APPENDIX 2

Selected Corridor, Connectivity and Linkage References from the MSCP, MHCP and associated documents relevant to the Connectivity Monitoring Strategic Plan

Multiple Species Conservation Plan Documents

MSCP Volume I: Appendix A Biological Resources Ogden 1995

Resource Document

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Vol.1 4.1.2 Biological Objectives

Maintain and enhance/restore functional wildlife corridors and habitat linkages between critical biological resource areas. Wildlife habitat patches should be linked by functional corridors to minimize problems associated with habitat fragmentation (Dickman 1987; Saunders et al. 1991; Rolstad 1991). Whenever possible, corridors should be of high quality habitat and of the same habitat type as the areas they connect. These landscape linkages are essential as pathways for genetic and demographic interchange. They are also important for facilitating daily, annual, and seasonal movements and, for some species, permitting dispersal to breeding and foraging areas. The preserve system will also provide for wildlife corridors between areas of high species richness.

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Vol.1 4.2.2 Animal Populations

Much of the preceding discussion related to rare plant population genetics also applies to animals. Theoretical and empirical evidence suggests that demography is usually of more immediate importance than population genetics in determining the short-term viability of wild populations (Lande 1988). The long-term viability of a species involves both demography and population genetics. The basic assumption is that populations with relatively high levels of genetic diversity/heterozygosity) are less vulnerable to extinction than populations with relatively less genetic diversity (Allendorf and Leary 1986). Many of the animal species of concern have relatively large home range area requirements which limit the maximum population density of a species within a given area. For animals with very large home ranges (e.g., mountain lion), no one habitat patch is sufficient to support a viable population. Thus, a network of interconnected reserves is necessary to maintain viable populations of certain species. Genetic diversity can be described at two scales: within population (local) diversity and between population (regional) diversity. Most natural populations possess some degree discontinuity in spatial distribution and have some geographic structure across the species range. A species' distribution may be composed of geographically distinct patches of occupied (or potentially occupied) habitat, interconnected through patterns of gene flow via an exchange of individuals between local populations. This group of interacting populations is termed a metapopulation. The long-term conservation of a species must consider the influence of metapopulation structure on the maintenance of regional genetic diversity of a species that allows for adaptation to environmental change and maintenance of a species' evolutionary potential (Franklin 1980; Soule 1980). Small isolated populations are expected to lose genetic variation more rapidly than large interconnected populations as a consequence of sampling error (i.e., genetic drift) being highly dependent on population size. The contribution of mutation is usually considered to be a

negligible source of genetic variation for relatively small populations. A species' persistence within a given area is dependent on local demographic conditions through time (demographic stability) and connectivity of the population with other populations that may contribute immigrants and effectively "rescue" a population from local extinction (Brown and Koderic-Brown 1977; Lande 1988).

Volume II Appendix A-9 Biological Goals, Standards and Guidelines for Multiple Species Preserve Design

Page A-9-12

Objective 2

Maintain functional wildlife corridors and habitat linkages between critical biological resource areas.

POLICY 2.1 Maintain landscape linkages to minimize habitat fragmentation, provide habitat for plants and animals in transit, maintain genetic and demographic interchange between populations, facilitate daily, annual, and seasonal movements, permit dispersal to breeding and foraging areas, and facilitate "rescue" of small peripheral populations from extinction.

Standards

1) Maintain regional habitat linkages (i.e., between regions and subregions) by preserving natural connections between large: areas of conserved native habitat.

2) Maintain local habitat linkages (i.e., within subregions) by preserving natural connections to allow access to necessary resources which otherwise may be impeded by development.

3) Maintain adequate natural habitat linkages with conserved habitat patches outside the MSCP study area.

4) Where habitat linkages are not possible (e.g., constrained by existing development), maintain functional movement corridors between habitat patches.

Implementation

1) Functional wildlife corridors and habitat linkages should be determined by the dispersal characteristics of the target species (habitat preferences, dispersal distance, and movement rates), structural and spatial characteristics of the landscape, distance between patches of suitable habitat, presence of barriers to movement (e.g., roads, development), and interference from humans or predators (Noss et al. 1992). Conservation plans should identify which species the corridor or linkage is intended to address and how the corridor or linkage is intended to function. In general, will they be used only rarely, with their major function being to allow "rescue" of locally extinct populations? Or, will the corridor be used on a regular basis to migrate to feeding and/or breeding grounds?

