

Chapter 4

Impact Assessment and Levels of Take

4.1 Introduction and Approach

This chapter addresses the potential effects of the covered activities described in Chapter 2, *Land Use and Covered Activities*. These potential effects are assessed for covered species, vegetation communities, and wetlands and streams. Direct impacts are assessed quantitatively; indirect impacts are assessed qualitatively.

Impact assessments were tailored to the three major categories of covered activities described in Chapter 2.

- Urban development within the UDA.
- Rural infrastructure projects outside the UDA.
- HCP/NCCP preserve activities.

4.1.1 Approach to Estimating Take

Implementation of the covered activities will result in take of some covered species. Where feasible, the level of incidental take has been identified. For most species, incidental take has been quantified on the basis of impacts on habitat assumed to be suitable for each species (see Table 3-10 and Appendix D). Estimates of incidental take are based on the habitat models developed for 20 of the 28 covered species. These estimates are likely to be inflated because (1) habitat models may overestimate the actual extent of suitable habitat (see species profiles in Appendix D for details on each model), and (2) not all suitable habitat is occupied by the subject species.

For eight of the covered species, sufficient information was not available to create habitat models. In these cases, worst-case assumptions were used regarding the amount of suitable habitat removed by covered activities.

4.1.2 Approach to Wetlands and Streams

The Plan uses two primary methods to determine the direct effects of covered activities on streams and wetlands: GIS analysis and field surveys conducted during implementation. A broad overview of potential impacts is provided through GIS analyses. A detailed stream layer and a wetlands layer were overlaid on the Plan's land use designation layer to identify potential impact areas. Impacts on streams and wetlands are assumed where the *development* land use designation (Table 2-2) and the location of covered rural infrastructure projects coincide with these features. However, this landscape-scale analysis may either overestimate or underestimate impacts. In both cases, an impact acreage cap is applied to the land-cover types on the basis of additional analysis and realistic estimation of the amount of take coverage required.

The GIS estimates of impacts on streams and wetlands are meant only as a means to estimate the rough impacts and to determine if enough acreage and sites are available for wetland and stream preservation and restoration to meet the conservation needs of the Plan. Because of the uncertainty in estimates of impacts on wetlands and other aquatic habitats, actual impacts will be determined in the field during implementation. All applicants for HCP/NCCP coverage will be required to conduct planning surveys, including jurisdictional wetland delineations, to determine the amount of wetlands and aquatic resources that occur on their property and the impacts that will affect these resources. See Chapter 6, *Conditions on Covered Activities*, for a description of these planning surveys. Required mitigation will be based on the results of these field surveys. Because of this process, successful implementation of the Plan will not rely on the uncertain impact estimates on streams and wetlands developed through GIS analysis.

4.2 Impact Mechanisms

Impact mechanisms are those actions affecting biological resources in the inventory area. Impact mechanisms can be direct, indirect, or cumulative.

Direct impacts are defined as ground-disturbing activities or projects that remove land-cover types, habitat for covered species, or populations (or portions of populations) of covered species. Direct impacts can be either permanent or temporary. Temporary impacts are defined as any impact on vegetation or habitat that does not result in permanent habitat removal.

USFWS defines *indirect impacts* as “those that are caused by the proposed action and are later in time, but are still reasonably certain to occur” (50 CFR 402.02). The definition of indirect impacts in this Plan also includes those impacts that take place at the time of the proposed action but occur beyond the footprint of a project or activity (i.e., beyond the area of land disturbance).

Cumulative impacts result from the proposed action's incremental impact when viewed together with past, present, and reasonably foreseeable future actions. Cumulative effects can result from individually minor but collectively significant actions that take place over time. The HCP/NCCP considers the cumulative effects of covered projects and activities as required under CEQA, NEPA, and Section 7 of the ESA.

Specific impact mechanisms are described for each of the major categories of covered activities: urban development within the UDA, rural infrastructure projects outside the UDA, and activities within HCP/NCCP preserves.

