cycles, such as foraging, nesting (southwestern pond turtle), aestivation, and hibernation, and may be capable of long-distance overland movements. In addition, amphibians in this guild may be susceptible to changes or degradation of water quality because of integument (skin) permeability. Therefore the continued presence of these species within the Project area will be highly dependent on the integrity of planned riparian buffers.

Section 4.2.1 Buffers for Semi-Aquatic Guild

Semlitsch and Bodie (2003) found that core terrestrial habitat (defined as including habitat necessary for feeding, over-wintering, and nesting) for semi-aquatic amphibians and reptiles ranged from 520 to 950 feet from the edge of the aquatic site for amphibians and from 417 to 950 feet for reptiles, depending on the species. These terrestrial habitat ranges are relevant for special-status species—such as southwestern pond turtle, two-striped garter snake, western spadefoot toad, and arroyo toad—that are present or potentially present in the Santa Clara River area, and use uplands adjacent to aquatic habitats for aspects of their life cycles.

Southwestern pond turtles are known to utilize terrestrial habitats adjacent to aquatic environments in the summer for nesting and over-wintering. Nests are typically located along stream or pond margins, but the movement of southwestern pond turtles is probably related to the availability of suitable nesting and over-wintering sites in relation to aquatic habitat and, thus, is likely to be very site-specific. Goodman (1997A), for example, studied populations at Aliso Creek in Chino Hills State Park and along the West Fork of the San Gabriel River in Southern California. Nest sites were generally on south-facing slopes ranging from 2 degrees to 60 degrees and an average of 53 feet (maximum of 158 feet) from the watercourse at Aliso Creek, and an average of 94 feet (maximum of 155 feet) from the watercourse at the San Gabriel River. Rathbun *et al.* (1992) found nests located more than 328 feet from water on adjacent hillsides, apparently with a southern exposure. A southern exposure is likely important for thermal regimes related to egg development. If suitable nesting sites are not available adjacent to aquatic habitat, females have been observed to travel up to 1.2 miles along a waterway to lay their eggs (Rathbun *et al.* 1992). Over-wintering turtles may travel farther than nesting turtles, with a mean distance of 666 feet and a maximum of 1,640 feet observed by Reese and Welsh (1998). Holland (1994) reported that pond turtles are capable of moving up to 3 miles overland between drainages.

Similar to the pond turtle, the arroyo toad uses terrestrial habitats adjacent to aquatic areas for foraging, aestivation, and hibernation. Subadults and adults may range widely into the surrounding uplands, commonly within 650 to 3,280 feet, but up to 1.2 miles (USFWS 2004). Radiotelemetry studies by Ramirez found that arroyo toads typically burrow no farther than about 121 to 1,062 feet from the edge of a stream, with an average distance of about 52 feet (cited in USFWS 2004). A radiotelemetry study of arroyo toads in San Juan Creek in southern Orange County, which has a similar structure to the Santa Clara River (*i.e.*, a fairly wide active floodplain and relatively narrow wet channel, with agricultural operations adjacent to much of the creek), found that virtually all of the toad activity was limited to the active floodplain (Ramirez 2003). Arroyo toads appear to be capable of long-distance dispersal along stream corridors. Based on a consistent absence in upper Piru Creek, it was inferred that toads had moved as far as 5 miles along a streambed (USFWS 2001).

There are relatively little life history data for western spadefoot that can be used as the basis for buffer design that would accommodate the terrestrial portions of its life history. After metamorphizing in the late spring, juvenile toads disperse after a short period of time (Zeiner *et al.* 1990). Western spadefoot toads apparently do not move far from their breeding pool during the year, with movements within a few hundred meters of breeding pools (Zeiner *et al.* 1990), and it is likely that their entire post-metamorphic home range is situated around a few pools. Toads estivate in terrestrial habitats adjacent to potential breeding sites in burrows approximately 3.3 feet in depth (Stebbins 1972). Although not observed specifically for this species, the soil of burrow refuge sites likely becomes fairly hard and compact during the period of summer aestivation (Jennings and Hayes 1994; Ruibal *et al.* 1969).

Very little is known about terrestrial habitat use by two-striped garter snakes, but they are considered to be highly aquatic (Stebbins 2003). They are usually found in or near permanent water and along rocky streams bordered by willows and other streamside vegetation, but are also found in sage scrub, chaparral, and oak woodlands (Stebbins 2003). They bear live young, so unlike pond turtles that require suitable terrestrial nesting sites, two-striped garter snakes are probably not limited by a lack of suitable terrestrial habitats to meet their life history needs as much as other semi-aquatic species discussed in this section. Home ranges for two-striped garter snake are relatively small, averaging between 0.37 and 0.84 acre from summer to winter, and likely attributable to this species' aquatic requirements (Kucera 2000).

Based on existing information for the four semi-aquatic species addressed in this section, the terrestrial buffer requirements of the arroyo toad and southwestern pond turtle probably are large enough to also provide adequate buffers for the western spadefoot toad and two-striped garter snake. However, the minimum 100-foot-wide buffers between development and the Santa Clara River alone would not provide adequate terrestrial habitat for the arroyo toad and southwestern pond turtle. That is, if the River corridor was entirely aquatic habitat there would not be adequate terrestrial habitat to provide foraging, nesting, aestivation, and over-wintering habitat for these two species because they use such broad terrestrial areas adjacent to aquatic habitats. A study by Spinks *et al.* (2003) of a pond turtle population in the arboretum waterway on the U.C. Davis campus near Sacramento, California is an example of why both aquatic and upland habitats are essential for pond turtles. The arboretum waterway was originally the North Fork of Putah Creek, but currently is highly modified, being channelized and impounded, with its banks covered in concrete or wire-wrapped rock for erosion control. It is bordered by a strip of terrestrial habitat 33 to 98 feet wide that is intensively landscaped, has a paved path, and is used for teaching and recreation, including walking, jogging, and cycling. Spinks *et al.* (2003) found that under existing conditions the waterway is heavily skewed toward adult turtles, whereas healthy natural populations are dominated by juveniles and subadults. Their data indicate that suitable terrestrial nesting habitat may be extremely limited. This study demonstrates the importance of maintaining both aquatic and terrestrial habitats for the pond turtle. While the waterway provides suitable aquatic habitat to maintain an adult population, the lack of natural recruitment, likely due to poor nesting habitat, precludes establishment of a self-sustaining population.

Development adjacent to the River will remove some suitable terrestrial habitat for semi-aquatic species. Under the assumption that suitable upland habitat for the arroyo toad and southwestern pond turtle will be lost, the main question is whether adequate habitat to support all life history stages of these species will remain in the River Corridor SMA following build-out of the Project area. Based on the life history information for the arroyo toad and southwestern pond turtle reviewed above, the River Corridor SMA would be adequate to at least meet the typical terrestrial habitat requirements of the arroyo toad and southwestern pond turtle. Radiotelemetry studies by Ramirez found that arroyo toads typically burrow no farther than about 121 feet to 1,062 feet from the edge of a stream, with an average distance of about 52 feet (cited in USFWS 2004). Southwestern pond turtle nest sites were on average 53 feet from the watercourse at Aliso Creek and 94 feet from the watercourse at the San Gabriel River (Goodman 1997A), although Rathbun *et al.* (1992) found nests located more than 328 feet from water on adjacent hillsides, apparently with a southern exposure. Over-wintering turtles may travel farther than nesting turtles, with an average distance of 666 feet.

Much of the River Corridor SMA within the Project area is wider than 1,000 feet, and ranges up to 2,200 feet wide. The active stream channel providing aquatic habitat is dynamic, but typically is confined to a relatively narrow portion of the River corridor the vast majority of the time, leaving broad dry areas that provide terrestrial habitat functions for these two species. Although under typical conditions the River Corridor SMA is wide enough to meet the life history requirements of the arroyo toad and southwestern pond turtle, a question is whether the River Corridor SMA will provide adequate terrestrial refuge under severe flood conditions such that over-wintering individuals, for example, are not swept downstream. Relevant to this question is a floodplain analysis conducted by Pacific Advanced Civil Engineering, Inc. (PACE) to evaluate post-development hydrologic and geomorphological conditions in the Santa Clara River with build-out of the Project area. The Flood Technical Report (PACE 2006) found that there would be no significant impacts in water flows, velocities, depth, sedimentation, or floodplain and channel conditions downstream of the Project area as a result of the proposed Project improvements. These hydraulic effects were also found to be insufficient to alter the amount, location, and nature of aquatic and riparian habitats within the Project area and downstream into Ventura County over the long term. The technical analysis further determined that the River would still retain sufficient width to allow natural fluvial processes to continue. Following build-out of the Project area, the mosaic of wetland, riparian, and terrace terrestrial habitats in the River Corridor SMA that support various species such as the arroyo toad and southwestern pond turtle would be maintained, and the populations of the species within and immediately adjacent to the River Corridor SMA would not be substantially affected.

Section 4.2.2 Connectivity for Semi-Aquatic Guild

The semi-aquatic guild species rely on aquatic environments for a portion of their life histories, and therefore their distributions are generally limited to areas in proximity to these aquatic environments' sources, including streams, rivers, ponds, reservoirs, and ephemeral wetlands (*e.g.*, vernal pools). While both the arroyo toad and southwestern pond turtle are capable of long dispersal movements through terrestrial habitat between suitable aquatic sites (USFWS 2001; Holland 1994), within the Project area, instream movements along the Santa Clara River and its major tributaries (*e.g.*, Castaic Creek, Salt Creek) are probably most important for these species. Any suitable aquatic habitats within the Project area and immediate region can be reached directly by moving along the River corridor. Furthermore, there are no suitable aquatic habitat areas (*i.e.*, major drainages or streams) within their dispersal capabilities (at least up to 5 miles along streambeds for the arroyo toad (USFWS 2001), and 3 miles overland for southwestern pond turtles (Holland 1994)) that could not be reached by moving along the River corridor. Habitat connectivity for the arroyo toad and southwestern pond turtle in the Project area, therefore, will not be significantly affected by build-out of the Project area. Because habitat connectivity considerations for the spadefoot and two-striped garter snake are probably similar to, or can be subsumed by the requirements of the arroyo toad and southwestern pond turtle, connectivity for these two species will also not be significantly affected by build-out of the Project area.

Section 4.3 High Mobility Ground-Dwelling Guild

Representative species in the high mobility ground-dwelling guild occurring within the Project area include American black bear (*Ursus americanus*), mule deer (*Odocoileus hemionus*), mountain lion, bobcat (*Lynx rufus*), and coyote. These species have in common that their spatial activity (*i.e.*, home ranges, movements related to foraging and seeking mates, and dispersal) extends beyond the boundaries of the Project area and thus needs to be addressed at a regional landscape level. Bobcat, coyote, mule deer, and likely mountain lion include all or portions of the undeveloped portions of the Project area as part of their home ranges. As a higher-elevation species, the black bear probably does not include the Project area within its normal home range in the region, but may pass through the Project area during dispersal movements between higher elevation forested habitat north and south of the area. Although the bobcat, coyote, mule deer, and mountain lion would be displaced from development areas to a large extent and dispersal habitat for the black bear may become more limited after development, providing for movement of these species across the larger landscape will help maintain populations within and beyond the Project area. Preservation of landscape linkages and wildlife corridors by maintaining a large connected open space system, as well as wildlife crossings of potential physical obstacles such as roads, will help maintain viable populations of these species on a regional scale. Buffers along critical areas of the open space–urban interface will provide additional protection for the movement of these species by protecting important habitat features such as cover and refuge areas and reducing negative interactions associated with urban development (*e.g.*, vehicle collisions, noise, nighttime lighting, harassment by humans and pets).

Section 4.3.1 Buffers for High Mobility Ground-Dwelling Guild

The following descriptions of the natural history of species in the high mobility ground-dwelling guild (mule deer, coyote, bobcat, mountain lion, and black bear) provide the context in which to evaluate the need for and effectiveness of habitat buffers.

Mule deer generally occur in rugged terrain, and generally remain on slopes and at higher elevations in Southern California. However, when mule deer move to lower elevations, particularly into riparian areas, to meet water and forage requirements (*e.g.*, high-protein forbs), predation risk from coyotes and mountain lions is increased. Moving into lower elevation areas, especially during drought, also increases their risk of negative interactions associated with urban development (*e.g.,* vehicle collisions, harassment by humans and pets). Upland habitat and wide riparian buffers adjacent to riparian areas are therefore beneficial to mule deer, because they can use adjacent hillsides and steep slopes to flee predators and avoid these negative interactions (Lingle 2002; Pierce *et al.* 2004).

Maintaining coyotes in the Project area is important, because, as a top predator, coyotes keep native and non-native mesopredators (raccoon, skunk, opossum, and fox) and stray and feral cats and dogs in check (Crooks and Soulé 1999). Coyotes are highly adaptable and are known to habituate to human development and shift their activity correspondingly toward nocturnal foraging and activity in urban environments (McClennan *et al.* 2001). Open areas in fact provide access to coyotes into residential and other developed areas and allow them to take advantage of unconventional foraging opportunities (*e.g.*, pets, pet food, and garbage) within developed areas. Although coyotes are adaptable to urban environments, habitat buffers probably are beneficial both to coyotes and humans. When provided the opportunity and adequate resources are available, coyotes likely use natural open habitat areas more than urban landscapes. Habitat buffers provide natural open space for coyotes to forage and move and reduce the need for them to enter residential areas, thus reducing risks to coyotes as well as humans and their pets.

Bobcats generally are wide-ranging, but their home range sizes vary geographically. Reported home ranges vary between 272 and 39,000 acres (Larivière and Walton 1997). Reported home ranges in Riverside County in Southern California varied from 1,152 to 13,248 acres (Bailey 1974). Although bobcats are nocturnal, fairly secretive, and seldom seen by humans, they are relatively adaptable to urban development as long as adequate natural habitat is provided. Availability of prey such as rabbits (Leporidae) and squirrels (Sciuridae), and habitat cover (rocky and brushy areas) are likely the limiting factors in bobcat distribution (Larivière and Walton 1997). Bradley and Fagre (1988), for example, found that bobcats in south Texas used fence-lines and roads for hunting more than expected by chance and were relatively undisturbed by human presence. Although buffer habitats may enhance the overall habitat value through increased cover and prey, reduced lighting, noise, and less human activity, there is no evidence that they shy away from development at particular distances from urban development as long as other habitat features and prey are present. Hawes and Smith (2005), for example, suggest that a riparian zone of 330 feet is adequate for bobcat. The main risk to bobcats in urban areas is collisions with vehicles.

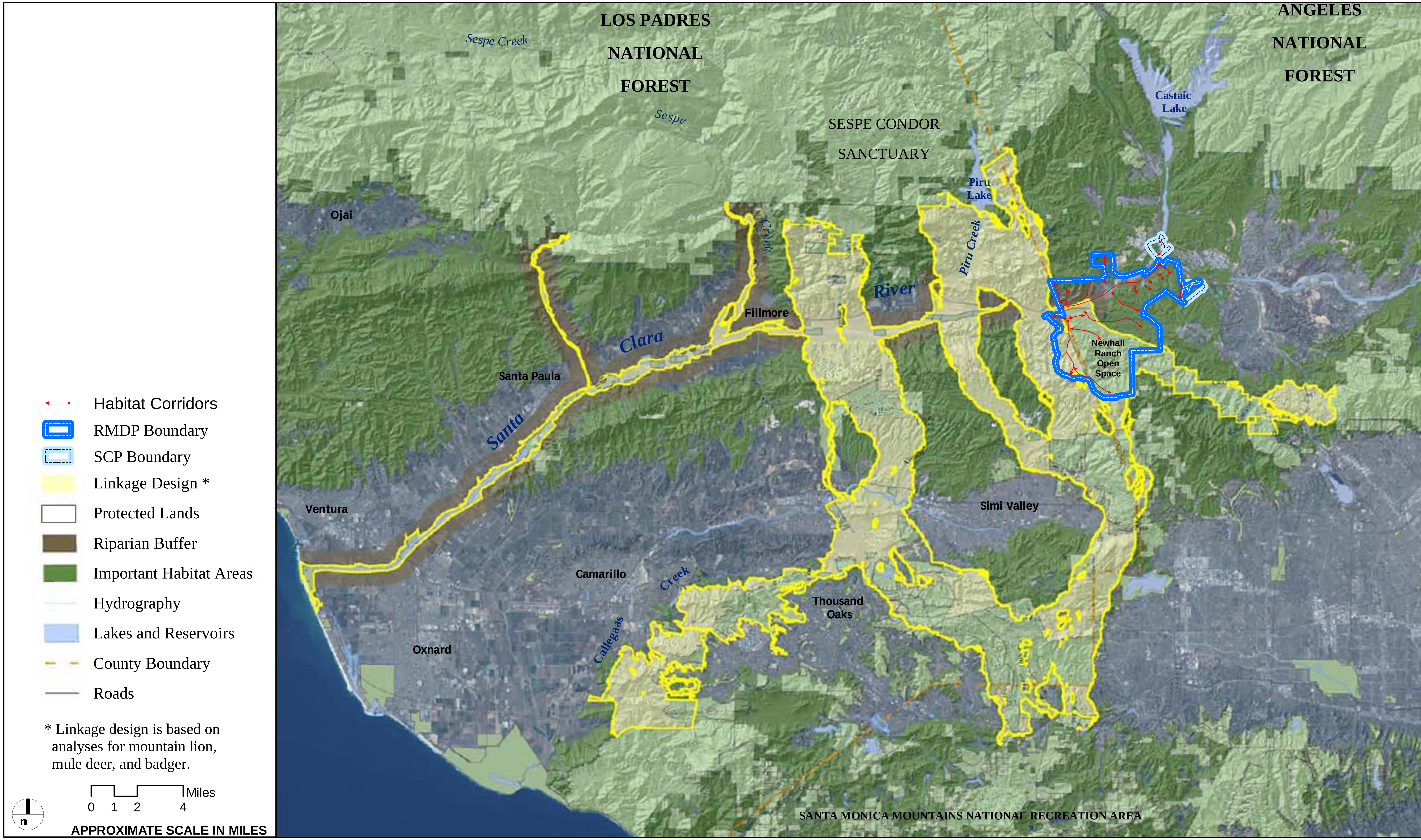
Mountain lions also are a wide-ranging species, with adult male home ranges exceeding 100 square miles (*e.g.*, Loft 1996). Although large, non-fragmented landscapes are desirable for mountain lions, which tend to avoid urban areas, they will use constricted passages (*i.e.*, low openness factors) in fragmented landscapes when necessary (Beier 1995; CBI 2002, 2003; Foster and Humphrey 1995; Hilty and Merenlender 2004). Mountain lions are expected to use the High Country SMA and Salt Creek area after development, with use of the Santa Clara River Corridor SMA primarily for movement between large habitat areas. Similar to the situation with bobcats, vehicle collisions are probably the greatest risk to mountain lions in urbanizing environments, but negative encounters with humans are also increasing. Habitat buffers that minimize direct contact between mountain lions and humans therefore are important for protecting both the mountain lion and humans.

Black bears are highly mobile and are capable of moving across a variety of terrains; only large bodies of water, major urban areas, and very rugged alpine ridges are considered to be major obstacles to movement (NatureServe 2007). Although they are not expected to occur regularly in the Project area, they are expected to move through the area occasionally for dispersal or to come down from higher elevations in search of food and water when resources become scarce in their normal home ranges (*e.g.*, during drought). As long as habitat connectivity is maintained between large habitat areas, buffers *per se* for this species probably are not particularly important, but as with the other high mobility species, minimizing interactions between bears and humans by including buffers is desirable.