Habitat linkages are defined herein as natural areas that not only provide connectivity between habitat patches but also provide year-round foraging and reproduction habitat for resident plants and animals. Corridors are defined herein as narrower connections between habitat patches that allow for wildlife movement and dispersal. Habitat linkages, rather than movement corridors alone, should be conserved wherever possible (e.g., where not constrained by existing development),

2) Maintain multiple linkages between habitats and resources where possible. Alternative movement corridors are especially important in areas subject to human use.

3) Identify and maintain existing movement corridors. Corridors channel animals in the appropriate direction by means of topography (canyons and ridgelines), dirt paths, streambeds, or fences. Riparian habitats are commonly used because they provide structural diversity of vegetative cover, an available water source, an abundance of insects and plant food, and microclimate with less intense temperature fluctuations than the surrounding upland habitats (Doyle 1990, Roberts et al. 1977).

4) Corridors should provide good vegetative and/or topographic cover (Noss 1983, Soule and Gilpin 1991).

5) Corridors can be combined with buffer zones to design a landscape that provides high quality wildlife habitat intermingled with low-intensity human land uses with a minimum of conflict (Noss 1983). This system involves having a core wildland area buffered by a zone of low-intensity land use. Beyond this would be an outer buffer zone of moderate-intensity land use providing an additional buffer from surrounding high-intensity land use areas.

6) Regional corridors should accommodate travel for a broad range of wildlife species as well as provide habitat for foraging and reproduction. Linkages that support resident populations of wildlife are more effective as corridors for those species (Bennett 1990). Regional corridors should have a year-round source of water.

7) The width of a corridor should be based on biological information for the target species (e.g., home range size and dispersal capabilities), the quality of the habitat within and adjacent to the corridor, topography, and edge effects of adjacent land uses. Where topography is lacking, the corridor must be well vegetated and development screened and well buffered from the center of the corridor. A corridor surrounded by natural vegetation may not need to be as wide to function as an appropriate travel corridor as it would need to be if the corridor were surrounded by development. If the corridor is relatively long, it must be wide enough for animals to hide in during the day. As a general rule, wide linkages are better than narrow ones, and narrow linkages should be relatively short in length. Corridors should have a maximum length of less than 500 feet for sections with a minimum width of 400 feet. A typical width greater than 1000 feet is recommended for large mammals and birds (Ogden 1992a). Corridors for bobcats, mountain lions, and deer should include the entire drainage (rim-to-rim), at least where the drainage is relatively steep (Ogden 1992a). Well landscaped parking areas associated with commercial/industrial parks and the corridor may buffer the corridor on one side of an

otherwise naturally vegetated corridor. Landscaped parks or golf courses can also contribute to the buffer of a corridor. Powerline easements may partially serve as movement corridors (Ogden 1992a).

8) A corridor should maintain visual stimuli (e.g., vegetative cover) along its entire length, or at least continually within sight, to keep animals moving through it. Developments along the rim of a canyon used as a corridor should be set back and visually screened with vegetation and/or fencing to minimize their visual impact

9) Corridors should have a minimum amount of human disturbance, especially at night, and low ambient noise levels during; the time (nighttime) that the target species are expected to use the corridor.

10) Minimize barriers such as roads. Roads that cross corridors should provide underpasses allowing large mammals and other animals to cross. Roads crossing the corridor should be fenced by at least a 10-foot fence that channels animals toward the wildlife underpass. Bridges are the preferred type of wildlife underpass; box and pipe culverts are infrequently used (Ogden 1992a). Corridors should be directed away from freeway interchanges. The length-to-width ratio of wildlife underpasses is less than 2. This ratio is less restrictive if the height of the underpass is greater than 30 feet (Ogden 1992a). Noise within underpasses should be less than 60 dBA during the time of day at which the animals use it. Corridors should be shielded from artificial lighting. Skylight openings within the underpass allow for vegetative cover within the underpass, and decrease the cave-like appearance, and thus will increase their success (Ogden 1992a).