4.2.1 Urban Development within the UDA

The primary impact considered in this HCP/NCCP is urban development within the UDA. A wide variety of construction activities within this area (see Chapter 2) will result in extensive ground disturbance and permanent conversion of most land-cover types. New urban development may also further isolate remaining natural habitat within the UDA, rendering it less suitable or unsuitable for covered species. Some covered species (e.g., Swainson's hawk, tricolored blackbird) that occupy or use habitat removed by urban development will be able to escape construction activities. Avoidance and minimization measures in this Plan (Chapter 6) are designed to minimize injury or death of covered species (e.g., western burrowing owl, San Joaquin kit fox, California red-legged frog, California tiger salamander, covered plants) that cannot easily escape ground-disturbing activities. However, some take of individuals is expected to occur.

Urban development within the UDA will also have indirect effects on biological resources within the HCP/NCCP preserves as the neighboring human population grows. Population growth will increase the general use of the inventory area, including the HCP/NCCP preserves (where recreation is allowed). Increased human use within the inventory area may have adverse effects on biological resources in the form of collection, harassment, introduction or spread of diseases, competition from or predation by nonnative species, trash dumping, spills of hazardous materials, water quality degradation from road runoff, or increased frequency of wildfire ignitions (Table 4-1).

Human population growth can exacerbate the introduction or spread of nonnative species throughout the inventory area. Nonnative aquatic wildlife species are known to have serious impacts on native amphibian populations. For example, aquarium species released in the wild may introduce new diseases to wild amphibian or fish populations. Feral cats pose a serious threat to native birds, especially those that nest on or near the ground, as well as to native reptiles. Ornamental plants may spread to adjacent protected areas and outcompete native plant species.

The predicted increase in local and regional human population will also increase vehicular traffic on roads in the inventory area. San Joaquin kit fox as well as

covered birds, reptiles, and amphibians may be injured, killed, or disturbed by increased vehicular traffic.

New urban development at the edge of the UDA presents a distinctive set of potential indirect impacts on biological resources because of its close proximity to natural areas. The final locations of HCP/NCCP preserves are not known, but some preserve lands are expected to occur adjacent to or near urban areas. The HCP/NCCP conservation strategy includes measures to minimize some of these indirect effects through actions such as the creation of buffer zones and design of development that reduces impacts on wildlife. Despite these measures, however, indirect effects are still assumed to occur. Table 4-1 lists the major categories of these indirect impacts that may be particularly pronounced at the urban-wildland interface.

Streams and wetlands may be particularly susceptible to the indirect effects of urban growth. Urban development within the UDA can result in increased runoff of urban pollutants such as grease, oil, and lawn pesticides into local streams and aquatic habitats. Urban development increases the extent of impermeable surface, which can increase runoff immediately after rain events, altering downstream hydrology. Covered amphibian species rely on upland areas adjacent to breeding sites (ponds and other wetlands) for movement and aestivation. Wetlands near urban development may experience reduced function due to the loss and degraded quality of upland habitat surrounding them.

The only covered species that may utilize habitat within the UDA after implementation of covered activities are Swainson's hawk, California red-legged frog, silvery legless lizard, and western burrowing owl. Swainson's hawks may nest in riparian woodlands along urban streams as long as suitable foraging habitat is present within approximately 1 mile (Estep pers. comm.). California red-legged frogs may disperse into urban creeks or other urban areas from natural areas and may attempt to aestivate or breed. Frogs that disperse into upland urban areas will likely not survive due to hazards such as pets and vehicles. Western burrowing owls may persist in isolated vacant lots or small fields within the UDA. Silvery legless lizards currently occur within the UDA (and ULL) in suitable sandy soils and may persist there.

The projected limited increases in urban pollution and changes in urban hydrology are not expected to impair reproduction or movement of Swainson's hawk or movement of California red-legged frog through urban creeks. The noise associated with urban expansion and the proximity to humans may reduce the suitability of smaller patches of riparian woodland for Swainson's hawk within the UDA. Similarly, the suitability of urban habitat for western burrowing owl and silvery legless lizard is expected to decline as habitat patches become less common, smaller, and more fragmented.

4.2.2 Rural Infrastructure Projects outside the ULL

Rural infrastructure projects outside the ULL will have the same direct ground-disturbing effects as development within the ULL. The indirect effects of infrastructure projects will depend on the type of project.