The 6,700-acre open space system comprised of the High Country SMA, Salt Creek area, and River Corridor SMA will provide adequate habitat for the high mobility guild species discussed in this section to persist and/or move through the region after build-out of the Project area. The open space system, and particularly the combined 5,220-acre High Country SMA and Salt Creek area, is large enough and varied enough topographically to provide both buffer and core habitat to allow these species to use the landscape without necessarily having to come into close contact with urban development, except at highway crossings discussed below. As shown in **Figure 2**, the High Country SMA and Salt Creek area are part of the eastern arm of the conceptual linkage design identified in the South Coast Missing Linkages Project (Penrod *et al.* 2006). This linkage in this area is about 4.5 miles (23,760 feet) wide, with the narrowest portion of the High Country SMA and Salt Creek area approximately 4,000 feet wide. This minimum 4,000-foot-wide zone will provide adequate buffer and core habitat for the high mobility guild species. Because of the rugged terrain and ridges between the Salt Creek area and development in Potrero Canyon, individuals using the mainstem Salt Creek drainage and its tributaries, for example, can traverse much of the landscape without visual contact with development. The River Corridor SMA is likely to be used by all of the high mobility ground-dwelling guild species, except perhaps black bear, which might only use it as a north-south crossing point to gain access to large habitat areas to the north and south of the River. At 1,000 feet to more than 2,000 feet wide, the River Corridor SMA also provides adequate habitat for these species without forcing them into direct contact with humans.

Section 4.3.2 Connectivity for High Mobility Ground-Dwelling Guild

The previous section discussed habitat buffer issues related to the high mobility ground-dwelling guild and indicated that these species are capable of utilizing fairly constricted corridors and crossings in urbanized areas. This section expands on the issues of habitat connectivity and wildlife corridors for these species, with a focus on the requirements of the larger species - mule deer, black bear, and mountain lion - for movement through constrained habitats. Linkages and corridors that function for these three species also would be adequate for the coyote and bobcat (**Table 1** and see Ruediger and DiGiorgio 2007).



SOURCE: South Coast Wildlands, 2006

FIGURE 2

RMDP Wildlife Habitat Buffers and Connectivity

South Coast Wildlands Open Space Connectivity and Linkage

DUDEK

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The High Country SMA, Salt Creek area, and River Corridor SMA collectively total approximately 6,700 acres. Generally, with the exception of the black bear, the high mobility ground-dwelling guild species will use the approximately 5,720-acre High Country and Salt Creek areas for core habitat within their home ranges after Project area build-out. This upland open space will also provide adequate habitat to encompass the home ranges of a number of individual bobcats, packs of coyotes, and herds of deer, and at least a portion of the home range of a few mountain lions. For black bear, and possibly the mountain lion, the High Country SMA and Salt Creek area are probably more important for dispersal between larger areas than as core habitat.

Based on a study in the Santa Ana Mountains of Southern California, Dickson and Beier (2006) suggest that mountain lion preferentially move along canyon bottoms and gently sloping terrain rather than ridgelines and steep terrain and that they prefer riparian vegetation for diurnal use and nocturnal travel. The rugged canyons and creeks within the High Country SMA and Salt Creek area will provide natural conduits for movement between the Santa Susana Mountains and the Santa Clara River corridor after development, as illustrated by Salt Creek-High Country linkage No. 3 shown in **Figure 3**. Additionally, the South Coast Missing Linkages Project's linkage design shown in **Figure 2** overlaps with the Salt Creek-High Country linkage. This natural feature is expected to provide corridors of movement and dispersal along the natural northwest-southeast alignment of the canyons, not only for mountain lion, but also the other high mobility ground-dwelling guild species. The mule deer is expected to use the rugged terrain throughout the High Country SMA and Salt Creek area.

The Santa Clara River Corridor SMA serves as a major east-west linear linkage to canyons and hills along the length of the River and provides far-reaching linkages to larger open space area north and south of the River. This linkage provides a 1,000-foot-wide to 2,000-foot-wide swath of riverine habitat that can probably meet the life history needs of the bobcat, coyote, and mule deer, and function as dispersal habitat for the mountain lion and black bear. Movement perpendicular to the River Corridor SMA is expected and the connectivity with the Salt Creek area and High Country SMA should be heavily used by wildlife moving between the Santa Susana Mountains and the River Corridor SMA. Individuals moving between the Santa Susana Mountains and the Santa Clara River corridor, however, will be constrained from moving directly north from the River within the Project area boundaries because of the proposed Homestead Village development partially blocking the Homestead/Off-Haul canyons north of the River Corridor SMA. Instead, they will need to use habitat west of the Project area in Ventura County to move into the Los Padres National Forest, as illustrated in the Missing Linkages conceptual design (**Figure 2**). Individuals moving east along the River corridor are more likely to encounter urban-related impacts as they move into the City of Santa Clarita and thus would be at greater risk. Coyotes and mule deer, and possibly bobcat, could probably traverse the length of the River corridor to the east and gain access to the Angeles National

Forest north and south of the River corridor, but mountain lion and black bear would be at much greater risk of negative urban-related encounters.

State Route 126 (SR-126) is a significant barrier to north-south movement by high mobility ground-dwelling species. Even for species that readily cross busy highways, such as coyotes, the high volume of existing and future traffic on SR-126 at all hours makes it a very dangerous at-grade crossing for wildlife. For the primary crossings of SR-126 in Ventura County there are three existing arched culverts that serve the ranch agricultural operations, as depicted in **Figure 4**. They measure about 14 feet, 7 inches in height, 25 feet in width, and 170 feet in length, resulting in an openness factor of 0.65, which well exceeds the openness factor of 0.25 found by Donaldson (2005) to be adequate for white-tailed deer. The easternmost of these will serve wildlife movement within and through the Project area *via* the Salt Creek corridors as well as Tapo Canyon in Ventura County. Based on various studies, these culverts are large enough to accommodate black bear and mountain lion as well. For example, in Banff National Park, Alberta, Canada, black bears used underpasses that ranged in size from about 14 feet to 44 feet in width, 8 feet to 13 feet in height, and 84 feet to 319 feet in length (Clevenger and Waltho 2000). Beier (1995) observed mountain lions using box culverts less than 15 feet by 15 feet to cross under freeways. Ruediger and DiGiorgio (2007) recommend similar dimensions for these two species and for mule deer (see **Table 1**). The Missing Linkages Project (Penrod *et al.* 2006) acknowledged the value of these crossings at Camulos Ranch and Tapo Canyon, as well as several smaller drainage culverts (where bobcat tracks were observed), and commented about the Tapo Canyon structures as follows (p.91):

> These structures should be maintained and enhanced during the next transportation improvement project. We strongly recommend maintaining the wild character of this branch of the linkage, one of the last remaining areas where natural habitats are still contiguous between the Santa Susana Mountains and the Sierra Madre Ranges.

Section 4.4 Moderate Mobility Ground-Dwelling Guild

Species representative of the moderate mobility ground-dwelling guild in the Project area include American badger (*Taxidea taxus*), San Diego black-tailed jackrabbit (*Lepus californicus bennettii*), gray fox (*Urocyon cinereoargenteus*), long-tailed weasel (*Mustela frenata*), and raccoon. These moderately mobile species are capable of dispersing wider than the Project area but typically have home ranges that could be wholly contained within the Project area. With the exception of the raccoon, which adapts well to urban settings, it is important to maintain sufficient habitat for these species that is buffered from the urban-related impacts, as well as regional connectivity to larger conservation areas important for population dispersal.

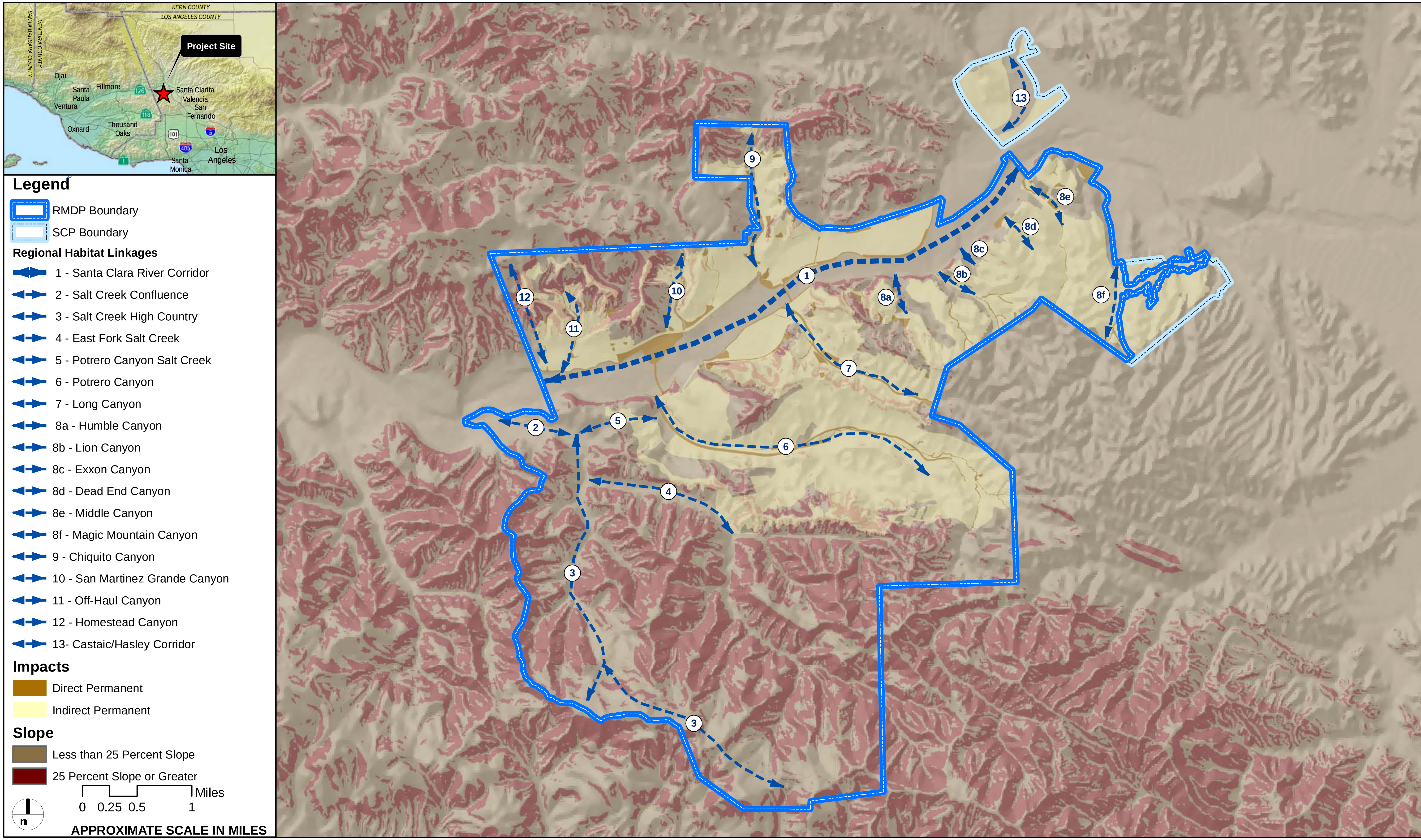

IMAGE SOURCE: USGS 24K Quad

FIGURE 3

RMDP Wildlife Habitat Buffers and Connectivity

Alternative 2 Impacts to RMDP/SCP Regional Wildlife Connectivity Corridors

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AERIAL SOURCE: DigitalGlobe, 2007

FIGURE 4

RMDP Wildlife Habitat Buffers and Connectivity

Wildlife Connectivity Crossings

DUDEK

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Section 4.4.1 Buffers for Moderate Mobility Ground-Dwelling Guild

Moderate mobility guild species such as raccoons and gray fox may spend all or a portion of their life in riparian zones characteristic of the Santa Clara River corridor, although their overall home ranges are much larger than small mammals and reptiles. Raccoons especially are highly opportunistic, however. While they are naturally associated with riparian and wetland areas, raccoons frequently forage in agricultural and urban areas (Zeiner *et al.* 1990). Densities of raccoons in suburban settings can be surprisingly high. Hoffmann and Gottschang (1977), for example, found that a population of raccoons in an Ohio suburb had home ranges of approximately 12.6 acres and foraged within about 1,300 feet of their dens. Gray foxes are also known urban predators, but are negatively affected by coyotes. Badgers, black-tailed jackrabbits, and long-tailed weasels occur in drier, open habitats (including agricultural areas), but also occur in narrow canyons and drainages. Because these five species can use various habitats, including human-modified land cover such as agriculture, buffer issues are not so much related to habitat quality or habitat degradation, but rather to urban-related adverse edge effects that can affect essential behavioral activities (foraging, reproduction, rearing of young) and increased risk of harm and mortality. For example, increased human activity and associated noise and nighttime illumination can directly affect their nocturnal foraging behavior by interfering with their ability to locate and capture prey, and indirectly by the effects of these factors on their prey. Pet, stray, and feral cats and dogs that are more likely to occur along the open space–urban interface are also a threat to these species as a result of harassment, predation, and competition for resources. For example, cats are probably a major competitor with weasels for rodent prey along urban edges. Another potential threat along the open space–urban interface is the use of rodenticides that can affect the prey base of fox, weasel, and badger.

The penetration zone of these kinds of edge effects on these species, without mitigation or management, is at least 200 feet from the edge of development. As described above, CBI (2000) suggested that domestic cats can still have impacts within 100 to 200 feet of the open space–urban interface even with a healthy coyote population to keep cats in check.

With build-out of the Project area, the future urban edge along the High Country SMA and Salt Creek area is of relatively low concern because of the substantial area (5,720 acres) of habitat that will remain in open space. Even with some level of impact along the edge of this open space, there will be adequate “core” habitat for these species in unaffected interior areas. As noted above in the discussion of the high mobility ground-dwelling species, the narrowest area of open space in the High Country SMA and Salt Creek area will be approximately 4,000 feet wide, leaving more than adequate interior habitat for the moderate mobility ground-dwelling species. In addition, several mitigation measures applicable to all open space areas, as discussed in **Section 6.0**, will provide additional protection, including public use only along designated trails, requirements that pets be kept on leash, requirements that nighttime illumination be downcast in areas adjacent to natural habitat areas, controls on stray and feral cats and dogs, and controls on the use of rodenticides.

The main area of concern for edge effects on these species and the issue of buffers is along the Santa Clara River corridor where development would be present on both sides of the River. Upon build-out, the River Corridor SMA will range from approximately 1,000 feet wide to 2,000 feet wide, with a 100-foot transition area between the top of the river bank and the urban edge. This amount of riverine habitat in the River Corridor SMA will be adequate for the two riparian-associated species—raccoon and fox—as well as provide some suitable habitat for the badger, black-tailed jackrabbit, and long-tailed weasel. Several mitigation measures will also provide additional protection from urban-related edge effects, including designated trails, fencing along the River Corridor SMA, controls on public access to the River (*e.g.*, daytime use only, prohibitions on motorized and mountain bikes), pet restrictions, controls on stray and feral cats and dogs, requirements that nighttime illumination be downcast in areas adjacent to natural habitat areas, and controls on the use of rodenticides (see **Section 6.0** for discussion of mitigation measures).

Section 4.4.2 Connectivity for Moderate Mobility Ground-Dwelling Guild

Species in the moderate mobility ground-dwelling guild tend to require suitable habitat for movement and dispersal and are generally limited in their ability, and are thus less apt, to traverse unsuitable habitat. However, raccoons are an exception, because, like coyotes, they can and often do utilize urban areas. For this reason, the discussion of connectivity is primarily focused on the badger, gray fox, black-tailed jackrabbit, and long-tailed weasel.

Badgers may be considered intermediate between highly mobile and moderately mobile species. While they are capable of long-distance dispersal (Messick and Hornocker (1981) documented a juvenile dispersal event of 68 miles), they may be relatively sedentary within home ranges where resources are plentiful. Various studies have documented badger home ranges varying from 400 acres to 600 acres (*e.g.*, Messick and Hornocker 1981) to as high as 74,000 acres (RISC 2007). Their distribution in a landscape coincides with the availability of prey, burrowing sites, and mates, with males ranging wider than females during the breeding and summer months (Minta 1993). In areas of British Columbia, Canada, where prey densities are very low, home ranges for male badgers ranged from approximately 19,500 acres to 74,000 acres, whereas in Illinois male badger home ranges were approximately 10,872 acres (RISC 2007). However, it is expected that prey densities associated with agriculture and ranching practices in the Project area are more similar to those studied by Minta (1993) in a sagebrush-grassland area of Wyoming. Minta (1993) found that outside of the breeding season male and female badger home ranges were similar at approximately 740 acres. In general, badger activity within a home range tends to concentrate in areas with suitable soils for burrowing or with colonies of ground squirrels.

Gray fox home ranges also are variable. In Wisconsin home ranges varied from approximately 32 to 766 acres; in Florida home ranges averaged 1,900 acres; in Utah home ranges averaged 247 acres; and in Davis, California the average home range for four females was 296 acres (Zeiner *et al.* (1990).

Black-tailed jackrabbits are capable of dispersing long distances, but typical dispersal distances may be relatively short. French *et al.* (1965) recorded most dispersal distances at less than 0.25 mile, but 18% of juveniles dispersed greater distances and one individual dispersed 28 miles in 17 weeks. Most seasonal movements involve short distances and may be related to food availability (Bronson and Tiemeir 1959). Home ranges of the black-tailed jackrabbit are also variable, but typically range from 49 to 346 acres (Best 1996). French *et al.* (1965), however, recorded ranges of only 40 acres in southeastern Idaho, while Smith (1990), using radiotelemetry, estimated home ranges in northern Utah of 247 to 741 acres. Smith (1990) also found that jackrabbits tend to shift their home range over time, with the shifts occurring gradually.

Long-tailed weasels are known to occupy home ranges varying from approximately 25 to 640 acres, depending on the condition of habitat (Zeiner *et al.* 1990). Gehring and Swihart (2004) monitored 11 long-tailed weasels in habitat fragmented by agriculture in Indiana and found that females occupied home ranges of 128 ± 20 acres and males occupied home ranges of 445.5 ± 149 acres. Male–male home ranges do not overlap. During the breeding season, male ranges increase in size to overlap the ranges of more females. Increased road kill of males has been observed in western Washington during the breeding season, indicating higher levels of roaming in search of mates (Buchanan 1987).

Species in this guild are expected to inhabit the River Corridor SMA, High Country SMA, and Salt Creek area collectively totaling 6,700 acres. These areas combined are large enough to support least a few (badgers) to many (black-tailed jackrabbits and long-tailed weasels) individuals in the moderate mobility ground-dwelling guild. Animals in this guild will most likely disperse through the open space by diffusion of populations, but also occasionally through long-distance dispersal events (*e.g.*, badger and black-tailed jackrabbit), allowing gene flow between connected open space areas. The dispersal capabilities of the gray fox and long-tailed weasel are unknown, but it is expected that long-range dispersal events are possible, albeit relatively uncommon. Rare or occasional long distance dispersal events would be possible via the natural habitat linkages that these open space areas provide. Canyons and creeks within the High Country SMA and Salt Creek area provide natural conduits for movement, particularly because the species in this guild are associated with shrublands, riparian, and wash environments. The low cost of movement provided for by the canyons (*i.e.,* gentle terrain, good cover) make these primary pathways for movement and dispersal. The River Corridor SMA will serve as the major linkage to canyons and hills along the length of the River and will provide a regional linkage to larger open space areas for species in this guild. The direct connection of the High Country SMA and Salt Creek area with the River Corridor SMA provides an important cross-linkage for this guild for moving from the higher elevations to and through the River corridor.