11) Gnatcatchers likely prefer to disperse through coastal sage scrub, but will use riparian scrub, riparian woodland, and chaparral as well. Areas lacking sufficient shrub cover (e.g., extensive grassland) are probably avoided. Continuous corridors are probably more reliable than stepping-stone corridors, although disjunct patches of sage scrub do appear to be used if within short dispersal distances (1-2 miles, Ogden 1992b). Gnatcatchers probably do not disperse through high density development; however, they do use vegetated powerline and road casements that are mostly adjacent to low density development (Ogden unpubl. data, D. Bolger pers. comm.).

12) Establish a monitoring program to evaluate wildlife use of corridors. Develop a management program to improve corridor design and effectiveness by maintaining natural habitat structure, including removal of exotic plant and animal species, and limiting human access. Management programs may include active restoration of degraded habitats and agricultural areas, and retrofitting of existing roads (new underpasses) to allow wildlife to cross. It is useful to identify several "target species" for a corridor study. Based on the sizes of the open space areas being linked and habitat types occurring in the areas, the species most sensitive to the constraints of the potential corridors should be used as target species. Bobcats, mountain lions, and mule deer, for example, are much more sensitive to human presence and urbanization than are species such as coyotes, opossums, or skunks. Birds such as the California gnatcatcher are more sensitive to vegetation types and disturbance levels than other species. It can be assumed that if the target species can move through a corridor, then less sensitive species will be

able to move through as well. This will help in determining the effectiveness of corridors, especially in high constraint situations.

Page A-9-131

Objective 4 Maintain viable populations of priority animal species

POLICY 4.45 Preserve the long-term viability of the mountain lion *(Felis concolor).*

Standards

2) Provide for movement corridors between large patches of occupied habitat.

Implementation

1) Determine present population levels and distribution of mountain lions in western San Diego County. Conduct radio telemetry studies to determine habitat use and requirements, movement activities, and causes of mortality. Identification of both intra-range and inter-range movement corridors is essential because immigration and emigration is critical for population viability. Beier (1993) indicates that population of 15-20 adult individuals in an area of 150,000 to 400,000 acres of habitat would be viable if movement corridors are provided. Without corridors the habitat area required to maintain a viable population increases to 250,000 to 540,000 acres. Require site-specific surveys for mountain lion use and movement for all proposed projects containing chaparral, coastal sage scrub, riparian zones, and other habitats that could provide forage or cover. Surveys should evaluate the potential of a site as a movement corridor. Studies indicate that mountain lions use canyon bottoms for movement (Ogden 1992b). Studies should concentrate those areas that provide the best continuous cover and is buffered from development Site-specific studies should include an evaluation of the prey base in the area (i.e., deer and smaller mammals). Preserve and manage in natural open space the habitat and movement corridors identified as necessary for preserving the long-term viability of the mountain lion population.

2) Maintain movement corridors of at least 1000 feet in width where possible. This assumes that the lion is only moving through the corridor and not using it for foraging. Site-specific studies would be required to demonstrate that a narrower corridor was adequate for movement or use. Road crossings should be fitted with suitable underpasses since automobiles are a major source of mortality for mountain lions. Bridge-type underpasses should be at least 12 feet in height and at least half as wide as they are long. Fencing should be used along roads to direct crossings to the underpass.

3) Stabilize the preserved population by removing impacts or threat of impacts. Restrict factors within the preserve that could degrade mountain lion habitat and movement corridors. These factors include, but are not limited to, human disturbance, illegal hunting, unsafe road crossings that increase the incidence of road-kills, human activity, artificial lighting, and noise.

MSCP Monitoring Plan 1996

Page 4-1

A wildlife corridor can be defined as a linear landscape feature that allows animal movement between two patches of habitat or between habitat and geographically discrete resources (e.g., water). It is useful to differentiate between regional and local wildlife corridors. Regional corridors link two or more large areas of natural open space and are necessary to maintain demographic and genetic exchange between wildlife populations residing within these geographically disjunct areas. Local corridors allow resident animals access to necessary resources (e.g., water, food, cover, or den sites) within a large habitat patch, and they also may function as secondary connections to the regional corridor system.