Transportation Projects

New roads or major road improvements covered by the HCP/NCCP in natural land cover outside the ULL (see Chapter 2) will have impacts on many covered species far beyond the direct impacts of their footprints. New roads such as Buchanan Bypass will create major new hazards or barriers to the movement of species such as California red-legged frog, California tiger salamander, and western pond turtle in the absence of designs to minimize these effects. Depending on its placement, the Vasco Road to Byron Highway Connector may have similar effects on the same species, as well as San Joaquin kit fox. New roads also create dispersal corridors for nonnative plants; introduce runoff of car waste (e.g., oil, grease, radiator fluid); and create substantial noise and physical disturbance that may disturb covered species far from the road. Vehicular traffic on roads generate debris such as tires, litter, or car parts that can be hazardous to wildlife.

Road expansion projects in natural land-cover types outside the ULL will have similar effects on covered species as will new roads, although the effects of these projects will be less pronounced. Road expansion increases vehicular traffic and/or traffic speed, thus increasing injury or mortality of terrestrial species such as San Joaquin kit fox, California red-legged frog, Alameda whipsnake, and California tiger salamander. Nearby streams and wetlands may be affected by increased sedimentation or runoff during or after construction, or by runoff of oil and grease from larger roads with more traffic. Expanded roads may impair wildlife movement and increase habitat and population fragmentation by acting as movement hazards or barriers.

The expansion of Kirker Pass Road is expected to increase the existing barrier and hazard to California red-legged frog, California tiger salamander, and western pond turtle. The Vasco Road Widening/SR 84 project will likely affect the same species, as well as San Joaquin kit fox. The Vasco Road Widening project is by far the largest and longest rural road project in natural land-cover types covered by this Plan. Vasco Road traverses mostly annual grassland for more than 10 miles, creating a significant hazard to California tiger salamanders (Jones & Stokes Associates 1998b, 1999), California red-legged frog, and San Joaquin kit fox (Contra Costa Water District and U.S. Bureau of Reclamation 1993; Jones & Stokes Associates 1992a). Extensive tunnels, culverts, and special fencing were incorporated into the original Vasco Road project to reduce these hazards and barriers to wildlife movement. Widening Vasco Road would likely reduce the effectiveness of these designs and create a greater hazard to wildlife

within the center of one of the core HCP/NCCP preserves proposed by this Plan (see Chapter 5, *Conservation Strategy*).

Rural road projects in cultivated agricultural areas of the eastern portion of the inventory area are not expected to have the substantial direct or indirect effects of road projects in grassland, oak woodland, and other natural land-cover types because wildlife values in cultivated agricultural areas are lower. Furthermore, the covered species found in cultivated agriculture (e.g., Swainson's hawk, western burrowing owl, tricolored blackbird) would be primarily affected only by the actual footprint of roads rather than the indirect effects of road traffic or road medians.

Maintenance of existing, expanded, or new roads outside the ULL is a covered activity in this Plan (see Chapter 2). Routine or emergency operations and maintenance activities are expected to have minimal permanent or temporary impacts on covered species because the vast majority of these activities occur within the disturbed road or shoulder. Vegetation management along road shoulders and rights-of-way has the potential to disturb a narrow strip of habitat for covered species and possibly to injure or kill individuals that occur in this habitat.

Flood Protection Projects

Expansion of existing and construction of new detention basins outside the ULL will have small but measurable effects on covered species. When not in use, detention basins will be maintained as managed grassland, and will consequently provide some habitat function for grassland wildlife species. (Detention basins are assumed to be unsuitable for covered grassland plant species.) Accordingly, impacts of detention basin expansion and creation on covered wildlife are restricted to the construction period, the time to recovery after construction, and immediately after flood events when the basin holds water. More details on the expected effects of the Marsh Creek Reservoir Expansion project are found in Chapter 2.