The main constraint on north-south movement of species in this guild in the Project area and to adjacent open space areas is SR-126. As described above for the high mobility ground-dwelling guild species, however, there are existing arched culverts that serve the ranch agricultural operations, as depicted in **Figure 4**. Because these culverts are large enough to accommodate black bear, mule deer, and mountain lion, they will be more than adequate for the smaller moderate mobility ground-dwelling guild species. The Missing Linkages Project (Penrod *et al.* 2006) also noted several smaller drainage culverts (where bobcat tracks were observed) and indicated that such smaller culverts are the best connection for species such as the badger. Similarly, Ruediger and DiGiorgio (2007) indicated that round and box culverts with dimensions of 36 inches are suitable for badger and weasel (see **Table 1**). With these existing culverts, along with new culverts associated with improvements and new roads, connectivity for moderate mobility ground-dwelling guild species will be maintained.

Section 4.5 Low Mobility Ground-Dwelling Guild

As illustrated in **Table 2, t**he low mobility ground-dwelling guild includes species such as rodents and reptiles that are relatively sedentary throughout their life cycle (have relatively small home ranges and limited dispersal capabilities) and depend almost continuously on available suitable habitat that meets virtually all of their life history needs. For instance, Bleich and Schwartz (1975) estimated desert woodrat (*Neotoma lepida*) male and female home ranges in northern San Diego County at 0.09 and 0.11 acre, respectively. Frank and Heske (1992) used radiotelemetry to study spatial patterns of southern grasshopper mouse in the Chihuahuan Desert of southeastern Arizona and estimated average home ranges of breeding males at 9.1 acres versus 4.2 acres for females. No specific dispersal data are available for the grasshopper mouse, but Stapp (1997) reported that most juveniles had disappeared from a study site by autumn. Some spatial data are available for special-status reptiles in the Project area. Radiotelemetry of several dozen coast horned lizards in Southern California locations over a 5-year period documented annual home range sizes of about 3.0 acres to 3.5 acres, with the likelihood that, across years, home range areas could be larger (unpublished data, Suarez, pers. comm. 2005). Anderson (1993) reported coastal western whiptail home ranges in California of 2.5 acres for males and 0.8 acre for females. Diffendorfer *et al.* (2005) studied movements by the rosy boa at four sites in San Diego and Riverside counties for up to 4 years. Movement (measured as estimated distance moved per day) by the rosy boa was characterized by frequent short distant movements and rare long distance movement events that primarily occurred in the spring. Short-distance movements per day were predominantly less than 33 feet per day. Rosy boa home ranges were relatively small, with a largest recorded home range of 3.7 acres after 4 years of cumulative data. Fitch (1975) found that ringneck snakes could still be located after a number of years within 33 feet of their initial capture point, indicating strong site tenacity. Some ranges for ringneck snakes in Kansas tended to be elongate, with maximum axes of 460 feet (Fitch 1975). In areas with large seasonal temperature fluctuations, there appears to be some seasonal movement between habitats, with average movements between summer habitats and hibernacula of about 394 feet (Fitch 1975; Parker and Brown 1974).

Species in this guild may be capable of inhabiting confined open areas such as drainages, narrow canyons, and even edge environments that would otherwise restrict larger wildlife as long as suitable habitat is available. Additionally, species in this guild are usually incapable of traversing unsuitable habitat or have difficulty doing so because certain elements of the landscape mosaic pose physical or behavioral barriers to their movement (*e.g.*, roads, vertical barriers such as fences, walls, curbs, large open spaces) and these species are not mobile enough to overcome these barriers.

Section 4.5.1 Buffers for Low Mobility Ground-Dwelling Guild

As long as suitable habitat is present in the open space–urban interface, such areas are probably capable of supporting species in this guild. However, as low mobility species, they are particularly vulnerable to many of the adverse edge effects discussed above in **Section 2.2**, such as increased predation from mesopredators and domestic pets (*e.g.*, Crooks and Soulé 1999), because they usually do not have the mobility or home range sizes to avoid or escape these effects. The Class 1 through Class 4 ecological interactions postulated by Fagan *et al.* (1999), and summarized in **Section 2.1**, are particularly applicable to these species because of their spatial limitations.

For species in the low mobility ground-dwelling guild, population densities may be lower and spatial behavior (such as home range size or the distribution of activity within a home range) may be altered in edge areas with lower habitat quality due to invasive species or other disturbances such as vegetation thinning for fuel modification. Impact Sciences, Inc. (1997), for example, analyzed small mammal populations in upland habitats next to riparian areas along the Santa Clara River and found that home ranges tended to be smaller and more compact in high-quality habitat (*e.g.*, higher native shrub cover) compared to low-quality habitats (*e.g.*, disturbed or agricultural areas with little cover), and that the highest densities and diversity of small mammals occurred in high-quality upland habitat. These results suggest that high-quality habitats provide greater resources for small mammals and reduce the need to travel longer distances, thus reducing predation risk and other behavioral costs. High-quality habitats, such as those with higher native shrub cover, also provide greater protection from predators than low-quality habitat.

Because home ranges for low mobility ground-dwelling species tend to be small, habitat conditions along buffer areas must contain suitable habitat and adequate cover for the species in order for them to be present. Snakes that rely on rodents for prey and cover for protection, for example, are unlikely to occur in buffer areas that lack rodents, burrows, shrubs, or rocky areas that provide prey and refuge. Even with suitable habitat, however, a buffer may not support a large number and diversity of low mobility ground-dwelling guild species without some control on edge predator species such as cats. CBI (2000) indicated that pet cats can have an effect on native species at 100 to 200 feet from the urban edge. Thus, the effective buffer for protecting low mobility ground-dwelling species should be on the order of at least 200 feet. Areas with 100-foot buffers will provide some level of protection, but there would likely be some edge effects beyond the 100-foot buffer areas. To provide additional protection along the open space–urban interface, several mitigation measures applicable to all open space areas will provide additional protection, including public use only along designated trails, requirements that pets be kept on leash, requirements that nighttime illumination be downcast in areas adjacent to natural habitat areas, controls on stray and feral cats and dogs, and controls on the use of rodenticides (see **Section 6.0**).

Section 4.5.2 Connectivity for Low Mobility Ground-Dwelling Guild

As noted above, species in the low mobility ground-dwelling guild generally have small home ranges and limited dispersal capabilities. These species tend not to traverse large open spaces or unsuitable habitat. Movement across a large landscape is more likely to be intergenerational (between generations) and occur by diffusion rather than by discrete, long distance movements between disjunct habitat patches by an individual (*i.e.*, jump dispersal). For this reason, suitable continuous habitat is considered necessary to maintain connections between local populations and provide for dispersal and genetic exchange. This guild is less likely to exhibit metapopulation dynamics characterized by local extirpations and colonizations; if a habitat patch loses a species in this guild, it is unlikely to be recolonized by that species. Because these species have low mobility and require continuous suitable habitat, they are also susceptible to edge effects at the open space–urban interface along habitat connections and corridors from the factors discussed above in relation to buffers. As a result, narrow, long wildlife corridors that may function for high and moderate mobility ground-dwelling species are likely less effective for low mobility ground-dwelling species.

Under the assumption that at least 200 feet of buffer is needed to protect a low mobility species from most edge effects (CBI 2000), a habitat linkage or corridor bounded on both sides by development would have to be at least 400 feet wide, plus whatever width of “interior” habitat is necessary to support a particular species’ life history. For simplicity, the width of the interior habitat necessary for the species can be the same as the typical width of an idealized or symmetrical home range (in reality most species have irregularly-shaped home ranges related to a number of factors such as microhabitats and the distribution of resources within the home range, the location of other individuals, *etc*.). For a hypothetical species with a circular home range of two acres, the interior habitat would have to be approximately 330 feet wide (the diameter of the circle) to be relatively free of edge effects, and, thus, the total width of the habitat linkage would have to be 730 feet. For a desert woodrat with a typical home range of 0.11 acre (assuming a circular range), the interior habitat would have to be about 78 feet wide and the entire linkage would have to be at least 478 feet wide.

The High Country SMA, Salt Creek area, and River Corridor SMA, collectively totaling about 6,700 acres, provide more than adequate habitat connectivity for species in the low mobility ground-dwelling guild. The narrowest section of open space in the combined High Country SMA and Salt Creek area will be more than 4,000 feet wide. Assuming interior habitat 3,600 feet wide at the narrowest section (*i.e.*, edge buffer of 200 feet on either side of the open space area), a species with a circular home range as large as 233 acres would be relatively protected from edge effects. That is, all of its home range could be encompassed in the interior habitat area.

The Santa Clara River Corridor SMA also will provide adequate interior habitat for many low mobility ground-dwelling species. Upon build-out of the Project area, the River Corridor SMA will range from approximately 1,000 to 2,000 feet wide, with a 100-foot transition area between the top of river bank and the urban edge, for a total width ranging from 1,200 to 2,200 feet. Assuming a 200-foot edge area on either side of the River, the minimum “functional” width of the River Corridor SMA would be approximately 800 feet, which equates to a hypothetical circular home range of 11 to 12 acres. Thus, most low mobility ground-dwelling species would have more than adequate habitat in the River Corridor SMA without necessarily being exposed to adverse edge effects. As a result, the River Corridor SMA will provide habitat connectivity function for adjacent large open space areas for the low mobility ground-dwelling species and allow for dispersal through intergenerational diffusion of populations.

As with the high and moderate mobility ground-dwelling guild species, SR-126 is probably the main constraint for north–south population diffusion of species in the low mobility ground-dwelling guild. Movement mostly will be limited to areas with existing and future culverts under the highway. For most of the species, the culverts themselves probably would not be suitable habitat, and thus the individuals would have to quickly move through them to gain access to suitable habitat north and south of the highway. Use of these culverts, however, will be species-specific, with some species likely using the culverts at a relatively high frequency and others at a low frequency or not at all. However, the habitat areas that will be preserved in open space, particularly south of the SR-126, will be large enough to support viable populations of the low mobility ground-dwelling guild species even without exchange of individuals and genetic material across SR-126.

Section 4.6 High Mobility Aerial Guild

The high mobility aerial guild is comprised of species capable of long-distance flight, typified by migratory or otherwise highly mobile birds, but also bats and some invertebrates. These species may utilize one or more habitats within the Project area for certain life history requirement such as nesting, roosting, or over-wintering. The key assumption for the high mobility aerial guild species is that their movement in an area is not highly constrained by local landscape conditions such as unsuitable habitat, urban development, or roads. Examples of migratory birds in this guild are the least Bell's vireo and other neotropical migrants that nest in the Santa Clara River. Examples of resident birds in this guild are raptors, such as white-tailed kite (*Elanus lecurus*) and red-tailed hawk (*Buteo jamaicensis*), and corvids such as common raven (*Corvus corax*). Several bat species also have been documented in the Project area, including night and day roosts for the pallid bat (*Antrozous pallidus*).

Section 4.6.1 Buffers for High Mobility Aerial Guild

While species in the high mobility aerial guild can generally move throughout an area independent of habitat corridors and linkages, open space–urban buffers and local habitats may be important in maintaining site-specific roosting and nesting areas, as reviewed in **Section 2.2**. Because of the large number and diversity of species in this guild, the buffer issues and requirements for high mobility aerial guild species are variable and species-specific. A few representative examples of buffer issues for this guild are provided here.

The white-tailed kite is a raptor species that may be particularly sensitive to buffers around nest sites. White-tailed kite nest sites are closely associated with suitable foraging habitat with high rodent prey populations in the immediate vicinity of the nest. Erichsen *et al.* (1996) described how successful nests are more often surrounded by preferred foraging habitat (particularly agriculture) within a 0.5-mile radius of the nest. Hawbecker (1942) noted that during the breeding season, kites seldom forage farther than a 0.5-mile radius from the nest site. Faanes and Howard (1987) also noted that within the 0.5-mile radius, there must be at least 50 acres of suitable foraging habitat to support a breeding pair of kites. Foraging outside the breeding season is more flexible and can be over wider areas of up to 1,200 acres (Zeiner *et al.* 1990). While adequate foraging habitat within about 0.5 mile of a nest site is necessary to maintain a nesting pair of white-tailed kites, other buffer considerations are important for this species. Threats to the white-tailed kites include nest disturbance and predation by urban-related species such as brown-headed cowbirds, western scrub-jays, crows, raccoons, and opossums (Zeiner *et al.* 1990). Askins (1995) found that brown-headed cowbirds and nest predators are most active within 328 to 656 feet of the habitat edge. Increased human activity in proximity to nests may also affect the behavior of the species and result in nest abandonment or lower reproductive success.

Long-eared owls (*Asio otus*) use abandoned corvid or small raptor nests typically in the dense cover of heavily wooded areas. Home ranges for long-eared owls during nesting vary, averaging about 134 acres and extending to about 262 acres (Craighead and Craighead 1956). Although long-eared owls are highly mobile and are capable of traveling relatively long distance to forage, their local occurrence may be more limited by urban-related disturbances around nesting sites than loss of breeding or foraging habitat *per se*. Human disturbance usually flushes females from nests, and although females usually return to the nest within 10 minutes of disturbance, eggs or hatchlings may be more vulnerable to predators during this period (Marks 1986). Bloom (1994) observed an absence of long-eared owl nests in Southern California within about 3,280 feet of residential streets. For this species, therefore, buffers on the order of several hundred to 1,000 feet may not be adequate to protect this species, and in an urbanizing environment such as Southern California, long-eared owls ultimately may be limited to only the most remote areas.

In contrast to the relatively large home ranges, including foraging areas, of the white-tailed kite and long-eared owl, least Bell's vireos territories are about 3.1 acres or less (Zeiner *et al.* 1990). Thus, all activities by least Bell's vireos, such as attraction of mates, establishment of nests, foraging, and rearing and fledgling of young, occur within a relatively small area. Buffer issues related to the least Bell's vireo include impacts that would reduce breeding success in edge areas, including nest parasitism by brown-headed cowbird; predation by pet, stray, and feral cats; nighttime lighting; and noise. For edge issues such as nest parasitism, predation, and nighttime lighting, the 100-foot-wide transition area between the top of the river bank and development will provide some protection, but these edge effects are likely to extend beyond the 100-foot transition area (CBI 2000). Additional measures to reduce these edge effects include public use only along designated trails, requirements that pets be kept on leash, requirements that nighttime illumination be downcast in areas adjacent to natural habitat areas, controls on stray and feral cats and dogs, and cowbird trapping (see **Section 6.0** for discussion of mitigation measures). The potential future impact of noise on the vireo mostly would be from increased traffic along SR-126 and bridge crossings of the Santa Clara River. As described above, however, least Bell's vireos have regularly nested along the River corridor in areas exposed to average noise levels exceeding 60 dBA (Guthrie 1998A, 1999C, 2000C, 2001B, 2002C, 2003B, 2004H, 2005B, 2006A; Bloom Biological, Inc. 2007A). One of the locations monitored by Dudek (2007B) at 120 feet from SR-126 was located in close proximity to a cluster of least Bell's vireo nest/territory locations consistently recorded from 1998 to 2007. The average noise level at this location was 61 dBA, with a range of 57 dBA at 12:00 a.m. to 1:00 a.m. to 66 dBA at 6:00 a.m. Given that least Bell's vireos currently nest in areas exposed to traffic noise along SR-126, as well as near Interstate 5, it is unlikely that the additional traffic along SR-126 and traffic at the new bridge crossings of the River will significantly affect the vireo beyond existing conditions.

For bat species, the key issue along the open space–urban interface is the viability of day and night roosts. General human activity, direct disturbances of roost sites by humans and pet, stray, and feral cats and dogs, nighttime illumination, and noise may all be factors resulting in permanent abandonment of a roost site in close proximity to development. A mitigation measure to address such impacts is to conduct pre-construction surveys for day roosts in the project disturbance footprint and within 300 feet of the disturbance boundary and to create artificial roost sites in suitable preserve open space located away from human disturbance (see **Section 6.0** for discussion of mitigation measures).

Section 4.7 Moderate Mobility Aerial Guild

The moderate mobility aerial guild includes species that are less mobile than migratory passerine species such as the least Bell's vireo and large birds such as raptors, which can move long distances between wintering and breeding areas or in during foraging bouts. Moderate mobility aerial guild species are typically year-round residents, and a relatively small area may meet all their life history needs. Dispersal by moderate mobility guild species usually occurs through diffusion across the landscape (*e.g.*, moving to available territories adjacent or in close proximity to their natal territory), but dispersal events may occasionally occur across relatively long distances and unsuitable habitat. The California gnatcatcher (*Polioptila californica*), for example, had mean dispersal distances of 0.65 mile in Orange County (Galvin 1998) and 1.7 to 2.0 miles for males and females, respectively, on the Palos Verdes Peninsula in Los Angeles County (Atwood *et al.* 1996). However, Galvin (1998) recorded one dispersal event of 4.7 miles and Bailey and Mock (1998) suggest that gnatcatcher dispersal capability is underestimated based on the ability of the species to traverse highly modified landscapes at least for short distances. Bailey and Mock (1998) observed juvenile dispersal distances averaging less than 1.9 miles from the nest territory; however, the longest recorded juvenile dispersal averaged 9.9 miles (Mock 2004).

Unlike the low mobility ground-dwelling species, flight allows these moderate mobility aerial guild species to make saltatorial or jump dispersal movements between disjunct habitat patches. Moderate mobility, special-status species in the Project area include the documented San Emigdio blue butterfly (*Plebulina emigdionis*), the Southern California rufous-crowned sparrow (*Aimophila ruficeps canescens*), and coastal California gnatcatcher, and the potentially occurring Bell's sage sparrow (*Amphispiza bellii bellii*), black-chinned sparrow (*Spizella atrogularis*), and cactus wren (*Campylorhynchus brunneicapillus*).

Species in this guild can meet their entire life history needs within habitat wholly contained within the Project area and constitute subpopulations or portions of larger populations. However, the habitat requirements of the species in this guild are variable and species-specific. For example, four-wing saltbush (*Atriplex canescens*) is the primary host plant for the San Emigdio butterfly, and though this saltbush is widespread throughout the western United States, the distribution of the San Emigdio blue butterfly is much more localized, suggesting that other factors may determine habitat suitability (Murphy 1990), and thus restricting it to certain locations. On site, the San Emigdio blue butterfly is associated with quailbush (*A. lentiformis*). Rufous-crowned sparrow occupies moderate to steep hillsides that are rocky, grassy, or covered by coastal sage scrub or chaparral. This species appears to be relatively sedentary and has home ranges averaging about 3.7 acres, with average territories (*i.e.*, a defended area) of about 2.0 acres (Zeiner *et al.* 1990). The California gnatcatcher's territory size varies and is influenced by season and locale (Preston *et al.* 1998B), but is unrelated to vegetation structure (Braden *et al.* 1997B). During the breeding season, territories in coastal areas are often smaller— averaging 5.7 acres (Atwood *et al.* 1998B)—than those in more inland regions which average 8.4 acres (Braden *et al.* 1997B). Territories for Bell's sage sparrow, which uses coastal scrub and chaparral communities in San Diego and Riverside counties, varied from 1.9 to 14.1 acres (Martin and Carlson 1998). Territories for the black-chinned sparrow, which primarily occurs in chaparral, have been documented at 3.9 to 9.9 acres per pair (Tenney 1997). Cactus wrens, which use cactus patches for nesting sites, have average territory sizes in Arizona of about 4.7 acres, with a range of 3.0 to 6.9 acres (Anderson and Anderson 1973).