The term "corridor" is used in a species-specific context (Soule 1991; Beier and Loe 1992). For example, a landscape feature that functions as a corridor for a songbird, such as a gnatcatcher, may not suffice for a bobcat or a reptile. In order to evaluate the arrangement of open space for its usefulness as a wildlife corridor, it is first necessary to identify a group of focal target species. These are species that naturally occur in relatively low densities and are unable to cross large areas of man-modified or otherwise unsuitable habitat. No single parcel of open space in southwestern San Diego County is likely to support viable populations of these focal species, and habitat linkages between large blocks of occupied habitat are required for regional population viability. The focal species to be monitored at the designated preserve habitat linkages are California gnatcatcher, coastal cactus wren, mammalian predators (mountain lion, coyote, and bobcat), and deer. This monitoring effort will achieve the plan objectives of collecting new biological data, evaluating the impacts of land uses and construction activities in and adjacent to the preserve, and evaluating management and enforcement difficulties in the preserve.

MSCP Plan 1998

Page 1-5

The MSCP was developed to conserve both the diversity and function of this ecosystem through the preservation and adaptive management of large blocks of interconnected habitat and smaller areas that support rare vegetation communities.

Page 2-1

When implemented, the MSCP and these other subregional plans will create an interconnected preserve system

Page 6-11

Biological monitoring will address several objectives

- Provide new data on species populations and wildlife movement

Page 6-12

Research topics could include the following

- Wildlife corridor and dispersal investigations

City of San Diego

City of San Diego Framework Management Plan 1997

Page 50

"To facilitate monitoring of selected target species, habitats, and linkages in order to ensure long-term persistence of viable populations of priority plant and animal species and to ensure functional habitats and linkages"

County of San Diego

MSCP County of San Diego Subarea Plan 1997

Page 1-11

1.2 Goals

The County Subarea Plan Objectives are to:

• Provide for the conservation of key regional populations of the covered species, and representation of sensitive habitats and their geographic subassociations in biologically functioning units; and

• Conserve large interconnected blocks of habitat that contribute to the preservation of wide-ranging species such as mule deer, golden eagle, and predators as appropriate. Special emphasis will be placed on conserving adequate foraging habitat near golden eagle nesting sites.

Page 4-5

4.2.1 Preserve Design Goals and Criteria for Cores and Linkages

Goals and criteria for conservation of core and linkage areas on both a project-by-project basis and for the Segment as a whole are to:

• Preserve the biological integrity of linkages between Biological Resource Core Area; and

• Achieve the conservation goals for covered species and habitats.

Pages 4-6 to 4-10

4.2.3 Linkages

The high and very high habitat value lands (Figure 4-1) will be the primary linkages that connect Core Biological Resource areas within the MSCP area or provide connections to habitat outside the MSCP area.

Goals and Criteria for Linkages and Corridors: Goals for linkages and corridors have been developed to aid in the evaluation of project impacts and of land being considered for conservation. For this discussion, a linkage is defined as an area of habitat that not only provides connectivity between core areas but also provides breeding and foraging habitat for resident species. Corridors are narrower connections that allow for movement and dispersal only.

The County Subarea Plan policy for habitat linkages is to minimize habitat fragmentation; provide habitat for plants and animals in transit; maintain genetic and demographic interchange between populations; facilitate daily, annual, and seasonal movements; permit dispersal to breeding and foraging areas; and facilitate 'rescue' of small peripheral populations from extinction. Meeting this policy calls for evaluating the habitat needs and dispersal characteristics of the target species and how they relate to the landscape and development patterns in the area. The following are the design criteria for projects to protect the biological values of linkages and corridors:

- Habitat linkages as defined by the Biological Mitigation Ordinance, rather than just corridors, will be maintained.

- Existing movement corridors within linkages will be identified and maintained.

- Corridors with good vegetative and/or topographic cover will be protected.

- Regional linkages that accommodate travel for a wide range of wildlife species, especially those linkages that support resident populations of wildlife, will be selected.

- The width of a linkage will be based on the biological information for the target species, the quality of the habitat within and adjacent to the corridor, topography, and adjacent land uses. Where there is limited topographic relief, the corridor must be well vegetated and adequately buffered from adjacent development.