Maintenance of existing flood control channels within and outside the ULL are also covered in this Plan. Regular dredging is needed in these channels to maintain their flood capacity. Dredging removes vegetation and temporarily disturbs habitat for covered species such as California red-legged frog, western pond turtle, and possibly foothill yellow-legged frog. If woody vegetation is removed, covered birds such as tricolored blackbird and Swainson's hawk may also be affected. Maintenance of sloughs or channels in the eastern portion of the inventory area may adversely affect giant garter snake. Maintenance of stream banks, levees, and channel rights-of-way (e.g., bank repair, vegetation management) could result in take of covered species, such as western burrowing owl or California red-legged frog, that utilize these habitats. Rodent control on levees and dams would reduce the available prey base for native raptors, including western burrowing owl, golden eagle, and Swainson's hawk, all of which are covered species.

Utility Construction and Maintenance

Utility construction may have direct effects within project footprints. Installation of underground utilities will entail linear disturbances involving trenching, movement of heavy equipment, and potential disruption of surface hydrology. Such activities could result in direct mortality of covered wildlife species (especially reptiles, amphibians, and plants); increased sediment discharge; and disturbance to habitat for any covered species.

Utility operations and maintenance may have temporary or low-impact indirect effects on covered species or habitat at or near the site of maintenance activities. Maintenance vehicles travelling on access roads or off road to conduct routine procedures or emergency repairs of powerlines, waterlines, or gas pipelines may cause injury or mortality of covered terrestrial species (e.g., San Joaquin kit fox, covered amphibians, covered plants); such activities may also disturb nesting or breeding wildlife species. Maintenance work involving minor grading or soil disturbance could cause increased sediment discharge into watercourses.

4.2.3 Activities within HCP/NCCP Preserves

Activities within HCP/NCCP preserves are expected to have a net benefit on all covered species (see Chapter 5). However, some conservation activities may have temporary or permanent adverse impacts on covered species resulting in take. Activities that are designed to benefit one or several covered species may have the effect of harming another set of covered species. However, the HCP/NCCP Preserve System is designed to be large enough to ensure that the net effect of all preserve activities is beneficial across the system.

Some habitat enhancement, restoration, and creation activities may temporarily and adversely affect covered species. For example, planting emergent vegetation in stock ponds could temporarily disturb California red-legged frogs occupying the pond. Periodic dredging of ponds to maintain pond capacity and habitat quality may also have temporary adverse effects on pond species.

Monitoring or research activities required by the HCP/NCCP (see Chapter 7, *Monitoring and Adaptive Management Program*) may also disturb wildlife. For example, in order to determine the presence of some covered species (e.g., California red-legged frog, vernal pool invertebrates), individuals must be handled by a qualified biologist. This qualifies as harassment—a form of take—under the ESA and requires authorization. All biologists working under the HCP/NCCP, after approval by USFWS, will be covered for their monitoring activities should any take occur.

Some management activities may also disturb or inadvertently harm covered species. For example, fuel breaks must be created in key areas of the preserves to minimize the risk of wildfire and to protect structures and adjacent lands. Creating and maintaining these fuel breaks may have minor adverse effects on

grassland-dependent species such as western burrowing owl and San Joaquin kit fox or chaparral-dependent species such as Alameda whipsnake.

Recreational or management facilities built by the Implementing Entity to support the preserves could result in a small amount of habitat removal. Facilities will be sited and built to avoid or minimize their effects on covered species, but a small amount of take may still occur. Recreational activities allowed on preserves are expected to have little or no impact on covered species. As described in Chapter 5, recreational uses will be limited to passive activities such as hiking and wildlife observation. Trails will be carefully sited and maintained to minimize their disturbance of habitat and potential disturbance to wildlife. Despite these restrictions, some take (e.g., harassment) is expected to occur to covered species sensitive to human disturbance as a result of recreational activities. These species include San Joaquin kit fox, Townsend's big-eared bat, and western pond turtle.

Table 4-1 lists indirect impacts of covered activities within the UDA and the Preserve System. Most of the indirect impacts of urban development will occur along or near the boundary between new urban development and new preserves. Because the urban areas are relatively consolidated, this boundary zone will be a comparatively small proportion of the total Preserve System.