Because species in this guild have moderate mobility, as long as there is adequate habitat connectivity (*i.e.*, suitable habitat patches within the flight capabilities of individuals) they may exhibit metapopulation dynamics characterized by local extirpations and recolonizations. Habitat patches that are too isolated for recolonization (*i.e.*, beyond the flight capability of the species) may permanently lose species in this guild.

Section 4.7.1 Buffers for Moderate Mobility Aerial Guild

Similar to the low mobility ground-dwelling guild, species in the moderate mobility aerial guild likely are sensitive to edge effects because of their relatively limited movement (*e.g.*, compared to high mobility migrants and raptors) and relative inability to avoid or escape adverse edge effects. Buffer areas must contain suitable habitat and adequate cover for these species in order for them to be present. As discussed above in **Section 2.2**, studies have demonstrated decreases in several native bird species at urban edges, including Bewick's wren, wrentit, California thrasher, rufous-crowned sparrow, spotted towhee, and California quail at urban edges (Longcore 2003; Rottenborn 1999).

In order to identify adequate buffer conditions for birds in the Project area, Impact Sciences, Inc. (1997) surveyed riparian areas and adjacent upland edges on the Santa Clara and San Francisquito rivers immediately east of the Project area to characterize riparian bird diversity, abundance, and habitat use in these areas prior to development. Bird species (including both resident and migrant species) characterized in the scientific literature as highly riparian-dependent were observed within adjacent upland habitat. Where upland habitat was of high quality,[3] 99% of observations of riparian-dependent birds were within 100 feet of the riparian edge; in low-quality upland habitat, 90% of such observations were within 100 feet. All observations of these species in adjacent uplands occurred within 150 feet of the riparian edge. For species that are known to be riparian associates but not riparian dependents, 84% of birds were observed within 100 feet of the riparian edge in high-quality upland habitat and 93% of birds were observed within 100 feet of the riparian edge in low-quality upland habitat. As with riparian dependents, riparian associates were not observed beyond 150 feet from the riparian edge where high-quality upland habitat was present. The Impact Sciences, Inc. (1997) study suggests that riparian buffers along the Santa Clara River should range from a minimum of 100 to 150 feet in width, depending on the quality of the upland habitat; a larger buffer width would be required if the upland habitat is of low quality. If existing upland habitat quality is low, habitat enhancement in areas where the buffer is narrower could compensate for the smaller buffer.

Even with high-quality habitat, a minimum 100-foot-wide buffer in the transition area between the top of the river bank and development, for example, likely will not ameliorate all adverse edge effects on nesting birds in the moderate mobility aerial guild, such as invasive plant species; nest parasitism by brown-headed cowbirds; predation by pet, stray, and feral cats; nighttime lighting; and noise. Expanding the buffer width to as much as 300 feet likely would not lower edge effects enough to preclude the need for management of these effects along the open space–urban interface (CBI 2000). Additional measures to reduce these edge effects include invasive species controls, public use only along designated trails, requirements that pets be kept on leash, requirements that nighttime illumination be downcast in areas adjacent to natural habitat areas, controls on stray and feral cats and dogs, and cowbird trapping (see **Section 6.0** for discussion of mitigation measures).

Section 4.7.2 Connectivity for Moderate Mobility Aerial Guild

Species in the moderate mobility aerial guild are highly dependent on suitable habitat, including vegetation structure and micro-topography, to meet all their life history needs within a relatively small area. Because these species have lower vagility and are more susceptible to disturbance at the open space–urban interface than high mobility aerial guild species, they usually do not move very effectively across large areas of unsuitable habitat, although some species such as the California gnatcatcher are capable of doing so (Bailey and Mock 1998).

Since species in the moderate mobility aerial guild have relatively small home ranges and territories, local populations or subpopulations could be supported in suitable habitat within the 6,700 acres comprising the High Country SMA, Salt Creek area, and River Corridor SMA. For

[3] Habitat quality was determined based on seven variables: (1) shrub/tree cover variability, (2) percentage of shrub/tree cover, (3) percentage of ground cover, (4) average shrub/tree height, (5) percentage of herbaceous cover, (6) herbaceous cover variability, and (7) shrub/tree height variability.

example, these three areas support a combined total of almost 2,000 acres of coastal scrub habitat that is considered suitable for the rufous-crowned sparrow. With an average rufous-crowned sparrow home range of less than 4 acres, these areas theoretically could support up to several hundred home ranges.

The High Country SMA, Salt Creek area, and River Corridor SMA are all directly connected to one another (**Figure 3**). Dispersal by moderate mobility aerial guild species throughout these areas is expected to occur primarily through diffusion *via* these existing linkages. In addition, these open space areas are directly connected to suitable habitat north and south of the Project area, as well as east and west via the River Corridor SMA. The largest "non-habitat" jumps would be across SR-126.

SECTION 5.0 APPLICATION OF WILDLIFE BUFFER AND HABITAT LINKAGE CONCEPTS AND PRINCIPLES TO SPECIAL-STATUS SPECIES IN PROJECT AREA

This section applies the buffer and habitat linkage concepts and principles discussed in the previous sections to the special-status species addressed in the RMDP EIS/EIR. The guilds identified in Table 2 are further refined in Table 3 by habitat associations and/or taxonomic groups that more specifically related to certain types of buffer or habitat connectivity issues. For example, the high mobility aerial guild in divided into different "sub-guilds" for invertebrates, bats, riparian birds (including nesting raptors), non-riparian nesting and foraging raptors, grassland birds (including burrowing owl), upland scrub and chaparral birds, and upland woodland birds. In the "Buffers" column in Table 3, potential long-term edge effects are identified for the species in the guild, and project design features and general mitigation measures implemented to avoid, minimize, and mitigate the edge effects are listed. In the "Habitat Connectivity" column the linkage, corridor, and wildlife crossing considerations for each of the guilds are addressed. Section 6.0 below lists each of the mitigation measures in full detail.

Table 3
Buffer and Habitat Linkage Concepts Applied to Special-Status Species Guilds

Species[1]	Buffers	Habitat Connectivity
Aquatic Guild – Fish		
Arroyo chub **Santa Ana sucker** **Unarmored threespine stickleback**	**Section 4.1.1** discusses buffers for the aquatic guild in detail. Generally, potential edge effects include discharges of chemical pollutants, increased turbidity, and sedimentation in the River, habitat changes along the edge of the River, and the invasion of non-native predatory species such as the bullfrog and African	**Section 4.1.2** discusses habitat connectivity for the aquatic guild in detail. The Santa Clara River is the only suitable habitat for the aquatic guild species in the Project area, forming a continuous linear environment. The River corridor function, including the mosaic of aquatic and riparian habitats, would not be

Table 3 (Continued)

Species[1]	Buffers	Habitat Connectivity
	clawed frog. The River corridor function, including the mosaic of aquatic and riparian habitats would not be substantially altered in the long-term (PACE 2006). Belt *et al.* (1992), Mahoney and Erman (1984), and Wegner (1999) show that buffers of at least 100 feet are adequate to protect aquatic habitats and their function. The preservation of the River Corridor SMA and the planned 100-foot transition area along the River Bank will maintain River function for aquatic guild species. Mitigation measures include stormwater and pollution controls, habitat restoration in the River Corridor SMA, and controls on invasive species.	substantially altered in the long-term (PACE 2006), and these species are expected to persist in the River Corridor SMA, including as residents and for movement and dispersal through the system. Although the aquatic guild species are not known from tributary drainages that are dry for most of the year, they may provide temporary refuge habitat during times of high flow.
Aquatic Guild – Mollusk		
Undescribed snail	Potential edge effects include hydrologic alteration such as water quality and quantity, habitat degradation from invasive species and trampling by humans, and predation by non-native species. Various construction BMPs and mitigation measures will be implemented to avoid and minimize these effects, including controls on runoff, pollutants, landscaping plans that prohibit invasive species, fencing to prevent unauthorized public access, preparation of a Middle Canyon Spring Habitat Management Plan, and controls on pet, stray, and feral cats and dogs.	This species is isolated and restricted to the Middle Canyon Spring in which it was found and therefore landscape habitat connectivity is not a concern for this species
Semi-Aquatic Guild		
Arroyo toad California red-legged frog **Western spadefoot toad** South coast garter snake **Southwestern pond turtle** **Two-striped garter snake**	**Section 4.2.1** discusses buffers for the semi-aquatic guild in detail. Generally, potential edge effects include discharges of chemical pollutants, increased turbidity, and sedimentation in the River, habitat changes along the edge of the River, the invasion of non-native predatory species such as the bullfrog, African clawed frog, and Argentine ant, nighttime illumination, increased predation by mesopredators and pet, stray and feral cats and dogs, and human collection. The River corridor function, including the mosaic of aquatic and riparian habitats would not be substantially altered in the long-term (PACE 2006). Belt *et al.* (1992), Mahoney and Erman (1984), and Wegner (1999)	**Section 4.2.2** discusses habitat connectivity for the semi-aquatic guild in detail. The Santa Clara River is the primary habitat area for the semi-aquatic guild species and forms a continuous linear environment. The River Corridor SMA would be conserved after build-out of the Project area and provide suitable resident, movement, and dispersal habitat. The River Corridor SMA also provides access to tributary drainages that may be used by some of the semi-aquatic species such as southwestern pond turtle and two-striped garter snake. Major crossings of SR-126 perpendicular to the Santa Clara River that would accommodate semi-aquatic guild species would be provided,

Table 3 (Continued)

Species[1]	Buffers	Habitat Connectivity
	show that buffers of at least 100 feet are adequate to protect aquatic habitats and their function. The preservation of the River Corridor SMA and the planned 100-foot transition area along the River Bank will maintain River function for aquatic life history phases of the semi-aquatic guild species. With build-out of the Project area, potential upland habitat adjacent to the River Corridor SMA would be developed, limiting terrestrial habitat adjacent to the River for the arroyo toad and southwestern pond turtle. However, the River Corridor SMA is 1,000 feet to more than 2,000 feet wide and would provide suitable nesting, foraging, aestivation, and over-wintering habitat for these two species (see **Section 4.2.1**). It is expected that the River Corridor SMA would be adequate for the other semi-aquatic species, which are not known to travel as far from aquatic habitats as the arroyo toad and southwestern pond turtle. The Salt Creek area also has the potential to support the southwestern pond turtle and two-striped garter snake. Additional mitigation measures include stormwater and pollution controls habitat restoration in the River Corridor SMA; controls on invasive predatory species; downcasting of lighting adjacent to open space; controls on pet, stray, and feral cats and dogs; and controls on public access to the River Corridor SMA.	including large and smaller culverts (see **Section 4.4.2** discussion of connectivity for moderate mobility ground-dwelling species). While most tributary drainages would be substantially altered for flood control and crossed by roads, adequate connectivity for semi-aquatic guild species would be maintained through the use of bridges and culverts.
High Mobility Ground-Dwelling Guild		
Black bear **Mountain lion** **Mule deer**	**Section 4.3.1** discusses buffers for the high mobility ground-dwelling guild in detail. The mule deer is generally tolerant of urban edge effects. Mountain lions and black bears occasionally come into contact with humans at habitat edges, but these interactions are often negative. The vast majority of activity by these species occurs in the relatively undisturbed open space areas, and buffers *per se* at the open space–urban interface are not crucial for these species to persist in the Project region because adequate core habitat will be preserved in the 6,700-acre open space system comprised of the High Country SMA, Salt Creek area, and River	**Section 4.3.2** discusses habitat connectivity for the high mobility ground-dwelling guild in detail. Distribution and movement of species in this guild within the Project area will be altered after development due to large-scale development of upland habitat areas. The mule deer and mountain lion are expected to use the 6,700-acre High Country SMA, Salt Creek area, and River Corridor SMA as both resident and movement habitat. The black bear is expected to occasionally move through the area during dispersal movements between the Santa Susana Mountains to the south and the Los Padres National Forest to the north.

Table 3 (Continued)

Species[1]	Buffers	Habitat Connectivity
	Corridor SMA.	Regional wildlife corridors on the southern and western portions of the Project area in the High Country SMA and Salt Creek area would be preserved. Movement perpendicular to the Santa Clara River will be accommodated by existing large culverts under SR-126 at Camulos Ranch and Tapo Canyon west of the Project area. Planned new bridges across the Santa Clara River at Potrero Canyon Road, Long Canyon Road, and Commerce Center Drive would be at least 20 feet high and large enough to allow movement by the species in this guild.
Moderate Mobility Ground-Dwelling Guild		
American badger Ringtail **San Diego black-tailed jackrabbit**	**Section 4.4.1** discusses buffers for the moderate mobility ground-dwelling guild in detail. These species are at risk to edge effects such as nighttime illumination; pet, stray, and feral cats and dogs; and rodenticides. These effects are expected to occur within at least 200 feet of the open space–urban edge (CBI 2000). Mitigation measures to control these impacts will be implemented. The High Country SMA and Salt Creek area provide more than 5,700 acres of habitat for the San Diego black-tailed jackrabbit and American badger, providing adequate unaffected habitat. The River Corridor SMA ranges from 1,000 feet to more than 2,000 feet wide and existing habitat mosaics will be maintained after development (PACE 2006). In combination with the 100-foot transition area and mitigation measures for edge effects, the River Corridor SMA is wide enough to provide adequate habitat for these species. To minimize edge effects, mitigation measures include downcasting of lighting adjacent to open space, controls on pet, stray, and feral cats and dogs, and controls on the use of rodenticides.	**Section 4.4.2** discusses habitat connectivity for the moderate mobility ground-dwelling guild in detail. Distribution and movement of species in this guild within the Project area will be altered after development due to large-scale development of upland habitat areas. The American badger and San Diego black-tailed jackrabbit are expected to use the 6,700-acre High Country SMA, Salt Creek area, and River Corridor SMA as both resident and movement habitat. Although the potential for the ringtail to occur on site is considered to be low, suitable riparian habitat for this species is present in the High Country SMA, Salt Creek area, and River Corridor SMA. These species will be able to move freely throughout these open space areas. Movement perpendicular to the Santa Clara River to habitat to the north of the Project area will be accommodated by existing large culverts under SR-126 at Camulos Ranch and Tapo Canyon west of the Project area and numerous existing and new smaller culverts under the highway. Planned new bridges across the Santa Clara River at Potrero Canyon Road, Long Canyon Road, and Commerce Center Drive would be at least 20 feet high and large enough to allow movement by the species in this guild.

Table 3 (Continued)

Species[1]	Buffers	Habitat Connectivity
Low Mobility Ground-Dwelling Guild (Reptiles and Mammals)		
Coast horned lizard Coast patch-nosed snake **Coastal western whiptail** Rosy boa San Bernardino ringneck snake **Silvery legless lizard** **San Diego desert woodrat** Southern grasshopper mouse	**Section 4.5.1** discusses buffers for the low mobility ground-dwelling guild in detail. Because of their relatively sedentary spatial distribution and limited mobility, species in this guild are vulnerable to edge effects that could extirpate local populations, such as mesopredators; pet, stray, and feral cats and dogs; collection (snakes) by pet traders and children; nighttime illumination; Argentine ants; and rodenticides. While adequate habitat will be preserved in the combined 6,700-acre High Country SMA, Salt Creek area, and River Corridor SMA for these species to persist in the Project region, edge effects are expected within at least 200 feet of the open space–urban interface (CBI 2000). To minimize edge effects, mitigation measures include downcasting of lighting adjacent to open areas; controls on pet, stray, and feral cats and dogs; controls on the use of rodenticides, and monitoring and controls on Argentine ants.	**Section 4.5.2** discusses habitat connectivity for the low mobility ground-dwelling guild in detail. Species in this guild require generally continuous suitable habitat because of their limited mobility. Habitat connections are vulnerable to edge effects that functionally reduce suitable habitat within the connection. The 6,700-acre High Country SMA, Salt Creek area, and River Corridor SMA will provide both resident and movement habitat. The narrowest habitat area in the High Country SMA and Salt Creek area would be more than 4,000 feet wide, providing enough interior habitat for a species with a 233-acre circular home range. Taking into consideration the 100-foot transition area and 200 feet of edge effects, the functional width of the River Corridor SMA would be at minimum 800 feet wide, accommodating a circular home range of 11 to 12 acres. These species will be able to move freely throughout these open space areas. Movement perpendicular to the Santa Clara River to habitat to the north of the Project area will be accommodated by existing large culverts under SR-126 at Camulos Ranch and Tapo Canyon west of the Project area and numerous existing and new smaller culverts under the highway. Planned new bridges across the Santa Clara River at Potrero Canyon Road, Long Canyon Road, and Commerce Center Drive would be at least 20 feet high and large enough to allow movement by the species in this guild.
High Mobility Aerial Guild – Invertebrate		
Monarch butterfly (wintering sites)	No buffer issues have been identified for this species. The monarch butterfly is only known from individual occurrences and is highly mobile. No wintering roost sites are known within the Project area. Large eucalyptus trees within the Project area are associated with agricultural land and associated facilities and would be removed in areas of build-out.	Because this species is highly mobile, habitat connectivity is not an issue.

Table 3 (Continued)

Species[1]	Buffers	Habitat Connectivity
High Mobility Aerial Guild – Bats		
Fringed myotis Long-legged myotis **Pallid bat** **Pocketed free-tailed bat** Western small-footed myotis Townsend's big-eared bat **Western mastiff bat** **Western red bat** **Yuma myotis**	Day and night roosts are vulnerable to edge effects including human disturbance; pet, stray, and feral cats and dogs; nighttime illumination; and noise that can result in permanent abandonment of the roost site. Project design features and mitigation measures to minimize these impacts include downcasting of lighting adjacent to open areas, and controls on pet, stray, and feral cats and dogs. Pre-construction surveys will be conducted for day roosts in the project disturbance footprint and within 300 feet of the disturbance boundary and to create artificial roost sites in suitable preserve open space located away from human disturbance	Because these species are highly mobile, habitat connectivity is not an issue.
High Mobility Aerial Guild – Riparian Birds, Including Nesting Raptors		
Black-crowned night heron (rookery) **Cooper's Hawk (nesting)** **Least Bell's vireo (nesting)** **Long-eared owl (nesting)** **Northern harrier (nesting)** **Nuttall's woodpecker (nesting)** **Southwestern willow flycatcher (nesting)** **Summer tanager (nesting)** **Tricolored blackbird (nesting)** **Vermilion flycatcher (nesting)**	**Section 4.6.1** discusses buffers for the high mobility aerial guild species, including riparian birds and nesting raptors. These species are known to nest or potentially nest in riparian habitats in the Santa Clara River corridor. The raptors also are expected to nest in riparian and woodland habitats in tributaries such as Salt Creek. Potential edge effects for these species generally include nest parasitism by brown-headed cowbirds; Argentine ants; predation by pet, stray, and feral cats; nighttime illumination; human activity; and noise. Habitat in the River Corridor SMA itself would not be substantially altered (PACE 2006). Design features and mitigation measures for the River Corridor SMA that would avoid and minimize edge effects include restoration of nesting habitat in the River Corridor SMA; the 100-foot transition area along the River banks; stormwater BMPs; controls on pet, stray, and feral animals; downcasting of lighting adjacent to open space; fencing along and limited human and pet use of trails along the River Corridor SMA; cowbird monitoring and trapping; and Argentine ant monitoring and controls.	Because these species are highly mobile, habitat connectivity, including crossings and corridors, are not relevant. Habitat along the River corridor provides instream linkages and would remain intact after development. Planned new bridges across the Santa Clara River at Potrero Canyon Road, Long Canyon Road, and Commerce Center Drive would be at least 20 feet high and large enough to allow unconstrained movement along the River corridor by the species in this guild.