- If a corridor is relatively long, it must be wide enough for animals to hide in during the day. Generally, wide corridors are better than narrow ones. If narrow corridors are unavoidable, they should be relatively short. If the minimum width of a corridor is 400 feet, it should be no longer than 500 feet. A width of greater than 1,000 feet is recommended for large mammals and birds. Corridors for bobcats, deer, and other large animals should reach rim-to-rim along drainages, especially if the topography is steep.

- Visual continuity (i.e., long lines-of-sight) will be provided within movement corridors. This makes it more likely that the animals will keep moving through it. Developments

along the rim of a canyon used as a corridor should be set back from the canyon rim and screened to minimize their visual impact.

• Corridors with low levels of human disturbance, especially at night, will be selected. This includes maintaining low noise levels and limiting artificial lighting.

• Barriers, such as roads, will be minimized. Roads that cross corridors should have 10 foot high fencing that channels wildlife to underpasses located away from interchanges. The length-to-width ratio for wildlife underpasses is less than 2, although this restriction can be relaxed for underpasses with a height of greater than 30 feet.

• Where possible at wildlife crossings, road bridges for the vehicular traffic rather than tunnels for wildlife use will be employed. Box culverts will only be used when they can achieve the wildlife crossing/movement goals for a specific location. Crossings will be designed as follows: sound insulation materials will be provided; the substrate will be left in a natural condition, and vegetated with native vegetation if possible; a line-of-sight to the other end will be provided; and, if necessary, low-level illumination will be installed in the tunnel. If continuous corridors do not exist, archipelago (or stepping-stone) corridors may be used for short distances. For example, the gnatcatcher may use disjunct patches of sage scrub for dispersal if the distance involved is under 1-2 miles.

County BMO (current)

Page 14

"Corridor" is a specific route that is used for movement and migration of species. A corridor may be different from a "Linkage" because it represents a smaller or more narrow avenue for movement.

"Linkage" shall mean an area of land which supports or contributes to the long- term movement of wildlife and genetic material.

County Framework Management Plan 1997

Page 11

In order to assure that the goal of the MSCP Preserve is attained and fulfilled, management objectives for the County of San Diego MSCP Preserve are as follows:

1. To ensure the long-term viability and sustainability of native ecosystem function and natural processes throughout the MSCP Preserve.
3. To enhance and restore, where feasible, the full range of native plant associations in strategic locations and functional wildlife connections to adjoining habitat in order to provide viable wildlife and sensitive species habitat.

4. To facilitate monitoring of selected target species, habitats, and linkages in order to ensure long-term persistence of viable populations of priority plant and animal species and to ensure functional habitats and linkages.

City of Chula Vista

Chula Vista Subarea Plan 2003

Page 7-1

Land located in the Preserve will be managed and maintained in accordance with specific management objectives as follows:

1. To ensure the long-term viability and sustainability of native ecosystem function and natural processes throughout the Preserve.

3. To enhance and restore, where feasible, appropriate native plant associations and wildlife connections to adjoining habitat in order to provide viable wildlife and sensitive species habitat.

4. To facilitate monitoring of selected target species, habitats, and linkages in order to ensure long-term persistence of viable populations of priority plant and animal species and to ensure functional habitats and linkages for those species.

City of Poway

Poway Subarea Habitat Conservation Plan/Natural Community Conservation Plan Vol. 1 1996

Page 3-8

3.3.3 Wildlife Corridors

Wildlife corridors are more or less linear vegetational or topographic features that facilitate movement of wildlife from one large habitat patch to another or between habitat and geographically discrete resources such as water Although the term wildlife corridor is often used synonymously with habitat linkage, corridors represent a subset of linkages in that linkages can include any habitat connections while corridors are generally considered narrow linkages that serve as pathways or funnels through which animals travel from one place to another. Corridors like linkages can be arbitrarily divided into regional and local scales. Regional corridors link two or more large areas of natural open space and are necessary to maintain demographic and genetic exchange between populations residing in these distinct areas. Movements through regional corridors would consist primarily of migration or dispersal by an animal to a new home range. Local corridors allow resident animals access to necessary resources such as food water and den sites within their daily home ranges.