4.2.4 Routine Agriculture near HCP/NCCP Preserves

Because the conservation strategy aims to increase populations of covered species through habitat enhancement, restoration, and creation within the HCP/NCCP Preserve System, certain species may disperse out of the preserves onto neighboring private lands. This Plan includes a Neighboring Landowner Assurances (NLA) program to protect landowners near preserves from the regulatory consequences of covered species expanding their occurrence onto their land. Coverage under the incidental take permits will be offered for all covered species to private lands within 1.0 mile of the HCP/NCCP Preserve System that are actively being used for agricultural purposes at the time the HCP/NCCP preserve is established. Coverage will be provided only for take beyond the baseline condition that existed prior to the establishment of the neighboring HCP/NCCP preserve.

The impacts from dispersal onto neighboring lands are anticipated to be very limited. These impacts are likely to affect only those covered species characterized by the criteria listed below.

- Species expected to increase on the preserve.
- Species likely to spread onto neighboring lands as populations increase.
- Species for which there is a reasonable likelihood of take from routine, ongoing agricultural activities on these lands.

Even though coverage will be extended for all covered species, only a small subset of covered species is anticipated to be affected by Neighboring Landowner Assurances: San Joaquin kit fox, western burrowing owl, western pond turtle, California red-legged frog, California tiger salamander, and possibly foothill yellow-legged frog. The other 22 covered species do not meet any of the criteria listed above.

Like Safe Harbor Agreements offered by USFWS, the NLA program does not allow take of listed species present before the neighboring HCP/NCCP preserve was established; rather, coverage is restricted to species that disperse onto lands after the creation of the neighboring preserve. Therefore, the NLA program will not result in additional take of covered species but may slightly reduce the beneficial effects of the HCP/NCCP conservation strategy. The NLA program is described in detail in Chapter 10, *Assurances*.

4.2.5 Methods and Assumptions for Assessing the Impact of Covered Activities

The amount of development within the UDA to be covered under the HCP/NCCP was carefully determined by County planning staff to balance the need to provide take authorization for all possible development with the need to estimate realistic build-out of participating jurisdictions for funding purposes. Quantitative estimates of the direct impacts of urban development within the UDA were obtained by overlaying two GIS layers—development of the initial urban development area and development of the maximum urban development area—on land-cover type and covered species habitat (i.e., habitat models). Projects that obtained take authorization prior to enactment of the Planning Agreement (November 2003) were considered urban development regardless of their current land cover. Projects that received entitlements after November 2003 were considered interim projects, as required by the NCCP Planning Agreement, and included in the overall impacts of covered activities within the UDA.

Quantitative estimates of the direct impacts of rural road projects were developed by County transportation planning staff. Quantitative estimates of the footprint of flood control projects were developed by staff of the County Flood Control District. A conservative project footprint was developed for both project types that incorporated possible construction footprints, grading, and staging areas. Approximate project locations were also digitized. Project impacts were estimated by overlaying the project footprints onto land-cover type and covered species habitat layers. When the exact location of a project was not yet known, estimates of footprint size and location were used that would have the maximum impact on biological resources. Construction of new or expanded detention basins in rural areas was considered a temporary impact because the projects would retain habitat value after vegetation recovery (detention basins within urban areas retain little or no habitat value). The impacts of utility projects outside the ULL were considered permanent for the purposes of this analysis because of the project-associated need to disturb soil or frequently disturb natural

land-cover types. Utility projects were estimated to affect up to 250 acres of all land-cover types, distributed in proportion to occurrence of each land-cover type in the inventory area.

The construction of recreation or management facilities within the preserves, including roads and trails, is estimated to result in up to 50 acres of impacts¹ on all land-cover types excluding wetlands, streams, and riparian woodland/scrub; impacts are distributed among land-cover types in proportion to their extent in the inventory area.

Temporary impacts are defined as any impact on vegetation or habitat that does not result in permanent habitat removal (i.e., vegetation can eventually recover). The impacts of temporary activities (other than utility operations) were not included in the calculations of total impacts on land-cover types or covered species habitat because these activities do not permanently remove habitat and are not quantitatively comparable to permanent impacts. The total footprint of covered temporary activities that could affect natural land-cover types outside the ULL (effects within the UDA are included in the development impacts described above) is assumed to be less than 500 acres. Expanded or new detention basins account for 300 acres of this impact, most of which (220 acres) involves annual grassland.