Table 3 (Continued)

Species[1]	Buffers	Habitat Connectivity
Western yellow-billed cuckoo (nesting) **White-tailed kite (nesting)** **Yellow warbler (nesting)** **Yellow-breasted chat (nesting)** **Yellow-headed blackbird (nesting)**	The raptors (except for Cooper's hawk) are expected to forage in open habitats within, adjacent to, and in the vicinity of the Santa Clara River and other riparian habitat areas. Because these species are highly mobile, they are likely to forage throughout the 6,700-acre High Country SMA, Salt Creek area, and River Corridor SMA; therefore, buffer conditions are not an important concern for their foraging habitat.	
High Mobility Aerial Guild – Non-Riparian Nesting and Foraging Raptors		
American peregrine falcon **California condor** **Golden eagle (nesting and wintering)** **Merlin (wintering)** **Prairie falcon (nesting)** **Sharp-shinned hawk (nesting)** **Short-eared owl (nesting)** **Turkey vulture**	Nest sites for breeding residents among these species (peregrine falcon, condor, golden eagle, prairie falcon, and turkey vulture) tend to be in isolated areas that are relatively inaccessible to the public. No nest sites for these species have been documented in the Project area, so buffers around nest sites are not an issue. Other species are only known to winter in the area (merlin, sharp-shinned hawk, short-eared owl). Depending on the species, they are expected to forage or fly over the High Country SMA, Salt Creek area, and/or the River Corridor SMA. Buffer issues along the open space–urban interface are not an important concern for foraging and overflight.	These species are extremely mobile and while the build-out of the Project area will remove potential foraging habitat, the preservation of the High Country SMA, Salt Creek area, and River Corridor SMA will serve to maintain suitable foraging habitat for these species in the Project region.
High Mobility Aerial Guild – Grassland Birds, Including Burrowing Owl		
California horned lark Grasshopper sparrow **Western burrowing owl (burrow sites)**	Use of edge habitats by these species for nesting may be limited by adverse edge effects such as noise; mesopredators; predation by pet, stray, and feral cats and dogs; increased human activity; as well as use of rodenticides that may affect primary prey for burrowing owl and ground squirrels that dig burrows used by the owl. The High Country SMA and Salt Creek area will provide suitable habitat for these species ranging from about 663 acres of grassland for the grasshopper sparrow to 1,057 acres of grassland and agricultural areas for California horned lark and western burrowing owl. These areas provide substantial unaffected core	These species are highly mobile and their movements in the Project area will not be constrained. While the build-out of the Project area will remove potential nesting and foraging habitat, the conservation of the High Country SMA, Salt Creek area, and River Corridor SMA will serve to maintain habitat connectivity on a landscape scale.

Table 3 (Continued)

Species[1]	Buffers	Habitat Connectivity
	habitat, especially from effects such as noise. Design features and mitigation measures for the open space–urban edge that would avoid and minimize edge effects include controls of pet, stray, and feral animals; downcasting of lighting adjacent to open space; limitations on public access to open space areas; and controls on the use of rodenticides.	
High Mobility Aerial Guild – Upland Scrub and Chaparral Birds		
Allen's hummingbird (nesting) **Costa's hummingbird (nesting)** **Loggerhead shrike** **Rufous hummingbird (nesting)**	The hummingbird species are somewhat tolerant of urbanization and utilize backyard feeders and some ornamental plants and invasive species such as tree tobacco (*Nicotiana glauca*) for foraging at open space–urban interfaces. They are vulnerable to predation by pet, stray, and feral cats. They also may be out-competed for foraging resources at the open space–urban interface by the highly urban-tolerant Anna's hummingbird. The loggerhead shrike is also susceptible to predation by cats, as well as other mesopredators. It is also vulnerable to vehicle collisions and pesticides, such as dieldrin (banned in 1987), which it ingests via its insect prey. Approximately 2,982 acres of suitable habitat for Costa's hummingbird, 3,614 acres for Allen's hummingbird, and 6,160 acres for loggerhead shrike will be preserved in the High Country SMA, Salt Creek area, and River Corridor SMA. Design features and mitigation measures for the open space–urban edge that would avoid and minimize edge effects include controls of pet, stray, and feral animals and controls on the use of rodenticides.	These species are highly mobile and their movements in the Project area will not be constrained. While the build-out of the Project area will remove potential nesting and foraging habitat, the conservation of the High Country SMA, Salt Creek area, and River Corridor SMA will serve to maintain habitat connectivity on a landscape scale.
High Mobility Aerial Guild – Upland Woodland Birds		
Chipping sparrow (nesting) **Hermit warbler (nesting)** **Lawrence's goldfinch** **Oak titmouse (nesting)**	These species are vulnerable to predation by pet, stray, and feral cats and other mesopredators. Chipping sparrows may suffer from direct competition with house sparrows and house finches. Lawrence's goldfinch and hermit warblers are vulnerable to cowbird parasitism and the warbler is possibly in competition with the urban-tolerant Townsend's warbler. Oak titmouse may be in competition for nest cavities with European starlings. Suitable	These species are highly mobile and their movements in the Project area will not be constrained. While the build-out of the Project area will remove potential nesting and foraging habitat, the conservation of the High Country SMA, Salt Creek area, and River Corridor SMA will serve to maintain habitat connectivity on a landscape scale.

Table 3 (Continued)

Species[1]	Buffers	Habitat Connectivity
	nesting habitat for these species will be preserved in the High Country SMA, Salt Creek area, and River Corridor SMA, ranging from 852 acres for Lawrence's goldfinch to 1,585 acres for oak titmouse. Project design features and mitigation measures that will help avoid and minimize edge effects include controls of pet, stray, and feral animals and cowbird monitoring and controls.	
Moderate Mobility Aerial Guild – Scrub and Chaparral Birds		
Bell's sage sparrow (nesting) Black-chinned sparrow **California thrasher** **Coastal California gnatcatcher** Coastal (San Diego) cactus wren **Southern California rufous-crowned sparrow**	**Section 4.7.1** discusses buffers for the moderate mobility aerial guild in detail. These species are sensitive to several edge effects because of their relatively limited mobility compared to migrants and raptors. Potential edge effects include pet, stray, and feral cats and dogs; other mesopredators; competition with or predation by urban-tolerant species; cowbird parasitism; off-road vehicles; and habitat degradation along the open space–urban edge from invasive species and wildfire. These effects are expected to be most pronounced within 200 feet of the open space–urban edge (CBI 2000). Mitigation measures to control these impacts will be implemented. The High Country SMA, Salt Creek, and River Corridor SMA will preserve suitable habitat for these species ranging from about 1,502 acres for the Bell's sage sparrow to 2,289 acres for the rufous-crowned sparrow. Design features and mitigation measures for the open space–urban edge that would avoid and minimize edge effects include controls of pet, stray, and feral cats and dogs; cowbird monitoring and controls; and controls on public access to and use of open space areas.	**Section 4.7.2** discusses habitat connectivity for the moderate mobility aerial guild in detail. Because of their limited mobility, these species are sensitive to habitat fragmentation and the quality of habitat in linkages. Landscape linkages containing scrub and chaparral habitats to regional sources will be maintained. The 6,700-acre High Country SMA, Salt Creek area, and River Corridor SMA will provide both resident and movement habitat for these species. The narrowest habitat area in the High Country SMA and Salt Creek area would be more than 4,000 feet wide, providing enough interior habitat for a species with a 233-acre circular home range. Taking into consideration the 100-foot transition area and 200-feet of edge effects, the functional width of the River Corridor SMA would be at minimum 800 feet wide, accommodating a circular home range of 11 to 12 acres. These species will be able to move freely throughout these open space areas.
Moderate Mobility Aerial Guild – Invertebrate		
San Emigdio blue butterfly	Specific edge effects and buffer issues relevant to this species have not been identified, but potentially include non-native, invasive plant and animal species (*e.g.*, Argentine ant), trampling, chemical pollutants, hydrologic changes, and wildfires that could affect its host plant quailbush. The Potrero Canyon colony is located entirely within a designated Open	Habitat fragmentation and vehicle strikes of individuals in the Potrero Canyon colony from vehicles on Potrero Canyon Road. Habitat connectivity would be addressed by preservation of the High Country SMA, Salt Creek area, and River Corridor SMA. These areas provide potentially suitable habitat for the species and potential dispersal and movement routes to the

Table 3 (Continued)

Species[1]	Buffers	Habitat Connectivity
	Area and partially within the proposed Potrero Spineflower Preserve. Potentially suitable habitat for this species is also present in the High Country SMA, Salt Creek area, and River Corridor SMA. Non-native species and human disturbance would be addressed by monitoring and management of the Spineflower Preserve; review of landscaping plans and inspection of plants proposed for planting near the preserve; restricting access to the Spineflower Preserve; and preparation of a landscaping plan comprised of native or non-native, non-invasive plant species. Secondary impacts associated with increased fire frequency would be addressed by the use of fuel modification zones and controlling the spread of non-native, invasive plants following a fire, allowing for the regeneration of quailbush.	north, south, east, and west. Secondary impacts associated with Potrero Canyon Road would be addressed by monitoring the Potrero Canyon colony and implementing habitat creation/restoration measures should the population decline.

1 Species in bold are known to occur on site; all other species have potential to occur on site based on their known geographic range and available suitable habitat.

SECTION 6.0 OPEN SPACE DESIGN AND MITIGATION MEASURES TO ADDRESS BUFFERS AND HABITAT CONNECTIVITY

This section describes the mitigation measures that would be implemented to address buffers and habitat connectivity issues for special-status wildlife species summarized above in Table 3 as they relate to implementation of the RMDP and ultimate build-out of the Specific Plan, VCC, and the Entrada planning area. Section 6.1 presents the mitigation measures related to wildlife buffers and Section 6.2 discusses project design features and mitigation measures related to habitat connectivity.

Section 6.1 Wildlife Buffers Mitigation Measures

A variety of mitigation measures will provide buffer protections for many of the special-status species in the Project area. Some of these mitigation measures are expressly designed to address buffer issues and edge impacts, while others provide multiple benefits, including buffer protection. For example, mitigation measures that involve restoration activities in preserved open space areas, such as habitat creation and enhancement, will result in additional suitable habitat within these core or interior areas and thus will increase the ratio of suitable habitat in the preserved area to the perimeter or "edge-affected" portion of the open space area. Such measures provide a "buffer" function because increased habitat areas will support larger populations in core areas and thus offset edge-affected areas where populations may be reduced.

The mitigation measures serving these buffer functions for various special-status species and their habitats are summarized below. They include mitigation measures previously incorporated in the Specific Plan EIR (prefix "4.6") and additional recommended measures for the RMDP EIS/EIR (prefix "BIO"). The reader should note that the RMDP EIS/EIR mitigation measures listed here are current as of the publication date of this paper, and are subject to revision by the lead agency and through the public review process prior to final approval of the EIS/EIR.

Previously incorporated Specific Plan EIR mitigation measures relevant to buffer function include:

SP-4.6-1 The restoration mitigation areas located within the River Corridor SMA shall be in areas that have been disturbed by previous uses or activities. Mitigation shall be conducted only on sites where soils, hydrology, and microclimate conditions are suitable for riparian habitat. First priority will be given to those restorable areas that occur adjacent to existing patches (areas) of native habitat that support sensitive species, particularly Endangered or Threatened species. The goal is to increase habitat patch size and connectivity with other existing habitat patches while restoring habitat values that will benefit sensitive species.

SP-4.6-2 A qualified biologist shall prepare or review revegetation plans. The biologist shall also monitor the restoration effort from its inception through the establishment phase.

SP-4.6-3 Revegetation Plans may be prepared as part of a California Department of Fish and Game 1603 Streambed Alteration Agreement and/or an U.S. Army Corps of Engineers Section 404 Permit, and shall include:

- Input from both the Project proponent and resource agencies to assure that the Project objectives applicable to the River Corridor SMA and the criteria of this RMP are met.
- The identification of restoration/mitigation sites to be used. This effort shall involve an analysis of the suitability of potential sites to support the desired habitat, including a description of the existing conditions at the site(s) and such base line data information deemed necessary by the permitting agency.

SP-4.6-4 The revegetation effort shall involve an analysis of the site conditions such as soils and hydrology so that site preparation needs can be evaluated. The revegetation plan shall include the details and procedures required to prepare the restoration site for planting (*i.e.*, grading, soil preparation, soil stockpiling, soil amendments, *etc*.), including the need for a supplemental irrigation system, if any.

SP-4.6-5 Restoration of riparian habitats within the River Corridor SMA shall use plant species native to the Santa Clara River. Cuttings or seeds of native plants shall be gathered within the River Corridor SMA or purchased from nurseries with local supplies to provide good genetic stock for the replacement habitats. Plant species used in the restoration of riparian habitat shall be listed on the approved project plant palette (Specific Plan Table 2.6-1, Recommended Plant Species for Habitat Restoration in the River Corridor SMA) or as approved by the permitting State and Federal agencies.

SP-4.6-6 The final revegetation plans shall include notes that outline the methods and procedures for the installation of the plant materials. Plant protection measures identified by the project biologist shall be incorporated into the planting design/layout.

SP-4.6-7 The revegetation plan shall include guidelines for the maintenance of the mitigation site during the establishment phase of the plantings. The maintenance program shall contain guidelines for the control of non-native plant species, the maintenance of the irrigation system, and the replacement of plant species.

SP-4.6-8 The revegetation plan shall provide for monitoring to evaluate the growth of the developing habitat. Specific performance goals for the restored habitat shall be defined by qualitative and quantitative characteristics of similar habitats on the river (*e.g.*, density, cover, species composition, structural development). The monitoring effort shall include an evaluation of not only the plant material installed, but the use of the site by wildlife. The length of the monitoring period shall be determined by the permitting state and/or federal agency.

SP-4.6-9 Monitoring reports for the mitigation site shall be reviewed by the permitting State and/or Federal agency.

SP-4.6-10 Contingency plans and appropriate remedial measures shall also be outlined in the revegetation plan.

SP-4.6-11 Habitat enhancement as referred to in this document means the rehabilitation of areas of native habitat that have been moderately disturbed by past activities (*e.g.*, grazing, roads, oil and natural gas operations, *etc*.) or have been invaded by non-native plant species such as giant cane (*Arundo donax*) and tamarisk (*Tamarix* sp.).

SP-4.6-12 Removal of grazing is an important means of enhancement of habitat values. Without ongoing disturbance from cattle, many riparian areas will recover naturally. Grazing except as permitted as a long-term resource management activity will be removed from the River Corridor SMA pursuant to the Long-Term Management Plan set forth in Section 4.6 of the Specific Plan EIR.

SP-4.6-13 To provide guidelines for the installation of supplemental plantings of native species within enhancement areas, a revegetation plan shall be prepared prior to implementation of mitigation (see guidelines for revegetation plans above). These supplemental plantings will be composed of plant species similar to those growing in the existing habitat patch (see Specific Plan Table 2.6-1).

SP-4.6-14 Not all enhancement areas will necessarily require supplemental plantings of native species. Some areas may support conditions conducive for rapid "natural" reestablishment of native species. The revegetation plan may incorporate means of enhancement to areas of compacted soils, poor soil fertility, trash or flood debris, and roads as a way of enhancing riparian habitat values.

SP-4.6-15 Removal of non-native species such as giant cane (*Arundo donax*), salt cedar or tamarisk (*Tamarix* sp.), tree tobacco (*Nicotiana glauca*), castor bean (*Ricans communis*), if included in a revegetation plan to mitigate impacts, shall be subject to the following standards:

- First priority shall be given to those habitat patches that support or have a high potential for supporting sensitive species, particularly Endangered or Threatened species.
- All non-native species removals shall be conducted according to a resource agency approved exotics removal program.
- Removal of non-native species in patches of native habitat shall be conducted in such a way as to minimize impacts to the existing native riparian plant species.

SP-4.6-16 Mitigation banking activities for riparian habitats will be subject to State and Federal regulations and permits. Mitigation banking for oak resources shall be conducted pursuant to the Oak Resources Replacement Program. Mitigation banking for elderberry scrub shall be subject to approval of plans by the County Forester.

SP-4.6-17 Access to the River Corridor SMA for hiking and biking shall be limited to the river trail system (including the Regional River Trail and various Local Trails) as set forth in this Specific Plan.

- The River trail system shall be designed to avoid impacts to existing native riparian habitat, especially habitat areas known to support sensitive species. Where impacts to riparian habitat are unavoidable, disturbance shall be minimized and mitigated as outlined above under Mitigation Measures 4.6-1 through 4.6-8.
- Access to the River Corridor SMA will be limited to day time use of the designated trail system.
- Signs indicating that no pets of any kind will be allowed within the River Corridor SMA, with the exception that equestrian use is permitted on established trails, shall be posted along the River Corridor SMA.
- No hunting, fishing, or motor or off-trail bike riding shall be permitted.
- The trail system shall be designed and constructed to minimize impacts on native habitats.

SP-4.6-18 Where development lies adjacent to the boundary of the River Corridor SMA a transition area shall be designed to lessen the impact of the development on the conserved area. Transition areas may be comprised of Open Area, natural or revegetated manufactured slopes, other planted areas, bank areas, and trails. Exhibits 2.6-4, 2.6-5, and 2.6-6 indicate the relationship between the River Corridor SMA and the development (disturbed) areas of the Specific Plan. The SMAs and the Open Area as well as the undisturbed portions of the development areas are shown in green. As indicated on the exhibits, on the south side of the river the River Corridor SMA is separated from development by the river bluffs, except in one location. The Regional River Trail will serve as transition area on the north side of the river where development areas adjoin the River Corridor SMA (excluding Travel Village).

SP-4.6-19 The following are the standards for design of transition areas:

- In all locations where there is no steep grade separation between the River Corridor SMA and development, a trail shall be provided along this edge.
- Native riparian plants shall be incorporated into the landscaping of the transition areas between the River Corridor SMA and adjacent development areas where feasible for their long-term survival. Plants used in these areas shall be those listed on the approved plant palette (Specific Plan Table 2.6-2 of the Resource Management Plan [Recommended Plants for Transition Areas Adjacent to the River Corridor SMA]).
- Roads and bridges that cross the River Corridor SMA shall have adequate barriers at their perimeters to discourage access to the River Corridor SMA adjacent to the structures.

- Where bank stabilization is required to protect development areas, it shall be composed of ungrouted rock, or buried bank stabilization as described in Section 2.5.2.a, except at bridge crossings and other locations where public health and safety requirements necessitate concrete or other bank protection.
- A minimum 100-foot-wide buffer adjacent to the Santa Clara River should be required between the top river side of bank stabilization and development within the Land Use Designations Residential Low Medium, Residential Medium, Mixed-Use and Business Park unless, through Planning Director review in consultation with the staff biologist, it is determined that a lesser buffer would adequately protect the riparian resources within the River Corridor, or that a 100-foot-wide buffer is infeasible for physical infrastructure planning. The buffer area may be used for public infrastructure, such as: flood control access; sewer, water and utility easements; abutments; trails and parks, subject to findings of consistency with the Specific Plan and applicable County policies.