Page 3-13

Preserve key linkages and corridors within the Mitigation Area that are currently afforded inadequate protection by existing constraints and ordinances.

Page 6-16

Evaluate and Prioritize Biological Restoration Needs

Evaluate restoration needs using the preserve biological management goals as a guideline Section 5.1 discusses existing habitat values and restoration needs restoration needed and the acreages affected. Restoration priorities may include habitat enhancement, increased habitat connectivity, increased areal extent of habitat or reduction of threats from invasive species. In some cases restoration or enhancement may be designed to improve the value of a movement corridor for target species by increasing vegetative cover or screening the corridor from nearby human influences.

Multiple Habitat Conservation Plan Documents

Volume I Final MHCP Plan 2003

Page 3-17

Preserve Configuration

Given the existing high degree of habitat fragmentation in the study area, it is not possible to achieve a biologically ideal preserve design consisting of large contiguous blocks of habitat connected by broad, unbroken landscape linkages. However, the MHCP will conserve as contiguous and functional a preserve system as possible given all of the legal, financial, and physical constraints to preserve design. In particular, the MHCP will (1) conserve and manage the majority (cumulatively, approximately 71%) of remaining BCLA; (2) help conserve a large core area contiguous with but outside the study area boundary in a regionally significant location; (3) conserve most east-west movement corridors between upland areas and coastal lagoon systems; (4) conserve a regionally significant north-south stepping stone corridor for bird species, especially the California gnatcatcher; (5) preserve significant landscape linkages between the study area and adjoining jurisdictions; and (6) restore and enhance linkage function in some critical locations. Nevertheless, many of these linkages and other habitat areas will be narrow and subject to severe edge effects. Consequently, active management to control edge effects and ensure ecosystem function will be required to achieve MHCP biological goals.

Page 3-20

North-south connectivity across the study area is currently only functional for birds due to intervening areas of development. The MHCP plan will allow for continued stepping-stone connectivity north-south across the study area for bird species, including the California gnatcatcher. Restoration of coastal sage scrub in some critical stepping-stone areas is expected

to improve functionality of this regionally important north-south linkage.

Linkages for small mammals, reptiles, amphibians, and invertebrates are nonexistent between many habitat blocks due to existing roads and urban and agricultural areas. However, some large blocks of habitat inside the study area (e.g., south San Marcos, north Escondido, and north Oceanside) are contiguous with larger blocks beyond the MHCP boundaries. These preserve areas are expected to sustain populations of many MHCP species that will otherwise be lost from more isolated portions of the MHCP preserve system. For example, San Diego horned lizards may be extirpated from interior preserve areas in the coastal cities, but are expected to persist on Daley Ranch, southern San Marcos, and northern Oceanside due to more extensive populations in adjacent habitats, outside of MHCP boundaries.

Page 3-30

3.7 REQUIREMENTS FOR SUBAREA PLANS TO PROTECT BIOLOGICAL RESOURCES

4. *Critical Locations.* Some Major Population areas, along with other areas that are considered essential to reserve design, are designated as *Critical Locations*, which are defined as "areas that must be substantially conserved for that species [or vegetation community] to be considered adequately conserved by the MHCP." Examples of Critical Locations include … essential wildlife movement corridors (especially for large mammals and selected amphibians, reptiles, and birds)… The MHCP Critical Location Policy (Appendix D of MHCP Volume II) applies to all locations listed and mapped as critical in MHCP Volume II, or that are found to meet the definition of critical in the future.

Volume III MHCP Biological Monitoring and Management Plan 2003

Page 4-5

Special Issues and Critical Assumptions

Connectivity between habitat fragments is assumed to facilitate dispersal and movements of plant and animal species among patches of habitat in the MHCP preserve network. The MHCP planning area is assumed to be a crucial bird dispersal corridor, connecting large patches of coastal sage scrub at Marine Corps Base (MCB) Camp Pendleton to the north and in the Multiple Species Conservation Program (MSCP) preserve system to the south. In particular, it is assumed that the "stepping stones" of coastal sage scrub habitats in the MHCP planning area maintain genetic and demographic connectivity between large core populations of the coastal California gnatcatcher on MCB Camp Pendleton and those in the MSCP planning area.