SP-4.6-24 The River Corridor SMA *Conservation and Public Access Easement* shall prohibit grazing, except as a long-term resource management activity, and agriculture within the River Corridor and shall restrict recreation use to the established trail system.

SP-4.6-27 Removal of grazing from the High Country SMA except for those grazing activities associated with long-term resource management programs, is a principal means of enhancing habitat values in the creeks, brushland and woodland areas of the SMA. All enhancement activities for riparian habitat within the High Country SMA shall be governed by the same provisions as set forth for enhancement in the River Corridor SMA. Specific Plan Table 2.6-3 of the Resource Management Plan provides a list of appropriate plant species for use in enhancement areas in the High Country SMA.

SP-4.6-29 Access to the High Country SMA will be limited to day time use of the designated trail system.

SP-4.6-30 No pets of any kind will be allowed within the High Country SMA, with the exception that equestrian use is permitted on established trails.

SP-4.6-31 No hunting, fishing, or motor or trail bike riding shall be permitted.

SP-4.6-32 The trail system shall be designed and constructed to minimize impacts on native habitats.

SP-4.6-33 Construction of buildings and other structures (such as patios, decks, *etc*.) shall only be permitted upon developed pads within Planning Areas OV-04, OV-10, PV-02, and PV-28 and shall not be permitted on southerly slopes facing the High Country SMA (Planning Area HC-01) or in the area between the original SEA 20 boundary and the High Country boundary. If disturbed by grading, all southerly facing slopes which adjoin the High Country SMA within those Planning Areas shall have the disturbed areas revegetated with compatible trees, shrubs and herbs from the list of plant species for south and west facing slopes as shown in Table 2.6-3, Recommended Plant Species For Use In Enhancement Areas In The High Country.

Transition from the development edge to the natural area shall also be controlled by the standards of wildfire fuel modification zones as set forth in Mitigation Measure 4.6-49. Within fuel modification areas, trees and herbs from Table 2.6-3 of the Resource Management Plan should be planted toward the top of slopes; and trees at lesser densities and shrubs planted on lower slopes.

SP-4.6-39 The High Country SMA conservation and public access easement shall prohibit grazing within the High Country, except for those grazing activities associated with the long-term resource management programs, and shall restrict recreation to the established trail system.

SP-4.6-48 Standards for the restoration and enhancement of oak resources within the High Country SMA and the Open Area include the following (oak resources include oak trees of the sizes regulated under the County Oak Tree Ordinance, southern California black walnut trees, Mainland cherry trees, and Mainland cherry shrubs):

- To mitigate the impacts to oak resources that may be removed as development occurs in the Specific Plan Area, replacement trees shall be planted in conformance with the oak tree ordinance in effect at that time.
- Oak resource species obtained from the local gene pool shall be used in restoration or enhancement.
- Prior to recordation of construction-level final subdivision maps, an oak resource replacement plan shall be prepared that provides the guidelines for the oak tree planting and/or replanting. The Plan shall be reviewed by the Los Angeles Department of Regional Planning and the County Forester and shall include the following: site selection and preparation, selection of proper species including sizes and planting densities, protection from herbivores, site maintenance, performance standards, remedial actions, and a monitoring program.
- All plans and specifications shall follow County oak tree guidelines, as specified in the County Oak Tree Ordinance.

SP-4.6-51 In order to enhance the habitat value of plant communities that require fuel modification, fire retardant plant species containing habitat value may be planted within the fuel modification zone. Typical plant species suitable for Fuel Modification Zones are indicated in Specific Plan Table 2.6-5 of the Resource Management Plan. Fuel modification zones adjacent to SMAs and Open Areas containing habitat of high value such as oak woodland and savannas shall utilize a more restrictive plant list, which shall be reviewed by the County Forester.

SP-4.6-56 All lighting along the perimeter of natural areas shall be downcast luminaries with light patterns directed away from natural areas.

SP-4.6-63 Riparian resources that are impacted by buildout of the Newhall Ranch Specific Plan shall be restored with similar habitat at the rate of 1 acre replaced for each acre lost.

SP-4.6-64 The operator of the golf course shall prepare a Golf Course Maintenance Plan which shall include procedures to control storm water quality and ground water quality as a result of golf course maintenance practices, including irrigation, fertilizer, pesticide and herbicide use. This Plan shall be prepared in coordination with the County biologist and approved by the County Planning Director prior to the issuance of a Certificate of Occupancy.

Additional RMDP EIS/EIR mitigation measures (current as of the publication date of this paper, but subject to revision by the lead agency and through the public review process prior to final approval of the EIS/EIR) relevant to buffers include:

BIO-1 Mitigation Measures SP-4.6-1 through SP-4.6-16 specify requirements for riparian mitigation conducted in the High Country SMA, Salt Creek area, and Open Area. The RMDP includes requirements for mitigation of both riparian and upland habitats (such as riparian adjacent big sagebrush scrub), and incorporates these Mitigation Measures (SP-4.6-1 through SP-4.6-16). A Comprehensive Mitigation Implementation Plan (CMIP) has been developed by Newhall Land that provides an outline of mitigation to offset impacts described in the RMDP. The CMIP demonstrates the feasibility of creating the required mitigation acreage from RMDP project impacts (see BIO-2).

Detailed wetlands mitigation plans, in accordance with the CMIP, shall be submitted to, and are subject to the approval of, the Corps and CDFG as part of the sub-notification letters for individual projects. Individual project submittals shall include applicable CMIP elements, complying with the requirements outlined below. The detailed wetlands mitigation plan shall specify, at a minimum, the following: (1) the location of mitigation sites; (2) site preparation, including grading, soils preparation, irrigation installation, (2a) the quantity (seed or nursery stock) and species of plants to be planted (all species to be native to region); (3) detailed procedures for creating additional vegetation communities; (4) methods for the removal of non-native plants; (5) a schedule and action plan to maintain and monitor the enhancement/restoration area; (6) a list of criteria by which to measure success of the mitigation sites (*e.g.*, percent cover and richness of native species, percent survivorship, establishment of self-sustaining native of plantings, maximum allowable percent of non-native species,); (7) measures to exclude unauthorized entry into the creation/enhancement areas; and (8) contingency measures in the event that mitigation efforts are not successful. Individual project detailed wetlands mitigation plans shall also classify the biological value (as "high," "moderate," or "low") of the vegetation communities to be disturbed as defined in these conditions, or may be based on an agency-approved method (*e.g.*, Hybrid Assessment of Riparian Communities (HARC)). The biological value shall be used to determine mitigation replacement ratios required under BIO-2 and BIO-10. The detailed wetlands mitigation plans shall provide for the 3:1 replacement of any southern California black walnut to be removed from the riparian corridor for individual projects. The plan shall be subject to the approval of the CDFG and the Corps and approved prior to the impact to riparian resources. BIO-4 describes that the functions and values will be assessed for the riparian areas that will be removed, and BIO-2 and BIO-10 describe the replacement ratios for the habitats that will be impacted.

BIO-2 The permanent removal of CDFG jurisdictional riparian habitats, in the river and tributaries shall be replaced by creating riparian habitats of similar functions and values (see BIO-4) on the Project site, or as allowed under BIO-10. Riparian habitat meeting success criteria (see BIO-6) two years in advance of the removal of riparian habitat at the construction site shall be in kind and at a 1:1 replacement ratio (except as indicated below). If replacement riparian habitat cannot meet the success criteria two years in advance of the Project, the ratios listed below in **Table 4** will apply.

Table 4
CDFG Jurisdictional Permanent Impacts Mitigation Ratios

Ratios Listed by Vegetation Types & Quality				
Vegetation Community	Veg Code / ID	HIGH Reach Value* (Mit. Ratio)	MEDIUM Reach Value** (Mit. Ratio)	LOW Reach Value** (Mit. Ratio)
Southern Cottonwood-Willow Riparian Forrest	SCWRF	4:1	3:1	2:1
Southern Willow Scrub	SWS	3:1	2.5:1	2:1
Oak Woodland (Coast Live, Valley)	CLOW / VOW	3:1	2.5:1	2:1
Big Sagebrush Scrub	BSS	2.5:1	2:1	1.5:1
Mexican Elderberry Scrub	MES	2.5:1	2:1	1.5:1
Cismontane Alkaline Marsh	CAM	2.5:1	2:1	1.5:1
Coastal and Valley Fresh Water Marsh	CFWM	2:1	1.5:1	1:1
Mulefat Scrub	MFS	2:1	1.5:1	1.25:1
Arrowweed Scrub	AWS	2:1	1.5:1	1:1
California Sagebrush scrub, and CSB dominated habitats	CSB, CSB-A, -BS, -CB, -CHP, and -PS	2:1	1.5:1	1:1
Herbaceous Wetland	HW	1.5:1	1.25:1	1:1
River Wash, emergent veg.	RW	1.5:1	1.25:1	1:1
Chaparral, Chamise Chaparral	CHP, CC	1.5:1	1.25:1	1:1
Coyote Brush Scrub	CYS	1.5:1	1.25:1	1:1
Eriodictyon Scrub	EDS	1.5:1	1.25:1	1:1
California Grass Lands	CGL	1:1	1:1	1:1
Agricultural / Disturbed / Developed	AGR / DL / DEV	1:1	1:1	1:1

Notes:

* HIGH reach value indicates a portion of the Santa Clara River or main tributary that scored above 0.79 Total Score utilizing the HARC methodology described in the Newhall Ranch RMDP EIS-EIR

** MEDIUM reach value indicates a portion of the Santa Clara River or main tributary that scored between 0.4 and 0.79 Total Score utilizing the HARC methodology described in the Newhall Ranch RMDP EIS-EIR

*** LOW reach value indicates a portion of the Santa Clara River or main tributary that scored below 0.4 Total Score utilizing the HARC methodology described in the Newhall Ranch RMDP EIS-EIR

Ratios for Permanent Impacts to all classifications: Mitigation established prior to disturbance: 1:1 ratio; mitigation initiated <2 years after disturbance shall follow ratios in table above; mitigation initiated 2 to 5 years after disturbance shall add 0.5 to each value in the table above; and over 5 years, 1.0 is added to each value in the table above. (For example, initiation of mitigation of mulefat scrub 3 years after disturbance for a high habitat impact would be a ratio of 2.5:1, instead of 2:1 if initiated within 2 years of disturbance or 3:1 if initiated more than 5 years after disturbance.)

Ratios for Temporary Impacts to all classifications: Disturbance period < 2 yrs, 1:1, 2 to 5 yrs, 1.5:1, over 5 yrs., 2:1, except for removal of Southern Cottonwood and Oak Woodlands, which shall be mitigated at 2:1 for High, 1.5:1 for Medium and 1:1 for Low for all periods (except for pre-mitigated, which is 1:1).

Exotic/Invasive Species Removal, followed by restoration/revegetation, may be used to offset impacts above. Mitigation shall be credited at an acreage equivalent to the percentage of exotic vegetation at the restoration site. This means, for example, if a ten acre area is occupied by 10% exotic species, restoration will be credited for 1 acre of impact. As appropriate and authorized by CDFG, reduced percentage credits may be applied for invasive removal with passive restoration (weeding and documentation of natural recruitment only).

BIO-3 Creation of new vegetation communities and restoration of impacted vegetation communities shall occur at suitable sites in or adjacent to the watercourses or in areas where bank stabilization would occur. The highest-priority vegetation community restoration sites are to be new riverbed and tributary areas created, or disturbed sites impacted, during the excavation of uplands for bank protection/stabilization activities. Restoration sites may also occur at locations outside the riverbed where there are appropriate hydrologic conditions to create a self-sustaining riparian vegetation community and where upland and riparian vegetation community values are absent or very low. All sites shall contain suitable hydrological conditions and surrounding land uses to ensure a self-sustaining functioning riparian vegetation community. Candidate restoration sites shall be described in the annual mitigation status report (BIO-12). Sites will be approved when the detailed wetlands mitigation plans are submitted to the Corps and CDFG as part of the sub-notification letters submitted for individual projects Status of the sites will be addressed as part of the annual mitigation status report and mitigation accounting form agency review. Each revegetation plan will include acreages, maps and site specific descriptions of the proposed revegetation site, including analysis of soils, hydrologic suitability, and present and future adjacent land uses.

BIO-4 Replacement vegetation communities shall be designed to replace the functions and values of the vegetation communities being removed. The replacement vegetation communities shall have similar dominant trees and understory shrubs and herbs (excluding exotic species) to those of the affected vegetation communities (see **Table 5** for example recommended plant species for the River Corridor SMA and Tributaries). In addition, the replacement vegetation communities shall be designed to replicate the density and structure of the affected vegetation communities once the replacement vegetation communities have met the mitigation success criteria.

Table 5
Potential Plant Species for Vegetation Community Restoration in the River Corridor SMA and Tributaries

Trees	
red willow	*Salix laevigata*
arroyo willow	*Salix lasiolepis*
Fremont cottonwood	*Populus fremontii*
black cottonwood	*Populus balsamifera* ssp. *Trichocarpa*
western sycamore	*Platanus racemosa*
Shrubs	
mulefat	*Baccharis salicifolia*
sandbar willow	*Salix exigua*
arrow weed	*Pluchea sericea*
Herbs	
mugwort	*Artemisia douglasiana*
western ragweed	*Ambrosia psilostachya*
cattail	*Typha latifolia*
bulrush	*Scirpus americanus*

prairie bulrush	*Scirpus maritimus*

Note: This is a recommended list. Other species may be found suitable based on site conditions and state and federal permits.

BIO-5 Average plant spacing shall be determined based on an analysis of vegetation communities to be replaced. The applicant shall develop plant spacing specifications for all riparian vegetation communities to be restored. Plant spacing specifications shall be reviewed and approved by the Corps and CDFG when restoration plans are submitted to the agencies as part of the sub-notification letters submitted to the Corps and CDFG for individual projects or as part of the annual mitigation status report and mitigation accounting form.

BIO-6 The revegetation site will be considered "complete" upon meeting all of the following success criteria. In a sub-notification letter the applicant may request modification of success criteria on a project by project basis. Acceptance of such request will be at the discretion of CDFG and the Corps.

1. Regardless of the date of initial planting, any restoration site must have been without active manipulation by irrigation, planting, or seeding for a minimum of three years prior to Agency consideration of successful completion.

2. The percent cover and species richness of native vegetation shall be evaluated based on local reference sites established by CDFG and the Corps for the plant communities in the impacted areas.

3. Native shrubs and trees shall have at least 80% survivorship after two years beyond the beginning of the success evaluation start date. This may include natural recruitment.

4. Non-native species cover will be no more than 5% absolute cover through the term of the restoration.

5. Giant reed (*Arundo donax*), tamarisk (*Tamarix ramosissima*), perennial pepperweed (*Lepidium latifolium*), tree of heaven (*Ailanthus altissimus*), pampas grass (*Cortaderia selloana)* and any species listed on the California State Agricultural list, or Cal-IPC list of noxious weeds will not be present on the revegetation site as of the date of completion approval.

6. Using the HARC assessment methodology, the compensatory mitigation site shall meet or exceed the baseline functional scores of the impact area in jurisdictional waters of the United States. If the compensatory mitigation site cannot meet or

exceed the baseline functional score of the impact area in jurisdictional waters of the United States, additional mitigation area would be required to compensate for the functional loss.

BIO-7 If at any time prior to Agency approval of the restoration area, the site is subject to an act of God (flood, fires, or drought)) the applicant shall be responsible for replanting the damaged area. The site will be subject to the same success criteria as provided for in BIO-6. Should a second act of God occur prior to Agency approval of the restoration area, the applicant shall coordinate with the Agencies and develop an alternative restoration strategy(ies) to meet success requirements. This may include restoration elsewhere in the River corridor or tributaries.

BIO-8 Temporary irrigation shall be installed as necessary for plant establishment. Irrigation shall continue as needed until the restoration site becomes self sustaining, regarding survivorship and growth. Irrigation shall be terminated in the fall to provide the least stress to plants.

BIO-9 As an alternative to the creation/restoration of vegetation communities to compensate for permanent removal of riparian vegetation communities, in the Santa Clara River, the applicant may control invasive exotic plant species within the Upper Santa Clara River Sub-Watershed for a portion of the Santa Clara River mitigation required under BIO-2. The applicant may perform this work or contribute "in-lieu fees" to the Upper Santa Clara River Arundo/Tamarisk Removal Program to perform this work, if available. The weed control sites shall be selected in a coordinated, logical manner to ensure that giant reed and other invasive weeds are controlled to improve and expand wildlife and endangered species habitat; reduce flooding, erosion, and fire hazards; improve water quality; and potentially increase stream flow/water quantity in the RMDP watercourses. Removal areas shall be kept free of exotic plant species for five years after initial treatment. In areas where extensive exotic removal occurs, revegetation with native plants or natural recruitment shall be documented.

BIO-10 The exotics control program may utilize methods and procedures in accordance with the provisions in the Upper Santa Clara River Watershed Arundo/Tamarisk Removal Plan Final EIR, dated February 2006, or the applicant may propose alternative methods and procedures for Corps and CDFG review and approval pursuant to a sub-notification letter or annual mitigation status report submittal. Exotic plant species control will be credited at an acreage equivalent to the percentage of exotic vegetation at the restoration site. By example: a 10-acre site occupied by 10% exotics species will be credited for one acre of mitigation. The exotic weed control location will be documented on the annual mitigation status report and mitigation accounting form. If "in-lieu fees" are paid, it will be documented on the annual mitigation status report and mitigation accounting form , along with a reporting of the status of exotic vegetation treatment.

BIO-11 To provide an accurate and reliable accounting system for mitigation, the applicant utilizing the RMDP shall file a mitigation accounting form annually with the Corps and CDFG by April 1. This form shall document the amount of vegetation planted during the past year, any "in-lieu fees" paid for exotic invasive plant species control, the status of all mitigation credits to date, and any credits subtracted by projects implemented during the past year. The applicant, utilizing the RMDP, shall keep detailed records and provide a mitigation accounting form to the Corps and CDFG annually for review for the life of the permit, or until all credits have been used up for individual projects, and success criteria have been met. The Corps and CDFG shall provide concurrence within 60 days, including written verification for all restoration and weed removal sites that meet the specified performance criteria. Adequate proof of delivery of applicable reports would be required as well as subsequent notice to the Agencies requesting surety release.

BIO-12 An annual mitigation status report shall be submitted to the Corps and CDFG by April 1st of each year until satisfaction of success criteria identified in BIO-6. This report shall include any required plans for plant spacing, locations of candidate restoration and weed control sites or proposed "in-lieu fees," restoration methods, and vegetation community restoration performance standards. For active vegetation community creation sites, the report shall include the survival, percent cover, and height of planted species; the number by species of plants replaced; an overview of the revegetation effort and its success in meeting performance criteria; the method used to assess these parameters; and photographs. For active exotics control sites, the report shall include an assessment of weed control; a description of the relative cover of native vegetation, bare areas, and exotic vegetation; an accounting of colonization by native plants; and photographs. The report shall also include the mitigation accounting form (see BIO-11), which outlines accounting information related to species planted or exotics control and mitigation credit remaining. The annual mitigation and monitoring report shall document the current functional capacity of the compensatory mitigation site using the HARC assessment methodology, as well as documenting the baseline functional scores of the impact site in jurisdictional waters of the United States.

BIO-13 The mitigation program shall incorporate applicable principles in the interagency Federal Guidance for the Establishment, Use, and Operation of Mitigation Banks (FR 60 58605–58614) to the extent feasible and appropriate, particularly the guidance on administration and accounting. Nothing in the section 404 or section 2081 permit or section 1605 agreement shall preclude the applicant from selling mitigation credits to other parties wishing to use those permits or that agreement for a project and/or maintenance activity included in the permits/agreement.

BIO-14 Temporary impacts from construction activities in the riverbed shall be restricted to the following areas of disturbance: (1) an 85-foot-wide zone that extends into the river from the base of the rip-rap or gunite bank protection where it intercepts the river bottom; (2) 100 feet on either side of the outer edge of a new bridge or bridge to be modified; (3) a 60-foot-wide corridor for utility lines; (4) 20-foot-wide temporary access ramps; and (5) 60-foot roadway width temporary construction haul routes. The locations of these temporary construction sites and the routes of all access roads shall be shown on maps submitted with the sub-notification letter submitted to the Corps and CDFG for individual project approval. Any variation from these limits shall be submitted, with a justification for a variation for Corps and CDFG approval. The construction plans should indicate what type of vegetation, if any, would be temporarily disturbed or removed and the post-construction activities to facilitate revegetation of the temporarily impacted areas. The boundaries of the construction site and any temporary access roads within the riverbed shall be marked in the field with stakes and flagging. No construction activities, vehicular access, equipment storage, stockpiling, or significant human intrusion shall occur outside the work area and access roads.

BIO-15 All native riparian trees with a three-inch diameter at breast height (dbh) or greater in temporary construction areas shall be replaced using one- or five-gallon container plants, containered trees, or pole cuttings in the temporary construction areas in the winter following the construction disturbance. The mitigation ratios for temporary impacts to vegetation communities are described in BIO-2. The growth and survival of the replacement trees shall meet the performance standards specified in BIO-6. In addition, the growth and survival of the planted trees shall be monitored until they meet the self sustaining success criteria in accordance with the methods and reporting procedures specified in BIO-6, BIO-7, BIO-11, and BIO-12.

BIO-16 Vegetation communities temporarily impacted by the proposed Project shall be revegetated as described in BIO-2. Large trunks of removed trees may also remain on site to provide habitat for invertebrates, reptiles, and small mammals or may be anchored within the Project site for erosion control. To facilitate restoration, mulch, or native topsoil (the top six- to 12-inch deep layer containing organic material), may be salvaged from the work area prior to construction. Following construction, salvaged topsoil shall be returned to the work area and placed in the restoration site.

Within one year, the Project biologist will evaluate the progress of restoration activities in the temporary impact areas to determine if natural recruitment has been sufficient for the site to reach performance goals. In the event that native plant recruitment is determined by the Project biologist to be inadequate for successful habitat establishment, the site shall be revegetated in accordance with the methods designed for permanent impacts (*i.e.*, seeding, container plants, and/or a temporary irrigation system may be recommended). This will help ensure the success of temporary mitigation areas. The applicant shall restore the temporary construction area per the success criteria and ratios described in BIO-1, BIO-2, and BIO-6. Annual monitoring reports on the status of the recovery of temporarily impacted areas shall be submitted to the Corps and CDFG as part of the annual mitigation status report (BIO-11 and BIO-12).

BIO-20 Approximately 1,900 acres of coastal scrub shall be preserved on the Project site. The preservation of this vegetation type shall occur on site within the High Country SMA, the Salt Creek area, and the River Corridor SMA within the Specific Plan site. Irrevocable offers of dedication will be provided to CDFG for identified impact offsets in accordance with the Plan (BIO-1) using a "rough step" land dedication approach. Some of this habitat is recovering from wildfire and the expectation is that it will recover without active intervention. The functional values of any burned dedicated land areas shall be evaluated annually until such time that conditions are commensurate with the quality of the impacted habitat being mitigated. In the event that the functional value of this burned habitat has not recovered within five years of the dedication due to invasive species, to fire ecology, erosion, drought, or unforeseen events, then adaptive management pursuant to BIO-21 will be implemented for coastal scrub restoration.

BIO-21 Supplemental restoration of coastal scrub shall be conducted as an adaptive management measure pursuant to BIO-20. Eight areas were identified in the Draft Newhall Ranch Mitigation Feasibility Report in the High Country SMA, Salt Creek area, and River Corridor SMA (Dudek 2007A) for coastal scrub restoration. In the event that coastal scrub restoration is required pursuant to BIO-20, the applicant shall develop a Coastal Scrub Restoration Plan, subject to the approval of the CDFG. The plan shall specify, at a minimum, the following: (1) the location of mitigation sites to be selected from suitable mitigation land in the High Country and Salt Creek areas identified in the Feasibility Study; (2) a description of “target” vegetation (native shrubland) to include estimated cover and abundance of native shrubs; (3) site preparation measures to include topsoil treatment, soil decompaction, erosion control, temporary irrigation systems, or other measures as appropriate; (4) methods for the removal of non-native plants (*e.g.*, mowing, weeding, raking, herbicide application, or burning); (5) the source of all plant propagules (*e.g.*, seed, potted nursery stock, etc. collected from within five miles of the restoration site), the quantity and species of seed or potted stock of all plants to be introduced or planted into the restoration/enhancement areas; (6) a schedule and action plan to maintain and monitor the enhancement/restoration areas, to include at minimum, qualitative annual monitoring for revegetation success and site degradation due to erosion, trespass, or animal damage for a period no less than 2 years; (7) as needed where sites are near trails or other access points, measures such as fencing, signage, or security patrols to exclude unauthorized entry into the restoration/enhancement areas; and (8) contingency measures such as replanting, weed control, or erosion control to be implemented if habitat improvement/ restoration efforts are not successful.

Habitat restoration / enhancement will be judged successful when: (1) percent cover and species richness of native species reach 50% of cover and species richness at reference sites; and (2) the replacement vegetation has persisted at least one summer without irrigation.

Annual monitoring reports will be prepared and submitted to CDFG and will be made available to the public to guide future mitigation planning. Monitoring reports will describe all restoration/enhancement measures taken in the preceding year; describe success and completion of those efforts and other pertinent site conditions (erosion, trespass, animal damage) in qualitative terms; and describe vegetation survival or establishment in quantitative terms.

BIO-22 **a.** Newhall shall prepare an Oak Resource Management Plan, to be submitted for approval to CDFG and County of Los Angeles, and implemented upon approval. The Plan shall identify areas suitable for oak woodland enhancement and creation. The Plan shall distinguish between oaks to be planted in compliance with CLAOTO (BIO-22b) and the additional measures required by this EIR/EIS (BIO-2 for woodlands in jurisdictional streambeds; and BIO-22c and 22d for upland areas).

The Oak Resource Management Plan shall include measures to create or enhance woodlands as follows: (1) locations and acreages of mitigation sites where woodland creation or enhancement will; (2) a description of proposed cover and number of native trees, shrubs and grasses per acre to be established. This description shall be based on comparable intact woodlands in the area of impact or elsewhere within the RMDP planning area, consistent with conditions of the proposed mitigation site; (3) site preparation measures to include (as appropriate) topsoil treatment, soil decompaction, erosion control, weed grow/kill cycle, or as otherwise approved by the agencies; (4) methods for the removal of non-native plants (*e.g.*, mowing, weeding, raking, herbicide application, or burning); (5) a plant palette listing all species, including sizes, planting densities, or seeding rates, to be based on target vegetation; (6) the source of all plant propagules (seed, potted nursery stock, etc) and the quantity and species of seed or potted stock of all plants to be introduced or planted into the mitigation areas; (7) temporary irrigation, protection from herbivores, fertilizer, weeding, etc; (8) a schedule and action plan to maintain and monitor the enhancement/restoration areas, to include at minimum, qualitative annual monitoring for revegetation success and site degradation due to erosion, trespass, or animal damage for a period no less than 5 years total and no less than 2 years after removal of irrigation (if any); (9) where sites are near trails or other access points, measures such as fencing, signage, or security patrols to exclude unauthorized entry into the mitigation areas shall be implemented as needed; (10) tree protection standards to be implemented for individual trees or woodlands adjacent to development activity; (11) success criteria as stated in BIO-22b and BIO-22d; and (12) contingency measures, such as replanting, erosion control, irrigation system repair, or understory re-seeding, to be implemented if habitat improvement / restoration efforts do not meet the success criteria stated in the plan.

b. To meet the minimum mitigation criteria set forth in CLAOTO, Newhall will replace impacted oaks (measuring 8 inches in diameter, or greater, or with a combined diameter of 12 inches for multi-stem oaks) at a ratio of 2:1. Additionally, oaks meeting the criteria for classification as a Heritage Tree (defined by CLAOTO as “any oak tree measuring 36 inches or more in diameter”) will be replaced at a ratio of 10:1.

Whether they are planted in dedicated open space areas or developed areas, replacement oak trees planted in conformance with CLAOTO shall adhere to the following standards:

1. Replacement oak trees shall be exclusively indigenous species and shall be at least a 15-gallon size specimen and measure at least 1 inch in diameter 1 foot above the base, unless otherwise approved by the County Forester.

2. Replacement trees shall be properly cared for and maintained for a period of two years and replaced by Newhall if mortality occurs within that period.

3. Replacement planting shall be conducted in phases as impacts occur. Alternatively, Newhall may choose to plant replacement trees in open space areas

prior to realization of Project-related impacts (pre-mitigation). Any pre-mitigation shall adhere to the standards outlined herein.

4. Following completion of the two-year maintenance period the County Forester shall provide final authorization that CLAOTO standards have been met.

c. In addition to the CLAOTO requirements (BIO-22b, above), this EIS/EIR requires replacement of oak trees at the ratios in the table below for trees lost or impacted in uplands. These trees are in addition to the CLAOTO requirement described above. These additional trees may also be incorporated into woodland habitat enhancement or creation, as described above.

Additional replacement ratios are provided in **Table 6**.

Table 6
Additional BIO-22c Oak Tree Replacement Ratios

Trunk Diameter*	Mitigation Ratio
8 – 35	0.5:1
36 +	2.5:1

d. Newhall will mitigate lost oak woodlands occurring on upland sites (*i.e.*, outside CDFG / Corps jurisdictional stream channels) by creating or enhancing oak woodlands in the Salt Creek and High Country areas. At minimum, Newhall Land will mitigate woodland habitat at a 1:1 ratio through creation of new oak woodlands. As an alternative, Newhall may choose to enhance, improve and manage existing degraded woodland areas at a minimum 2:1 ratio for lost woodland acreage.

For woodland enhancement or replacement, dominant species (coast live oak or valley oak) and planting densities will be based on mitigation site suitability. All plant propagules, including acorns or tree cuttings and all seed or potted nursery stock of oaks or other species shall be collected within a five mile radius and within 1000 feet elevation of the restoration site.

The woodland creation or enhancement sites shall be monitored for oak tree survival and vigor and other habitat values including species diversity and wildlife use. The replacement or enhancement sites will be considered "complete" upon meeting all of the following success criteria, or as otherwise approved by CDFG. Any replacement oak trees planted in woodlands for conformance with CLAOTO will also be subject to CLAOTO performance criteria (BIO-22b).

1. Regardless of the date of initial woodland creation or enhancement, each site must have been without active manipulation by irrigation, planting, or re-seeding for a minimum of three years prior to evaluation for successful completion.

2. The percent cover and species richness of restored or enhanced native vegetation shall be evaluated based on target vegetation described in the woodland creation or enhancement plan.

3. Densities (numbers / acre) of surviving, healthy oak shall be within 5% of the plan target density. Cover and species richness of other native shrubs shall reach 50% of the cover and species richness described for the "target" woodland. Optimal woodland densities and acorn planting quantities, by oak woodland type, are presented in **Table 7**.

Table 7
Optimal Woodland Densities and Acorn Planting Quantities, by Oak Woodland Type

Woodland Type	Average Existing Woodland Density (trees per acre)	Target Density for Newhall (trees per acre)
Coast live oak woodland	22	50
Mixed oak woodland	19	40
Valley oak woodland	16	25

4. Non-native grass cover shall not exceed the "target" woodland non-native grass cover, and other non-native species shall not exceed 10% cover at any time. Any species listed on the California State Agricultural list, or Cal-IPC list of noxious weeds will not be present on the revegetation site at the time that project success is determined.

BIO-48 Installation of bridges, culverts, or other structures shall not impair the movement of fish and aquatic life. Bottoms of temporary culverts shall be placed at or below channel grade. Bottoms of permanent culverts shall be placed below channel grade. Culvert crossings shall include provisions for a low flow channel where velocities are less than 2 feet per second to allow fish passage.

BIO-51 Bridges over the Santa Clara River shall be designed to minimize impacts to natural areas and riparian resources from associated lighting and stormwater runoff. All lighting will be designed to be directed away from natural areas (pursuant to SP-4.6-56) using shielded lights, low sodium-vapor lights, bollard lights, or other available light and glare minimization methods. Bridges will be designed to minimize normal vehicular lighting from trespassing into natural areas using side walls a minimum of 24 inches high. All stormwater from the bridges will be directed to water treatment facilities for water quality treatment.

BIO-64 An integrated pest management (IPM) plan that addresses the use of pesticides (including rodenticides and insecticides) on site will be prepared prior to the issuance of building permits for the initial tract map. Preparation of the CC&Rs for each tract map shall include language that prohibits the use of anticoagulant rodenticides in the Project site.

BIO-68 Any special-status species bat day roost sites found by a qualified biologist during pre-construction surveys conducted per BIO-61, to be directly (within project disturbance footprint) or indirectly (within 300 feet of project disturbance footprint) impacted are to be mitigated with creation of artificial roost sites. The Project applicant shall establish (an) alternative roost site(s) within suitable preserved open space located at an adequate distance from sources of human disturbance.

BIO-69 The Project applicant and/or NLMO shall develop and implement a conservation education and citizen awareness program for the High Country SMA informing the public of the special-status resources present within the High Country SMA and providing information on common threats posed by the presence of people and pets to those resources. The NLMO shall install trailhead and trail signage indicating the High Country SMA is a biological conservation area and requesting that people and their animals stay on existing trails at all times. The NLMO shall provide quarterly maintenance patrols to remove litter and monitor trail expansion and fire hazards within the High Country SMA, funded by the JPA.

BIO-72 Plant palettes proposed for use on landscaped slopes, street medians, park sites, and other public landscaped and FMZ areas within 100 feet of native vegetation communities shall be reviewed by a qualified restoration specialist to ensure that the proposed landscape plants will not naturalize and require maintenance or cause vegetation community degradation in the open space areas (River Corridor SMA, High Country SMA, Salt Creek area, and natural portions of the Open Areas). Container plants to be installed within public areas within 100 feet of the open space areas shall be inspected by a qualified restoration specialist for the presence of disease, weeds, and pests, including Argentine ants. Plants with pests, weeds, or diseases shall be rejected. In addition, landscape plants within 100 feet of native vegetation communities shall not be on the Cal-IPC California Invasive Plant Inventory (most recent version) or on the list of Invasive Ornamental Plants listed in Appendix B of the SCP. The current Cal-IPC list can be obtained from the Cal-IPC website (http://www.cal-ipc.org/ip/inventory/index.php). Landscape plans will include a plant palette composed of native or non-native, non-invasive species that do not require high irrigation rates. Except as required for fuel modification, irrigation of perimeter landscaping shall be limited to temporary irrigation (*i.e.*, until plants become established).

BIO-73 Permanent fencing shall be installed along all River Corridor SMA trails adjacent to the Santa Clara River, or other sensitive resources, in order to minimize impacts associated with increased human presence on protected vegetation communities and special-status plant and wildlife species. The fencing will be split rail to avoid inhibiting wildlife movement. Viewing platforms will be located in land covers currently mapped as agriculture, disturbed land, or developed land.

BIO-74 To protect Middle Canyon Spring and to reduce potential direct impacts to any special-status species that may be located within the Spring complex due to unrestricted access, the Project applicant or its designee shall avoid all construction-related activities within the Middle Canyon Spring complex and erect and maintain temporary orange fencing and prohibitive signage around the Middle Canyon Spring prior to and during all phases of construction within 200 feet of the Spring and, if applicable, around the Middle Canyon drainage within 100 feet of flowing water. A qualified biologist will be present to monitor construction activities within 200 feet of the Spring and, if applicable, around the Middle Canyon drainage within 100 feet of flowing water. The areas behind the temporary fencing shall not be used for the storage of any equipment, materials, construction debris, or anything associated with construction activities. Any upslope runoff from construction areas will be directed away from the Middle Canyon Spring.

Following the final phase of construction of any Newhall Ranch subdivision tract adjacent to Middle Canyon Spring, the Project applicant or its designee shall install and maintain permanent fencing along the subdivision tract bordering the spring. Permanent signage shall be installed on the fencing along the spring boundary to indicate that the fenced area is a biological preserve that contains protected species and habitat. No trail shall be constructed that passes within 100 feet of the Middle Canyon Spring.

a. As described in BIO-51, the Commerce Center Drive bridge will be designed to minimize secondary impacts associated with lighting and water quality impacts through the installation of indirect and downcast lighting, and routing of stormwater to water quality treatment facilities.

BIO-77 A Middle Canyon Spring Habitat Management Plan will be developed that details the measures to be implemented to maintain the populations of the undescribed snail and sunflower species. The plan shall be subject to the approval of CDFG and implemented by Newhall Land prior to disturbance within 100 feet of flowing water in Middle Canyon Creek and/or 200 feet of Middle Canyon Spring. The plan shall include the following elements: (1) collection of data on existing site conditions; (2) construction monitoring program and a post-development monitoring program; (3) threshold parameters that activate adaptive management measures across a series of potential future scenarios, including water quality and water quantity scenarios, including the potential use of infiltration wells, if these should become necessary to assure water quantity; (4) measures to exclude unauthorized entry into the spring; and (5) contingency measures in the event that management efforts are not successful. Plan elements are further described below:

Pre-development data collection:

Upon approval of the proposed Project, data collection for Middle Canyon Spring and its biotic community will be initiated. Site assessments will be completed by biologists, and as needed with surveyors, engineers, geologists, and hydrogeologists, to collect the following data, subject to limitations on disturbances: (1) inventory of plant species within and adjacent to the spring; (2) percent native and non-native plant cover and percent bare ground within and adjacent to the spring using relevé method, a visual estimation technique to classify and map large vegetation areas in a limited amount of time (see below); (3) structural description of vegetation communities within each relevé plot; (4) GPS mapping of all trees within core spring area and adjacent 100 feet; (5) GPS mapping of special-status sunflower; (6) census special-status sunflower stem numbers; (7) description of any disturbances to the spring area; (8) establish permanent photo points; (9) photo documentation of seasonal changes in the spring; (10) survey and mapping of hydrologic and topographic features in the area adjacent to the spring; (11) population data on the undescribed snail, including distribution, abundance, density, size classes and seasonal activity, and microhabitat descriptions; (12) invertebrates survey; (13) amphibian survey; (14) characterization of algal and microbial components; (15) survey of spring inlet and outlets for comparison to piezometer water elevations from monitoring points P-1MS, P-2MS and P-8B; (16) flow rates of spring outlets at a frequency to record diurnal fluctuations; (17) determine approximate evapotranspiration (ET) rates of the vegetation community; (18) collect piezometer water elevation data from P-1MS, P-2MS and P-8B at a frequency suitable to determine seasonal variations in ground water elevations; (19) continuously record surface water temperature and depth profile at a spring monitoring location and piezometers P-1MS and P-2MS; (20) Water quality/chemistry data in the spring and the three nearby piezometers (P-1MS, P-2MS, and P-8B) (dissolved oxygen [DO, spring only], salinity, pH and alkalinity, nitrates, sulfates, relevant cations and anions [bicarbonate, calcium, chloride, magnesium, nitrate as NO_3, potassium, sodium], total dissolved solids [TDS], turbidity [spring only], and suspended solids [spring only]); (21) sample soils along the margin of the spring and determine soil classification types; and (22) As available, compile a record of historical photographs and aerial photographs of the spring and adjacent areas.