Page 4-6

Monitoring Protocols

Underpass (Pinch-point) Surveys. At each of the corridor pinch-points or underpasses, standardized track stations and remotely triggered camera stations will be established. Track

stations will be constructed near each opening of each underpass to detect animal movement on both sides of the undercrossing. Each track station will consist of a 1-m diameter circle of freshly sifted gypsum, 1 cm deep. In addition, to monitor animals traveling through an underpass, wildlife sign surveys will be conducted through presumed wildlife corridors (including under overpasses). Gypsum powder will be used in specific locations as necessary to improve the clarity of tracks. All tracks will be identified and measured, and direction of travel will be noted.

Each track station will be sampled for a minimum of 5 consecutive days during each of two sampling periods per year (summer and fall). For each undercrossing, relative abundance will be expressed as the total number of recorded visits for each species divided by the total sampling effort (Linhart and Knowlton 1975; Diefenbach et al. 1994). Surveys of mammal sign will be conducted once during each 5-day track station survey.

Remotely triggered infrared cameras will also be stationed at selected undercrossings. Although it would be valuable to have camera stations at all undercrossings, camera locations may need to be restricted to relatively concealed locations to minimize the possibility of camera theft or vandalism. Camera systems will serve to positively identify carnivore species present in the area and provide verification of track identifications at track stations.

Road-Kill Surveys. If possible, historical and current road-kill records will be obtained throughout the planning area from Caltrans and local cities that collect such information. Compilation and mapping of road kill information will help identify animal crossing locations, areas of high hazard for wildlife crossing roads, and possibly effects of increasing traffic over time. This information can be correlated with results of the track and camera sampling to identify areas where carnivores appear to be crossing over roads rather than using undercrossings.

City of Carlsbad

Habitat Management Plan for Natural Communities in the City of Carlsbad 2004

Page A-1

2. Goals and Objectives

The specific biological objectives of the Plan are to:

- Maintain functional wildlife corridors and habitat linkages within the City and to the region, including linkages that connect gnatcatcher populations and movement corridors for large animals

The specific conservation objectives of the Plan are to:

- Maintain functional linkages and movement corridors;

Page B-3

2. Definitions

Corridor: A defined tract of land, usually linear, through which a species must travel to reach habitat suitable for reproduction and other life-sustaining needs.

Linkage: A component of the preserve system established under the HMP, consisting of conserved habitat that provides connectivity between Cores and to natural communities within it (Figure 4).

Metapopulation: A network of semi-isolated breeding populations of a species that have some level of regular or intermittent migration and gene flow among them.

Special Resource Area (SRA): A component of the Focus Planning Areas established under the HMP, consisting of conserved habitat outside of HMP Cores and Linkages; SRAs are limited to areas with vernal pools, significant populations of listed plant species, and movement corridors for large mammals.

Stepping Stone Linkage: A discontinuous linkage or corridor that consists of a series of habitat patches separated by non-habitat patches. Individuals may move across the linkage by moving from one habitat patch to another. Generally, at least some of the stepping stones should support some breeding individuals of a species, at least in some years.

Page C-41

b. Conservation Goals

Conserved Linkages: Conservation planning for the California Gnatcatcher has focused primarily on the maintenance and enhancement of functional regional linkages that would ensure long-term connectivity between large Gnatcatcher populations that exist to the north and south of the City. Planning for the Gnatcatcher has focused conservation efforts on the maintenance and enhancement of Core Area 3 in northeastern Carlsbad and Linkage Areas A, C, D. To increase the effectiveness of this eastern linkage, coastal sage scrub habitat within linkage areas may be enhanced and restored to maximize breeding opportunities for Gnatcatchers. Maintaining stable populations of breeding Gnatcatchers in core areas 3 and 7 and providing breeding opportunities and functional corridors between these two core areas should ensure long-term regional demographic and genetic connectivity for this species.

Page D-76

2. HMP Conservation Goals

Establish, enhance, and maintain viable habitat linkages across Linkage Area B to ensure connectivity for gnatcatchers and other HMP species between Core Areas 3 and 4. Allow no net loss of wetlands and conserve through preservation, restoration or enhancement, 67% of coastal sage scrub.