Vegetation data will be collected using a non-invasive monitoring method and analyzed in accordance with the California Native Plant Society (CNPS) *Relevé Protocol* (2004), which provides for a visual assessment of vegetation communities instead of the more intrusive point-intercept transect methods. This will ensure that collection of vegetation data will limit damage to the spring vegetation and limit the establishment of trails during monitoring visits.

Additionally for two years following approval of the proposed Project, the applicant, in consultation with CDFG, shall provide for the collection of seed from the undescribed sunflower species by a qualified research institution for long-term seed bank preservation or other conservation purposes. Further, to facilitate additional research of the species, applicant shall allow CDFG access to the spring complex for future conservation purposes.

Prior to establishing the post-development long-term thresholds discussed below, hydrologic and biologic data will be evaluated, and any increase or decrease greater than 10% in monitoring parameters 2, 11 through 16, and 18 through 20, described above, will serve as an interim threshold and will trigger adaptive management measures, such as those described below. Should these thresholds be triggered, CDFG will be notified within 24 hours to determine what actions, if necessary, will be implemented. Biological data collection will contribute to the establishment of habitat criteria necessary for sustaining the undescribed snail and the undescribed sunflower. .

Construction monitoring program and data collection

Data collection described above will continue during construction near the spring complex (Commerce Center Bridge and development of Middle Canyon (Mission Village planning area). Monitors will be on site daily when work is conducted within 100 feet of flowing water in Middle Canyon Creek and/or 200 feet of the spring complex, and weekly during mass grading of Middle Canyon, to observe and report on construction activities. Monitors will ensure that appropriate avoidance and minimization measures are implemented, such as the installation and maintenance of perimeter construction fencing and storm water controls, silt fences and sand bags. During any period where dewatering occurs within 100 feet of flowing water in Middle Canyon Creek and/or 200 feet of the spring complex, biological and hydrologic parameters will be monitored daily. No dewatering activities shall occur in the spring complex. Discharge of any dewatering waters, nuisance irrigation flows, water quality basin, subdrain, backdrain, or toe drain flows shall be directed away from the spring.

Post-development data collection

Biological and hydrologic monitoring will continue post-development. For the first 2 years after build-out of Middle Canyon (Mission Village), post-construction monitoring will be as frequent as during the pre-construction period. After the 2-year period, data collected and the frequency of monitoring may be adjusted, in consultation with CDFG. The post-development monitoring program will continue to collect data on trends and changes in the populations of the undescribed snail and sunflower, document any shift in spring habitat composition, or any changes in conditions that would potentially impact the spring system, as detailed above. Analysis and comparison of collected data will establish long-term thresholds. These thresholds will serve to trigger adaptive management measures during the post-development period.

Adaptive Management

As dictated by the thresholds discussed above, the following measures may be implemented after consultation with CDFG, in the event a threshold is exceeded. These actions may include, but are not limited to: (1) the addition of supplemental water via an existing deep Saugus well in Middle Canyon; (2) removal of infiltration water by diverting flow from upstream water quality features; (3) implement invasive species control; and (4) implement additional controls to prevent unauthorized access to the spring complex.

Monitoring Report

Annual monitoring reports will be prepared to summarize the status of the undescribed snail and sunflower and hydrology within Middle Canyon Spring. These reports will be used to evaluate the significance of impacts and the efficacy of mitigation measures. Reports will include results of biological surveys, flow data, groundwater modeling results, water quality data, mapping of the spring features and biota, photo-documentation from permanent photo points, analysis of field and lab data, conclusions based on ongoing monitoring efforts, and recommendations for future management actions. Annual monitoring reports will be submitted to CDFG and Corps.

BIO-78 A cowbird trapping program shall be implemented once vegetation clearing begins and maintained throughout the construction, maintenance and monitoring period of the riparian restoration sites. A minimum of 5 traps shall be utilized, with at least one trap adjacent to the project site and one or two traps located at feeding areas or other CDFG-approved location. The trapping contractor may consult with CDFG to request modification of the trap location(s). CDFG must approve any relocation of the traps. Traps will be maintained beginning each year on April 1st and concluding on/or about November 1st (may conclude earlier, depending upon weather conditions and results of capture). The trapping contractor may also consult CDFG on a modified, CDFG-approved trapping schedule modification. The applicant shall follow the CDFG and USFWS protocol. In the event that trapping is terminated after the first few years, subsequent phases of the RMDP development will require initiation of trapping surveys, to determine whether re-establishment of the trapping program is necessary.

BIO-79 The status of the Potrero Canyon San Emigdio blue butterfly colony shall be monitored by a qualified biologist for a period of five years after Potrero Canyon Road construction completion/operation commencement to evaluate whether the operation of the road may be contributing to a population decline in the colony. Should it be determined that a population decline is occurring, habitat creation for the San Emigdio blue butterfly shall be implemented in suitable locations contiguous to the habitat but away from the road. A habitat creation plan will be prepared that details the location and methods for creating habitat, that specifies success criteria, and that describes measures that will be implemented in the event that the habitat creation does not stabilize the San Emigdio blue butterfly population.

BIO-80 The Project applicant will retain a qualified biologist to develop an Exotic Wildlife Species Control Plan and implement a control program for bullfrog, African clawed frog, and crayfish. The program will require the control of these species during construction within the River Corridor and modified tributaries (bridges, diversions bank stabilization, drop structures). The Plan shall include a description of the species targeted for eradication; the methods of harvest that will be employed; the disposal methods; and the measures that would be employed to avoid impacts to sensitive wildlife (e.g., stickleback, arroyo toad, nesting birds) during removal activities (i.e., timing, avoidance of specific areas). Annual monitoring shall occur for the first five years after construction of Project facilities. After five years, bi-annual monitoring shall occur up to 50 years to determine if additional control is necessary. Monitoring will be conducted within sentinel locations along the River Corridor SMA and where the Project provides potential habitat for these species (e.g., future ponds and water features). Control shall be conducted within Project facilities where monitoring results indicate that exotic species have colonized an area.

BIO-87 Following the completion and occupancy of a development area, quarterly monitoring shall be initiated for Argentine ants along the urban–open space interface at sentinel locations where invasions could occur (e.g., where moist microhabitats that attract Argentine ants may be created). A qualified biologist shall determine the monitoring locations. Ant pitfall traps will be placed in these sentinel locations and operated on a quarterly basis to detect invasion by Argentine ants. If Argentine ants are detected during monitoring, direct control measures will be implemented immediately to help prevent the invasion from worsening. These direct controls may include but are not limited to nest/mound insecticide treatment, or available natural control methods being developed. A general reconnaissance of the infested area would also be conducted to identify and correct the possible source of the invasion, such as uncontrolled urban runoff, leaking pipes, or collected water. Monitoring and control of Argentine ants would occur for a 50-year period.

Section 6.2 Habitat Connectivity

Habitat connectivity in the Project area is addressed at three scales, as illustrated in **Figures 2** through **4:** (1) the regional landscape linkage scale (**Figure 2**), (2) the on-site Project area scale (**Figure 3**), and (3) the wildlife crossing scale (**Figure 4**).

Section 6.2.1 Landscape-Scale Habitat Connectivity

Figure 2 shows the conceptual regional open space connectivity identified by Penrod *et al.* (2006) that would provide for landscape-scale habitat connectivity between the Santa Susana Mountains to the south and the Los Padres National Forest to the north. These conceptual linkages encompass the High Country SMA, the Salt Creek area within the Project area, and the Santa Clara River west of the Project area. Penrod *et al.* (2006) considered the High Country SMA and Salt Creek area, along with regional open space conservation areas and initiatives such as "SOAR,"[4] in recommending a linkage design that would connect the Santa Monica Mountains, San Gabriel Mountains, and the Sierra Madre Mountains. This linkage design was also based on a "least cost analysis" that quantitatively models the most efficient routes target animals could take to travel between these open space areas. The least costs analysis incorporates available information for movement-limiting variables such as elevation, vegetation, topography, and road density. The "least cost path" is the most direct or optimum route utilizing suitable habitat and minimizing costs (*e.g.*, energy costs, risk of mortality), but does not represent all potential routes available to a species that may be more costly, but feasible alternatives. Dispersing animals are often young adults, and behaviorally these animals may take routes that do not ensure the least cost or the highest rate of survivability, or they may be inhibited from using such routes by adults. However, these least cost analyses quantitatively identify idealized linkages and corridors that would allow for the most efficient long-range dispersal and migration movement for wildlife between larger conservation areas.

The High Country SMA and Salt Creek area within the Project area comprise an important part of the least cost path linkage design identified by Penrod *et al.* (2006). They provide a key part of

[4] Save Open-Space and Agricultural Resources (SOAR) is a non-profit organization that seeks to maintain agricultural, open space, and rural lands within Ventura County and surrounding regions. Development activities within the SOAR boundaries are limited by County Ordinance.

the east-west linkage that crosses Interstate 5 and connects to the Angeles National Forest in the San Gabriel Mountains to the east and Ventura County SOAR open space to the southwest. They also provide a significant part of the north-south linkage between the Santa Susana Mountains and the "Fillmore Greenbelt" to the northwest that further links to the Los Padres and Angeles National Forests to the north.

Section 6.2.2 Project Area Habitat Connectivity

At the Project area level, the High Country SMA, Salt Creek area, and River Corridor SMA are the foundation for post-development dispersal and movement throughout the Project area landscape by the different species guilds discussed in **Sections 4.0** and **5.0**.

Wildlife corridors within the Project area in relation to the proposed RMDP Alternative 2 project were identified primarily by using existing scent station/track station data, topographic analysis, incidental field observations (Dudek and Associates 2006), and professional judgments based on known habitat associations of wildlife species in the Project area. The scent/track station data were collected by Impact Sciences, Inc. (2005) as part of a comprehensive mammal assessment and survey for the Specific Plan area. Impact Sciences, Inc. (2005) monitored 104 scent/track stations for five consecutive nights each between March 1 and September 30, 2004. Each station consisted of a smoothed 4-square-foot area with a thin layer of flour to pick up tracks and a bait (usually a can of tuna cat food) placed in the center to attract animals. Stations were located throughout the Specific Plan area, including along Salt Creek Canyon from the eastern portion toward the Ventura County line, north above Potrero Mesa, throughout Long Canyon and around the agriculture field north of Long Canyon, south of Lion Canyon and Grapevine Mesa, dispersed throughout Exxon Canyon and Middle Canyon, and in a few portions of Chiquito Canyon, San Martinez Grande, and Entrada. Impact Sciences, Inc. (2005) also conducted nighttime spotlight surveys along roadways throughout the Project area five nights a week during the summer and fall of 2004.

In an undeveloped landscape, high and moderate mobility ground-dwelling wildlife can be expected to travel relatively freely throughout an area because there are no significant obstacles to movement. However, as described above in **Section 4.3**, some species prefer certain habitat types related to vegetation cover and topography, such as mule deer preferring rugged terrain and slopes, and mountain lion preferring canyon bottoms and gently sloping terrain. Therefore, with the understanding that an open landscape allows wildlife to range freely, areas that exhibit the characteristics of wildlife corridors with the RMDP Alternative 2 build-out scenario (*i.e.*, linear landscape elements that connect larger habitat patches) were included in this corridor analysis. Corridors were identified that would (1) allow high mobility ground-dwelling guild species to move through areas in a single generation, and (2) contain sufficient habitat components for occupation by low and moderate mobility ground-dwelling species. As described in **Section 4.0**, less vagile species that are unable to move through a corridor in a lifetime require sufficient habitat to allow diffusion of the species over more than one generation (intergenerationally) through the area. High mobility aerial species were not considered in this analysis because of their relative independence of wildlife corridors.

Thirteen potential corridors were identified in this analysis within the Project area under the Alternative 2 build-out scenario (**Figure 3**):

1. Santa Clara River Corridor
2. Salt Creek Confluence
3. Salt Creek-High Country
4. East Fork Salt Creek
5. Potrero Canyon-Salt Creek
6. Potrero Canyon
7. Long Canyon
8. Short Canyons–River Corridor
    a. Humble Canyon
    b. Lion Canyon
    c. Exxon Canyon
    d. Dead End Canyon
    e. Middle Canyon
    f. Magic Mountain Canyon
9. Chiquito Canyon
10. San Martinez Grande Canyon
11. Off-Haul Canyon
12. Homestead Canyon
13. Castaic/Hasley Corridor.

As clearly shown in **Figure 3,** the potential wildlife corridors that will remain functional after build-out of the Project area are: No. 1: Santa Clara River, No. 2: Salt Creek Confluence, No. 3: Salt Creek-High Country, No. 4: East Fork Salt Creek, and No. 12: Castaic/Hasley Corridor. These corridors will provide habitat connections among the protected open space areas—High Country SMA, Salt Creek area, and River Corridor SMA—and will provide connections to habitat areas beyond the Project area, as discussed above in the context of the regional landscape-level habitat connections.

The Santa Clara River is a critical wildlife corridor in the Project area because it provides both significant habitat connectivity and resident or "live-in" habitat for many wildlife species. The River corridor connects downstream and upstream areas, including tributary drainages such as Salt Creek and Castaic Creek that allow wildlife access to uplands from the River.

The Salt Creek High Country, East Fork Salt Creek, and Salt Creek Confluence corridors provide the most direct connections between the River corridor habitat and large upland habitat areas south of the River. As noted above, the least cost analyses conducted by Penrod *et al.* (2006) identified these areas as important components of regional habitat connectivity. Based on the Impact Sciences, Inc. (2005) mammal study and incidental observations (Dudek and Associates 2006), wildlife activity appears to be concentrated in these areas despite agricultural and grazing activities. Wildlife likely move from the River Corridor to upland areas through the Salt Creek Confluence. These corridors will remain fully intact after build-out of the Project area and are expected to function as they have in the past.

The Castaic/Hasley corridor will also remain intact as an Open Space/Open Area following build-out of the Project area, but with a narrowing of the corridor that passes between the VCC and Entrada planning areas (**Figure 3**). This corridor was not identified by Penrod *et al.* (2006) as a regional linkage, but it will still allow for movement of many species such as coyote, mule deer, and possibly mountain lion, and function as live-in habitat for many other species. Although the vicinity of Castaic Creek north of the Project area is becoming increasingly developed, it will continue to have connectivity value between the Santa Clara River and upland habitats to the northeast of the Project Area extending to Castaic Lake and the Angeles National Forest.

Figure 3 also shows the potential corridors that will be developed, become dead-ends, or be highly constrained for wildlife after build-out of the Project area: No. 5: Potrero Canyon-Salt Creek, No. 6: Potrero Canyon, No. 7: Long Canyon, No. 8a: Humble Canyon, No. 8b: Lion Canyon, No. 8c: Exxon Canyon, No. 8d: Dead End Canyon, No. 8e: Middle Canyon, No. 8f: Magic Mountain Canyon, No. 9: Chiquito Canyon, No.10: San Martinez Grande Canyon, No. 11: Off-Haul Canyon, and No. 12: Homestead Canyon. Although some urban-adapted wildlife species such as coyotes or raccoons, and even occasionally mule deer, may move through these corridors, and others may permanently occupy portions of these corridors, such as the San Diego desert woodrat or some resident passerines with small home ranges/territories such as the rufous-crowned sparrow, in general these corridors are not considered to effectively contribute to long-term habitat connectivity function in the Project area because of the amount of urban development that will be adjacent to the corridors.

Section 6.2.3 Wildlife Crossings

Wildlife crossings are primarily located under the existing SR-126, linking the River Corridor through drainages to areas north of the Project Area. **Figure 4** shows six of these crossing locations, including three crossings in Ventura County west of the Project area that can be accessed by wildlife moving along the Santa Clara River. These crossings, which are associated with current agricultural operations, are arched culverts large enough for vehicles to pass through and for conveying the high mobility ground-dwelling guild species, as discussed above in **Section 4.3.2**. The easternmost of these will serve wildlife passing through the Project area via Salt Creek corridors discussed above, as well as through Tapo Canyon in Ventura County.

Within the Project area there are existing crossings of SR-126 at San Martinez Grande and Chiquito canyons, and at the Castaic Creek confluence. These crossings currently are short and include a soft-bottom bridge overpass at San Martinez Grande and Castaic Creek and a triple box culvert at Chiquito Canyon (**Figure 4**). After development, the existing box culverts at Chiquito Canyon will be replaced by a bridge. These crossings will be adequate in size and openness for wildlife such as mule deer, and thus these crossings are not expected to significantly constrain current wildlife movement in the area. However, they are not considered to be important long-term regional crossings because of the constrained future conditions due to build-out of the Project area.

Implementation of the RMDP under Alternative 2 would result in the construction of three large-span bridges across the Santa Clara River corridor (Commerce Center Drive Bridge, Long Canyon Road Bridge, and Potrero Canyon Road Bridge). These bridges would not inhibit wildlife movement along the River because the proposed structures would span long lengths and would allow sufficient daylight. Commerce Center Drive Bridge would be 1,260 feet long, 120 feet wide, and have a vertical clearance of 25 feet. The Long Canyon Road Bridge would be 980 feet long, 114 feet wide, and have a vertical clearance of 19 feet. The Potrero Canyon Road Bridge would be 1,350 feet long, 100 feet wide, and have a vertical clearance of 16 feet. All three bridge vertical clearances exceed the recommended minimum height of 10 feet for black bear, mountain lion, and deer by Ruediger and DiGiorgio (2007) (**Table 1**). The minimum openness factor of the three bridges would be 49.78 for the Long Canyon Bridge, which far exceeds the 0.25 openness factor considered necessary for deer (Donaldson 2005).

In addition, two RMDP EIS/EIR recommended mitigation measures will facilitate wildlife movement in the Project area:

BIO-48 Installation of bridges, culverts, or other structures shall not impair the movement of fish and aquatic life. Bottoms of temporary culverts shall be placed at or below channel grade. Bottoms of permanent culverts shall be placed below channel grade.

Culvert crossings shall include provisions for a low flow channel where velocities are less than 2 feet per second to allow fish passage.

BIO-59 Road undercrossings will be built in accordance with accepted design criteria to allow the passage of mountain lions and mule deer. The applicant shall prepare a Wildlife Movement Corridor Plan that specifically addresses wildlife movement corridors at San Martinez Grande, Chiquito Canyon and Castaic Creek, which shall be monitored for one year prior to construction of the SR-126 widenings. The Plan shall address current movement that is occurring, the methods that will be implemented to provide for passage including lighting, fencing, vegetation planting, the installation of bubblers to encourage wildlife usage, and the size of the passage. The applicant shall install motion cameras at these locations in consultation with CDFG and monitor these passages for a period of two years subsequent to constructing improvements. A report of the wildlife documented to utilize these crossings shall be provided to the CDFG annually. In addition, the Salt Creek crossing west of the Project area will be enhanced prior to initiation of construction in Long Canyon (southern portion of the Homestead Village). This crossing will be monitored for one year at the initiation of RMDP development, for two years at the time the crossing is enhanced, and then for three years after Project build-out. Prior to the construction of adjacent developments, signs will be placed along the roads indicating potential wildlife crossings where mountain lions and mule deer are likely to cross.

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