The impacts of conservation actions within HCP/NCCP preserves were not quantified because they are expected to be temporary and relatively small (much less than 1% of the total impact acreage) compared to the impacts of urban development and covered projects outside the ULL. The net effect of conservation actions within HCP/NCCP preserves will be highly beneficial to covered species and natural communities, as described in Chapter 5.

The following additional assumptions were used in the impact assessment.

- To the extent feasible, covered activities throughout the inventory area will be modified to avoid the breeding season of covered species. However, for the purposes of the impact analysis, activities were assumed to occur during the season(s) with the greatest potential impact on each covered species (e.g., during the breeding season).
- Covered activities will avoid take of all fully protected and extremely rare species (see Chapter 5).
- Future surveys unrelated to HCP/NCCP implementation that may require capturing and handling individuals of covered species are not assessed by this Plan, nor are they considered covered activities.
- All covered activities will avoid and minimize take in accordance with the conservation measures described in Chapter 6.

¹ Approximately 20 miles of new trails (5 acres), 20 miles of new roads (30 acres), and an additional 15 acres for management facilities and other recreational facilities.

4.3 Effects on Natural Communities, Wetlands, and Streams

Tables 4-2 and 4-3 summarize anticipated impacts on covered natural communities, wetlands, and streams under the minimum and maximum permit area. The effects of urban development, rural infrastructure projects, and activities within the preserves on these land-cover types are addressed below, assuming the maximum growth scenario.

In two cases, the GIS analysis overestimated the potential impacts on land-cover types; these errors were corrected. Approximately 56 acres of riparian woodland/scrub occurs within the ULL outside urban parks. A literal interpretation of the GIS analysis leads to the conclusion that 40 acres of this habitat would be removed by build-out within the UDA. Instead, urban streams are expected to be retained even with additional development. To account for this, the GIS estimate of impacts on riparian woodland/scrub was revised to 20 and 25 acres within the ULL under the initial and maximum urban development areas, respectively. Analysis of streams leads to similar overestimates of impact within the ULL. The GIS estimate of up to 54 miles of stream impacts was revised to allow only 0.6 and 0.8 mile of impact on mapped streams under the initial and maximum urban development areas, respectively. Impacts on larger, mapped streams will likely be restricted to narrow stream crossings for roads, bridges, pipelines, and other linear infrastructure. An impact cap for unmapped ephemeral creeks was added to allow up to 4.0 and 5.0 miles of impacts under the initial or maximum urban development areas, respectively. Ephemeral streams may be filled for development within the UDA, particularly in the hills above Pittsburg. The HCP/NCCP limits take authorization for riparian woodland/scrub and streams to ensure that these important resources are maintained in the inventory area.

4.3.1 Existing Protection

Approximately 42% of all natural land-cover types are currently preserved within parks and other conservation open space areas (e.g., conservation easements). The land-cover types that are well represented within these protected areas are rock outcrop (96%), chaparral/scrub (74%), and oak woodland (51%). The land-cover types that are poorly represented in parks and open space are alkali grassland (19%), riparian woodland/scrub (22%), undetermined wetlands (19%), seasonal wetland (11%), and ponds (29%).

4.3.2 Effects of Urban Development within the UDA

Urban development (as defined in Chapter 2) is the primary impact within the inventory area. Tables 4-2 and 4-3 quantify impacts on all land-cover types that will result from urban development within the UDA. Overall, the effects on chaparral/scrub and ponds are very low (up to 2 and 8 acres, respectively). No direct impacts are anticipated on rock outcrops, and relatively low direct impacts are expected on oak woodland and oak savanna (1% and 5%, respectively). The greatest impact on natural land cover occurs on annual grassland (4,363 acres).

This analysis assumes that most habitat types within the UDA will be permanently converted by urban development and will have little or no biological value for covered species or vegetation communities. However, land-cover types such as riparian woodland/scrub, streams, and important small-scale mitigation sites needed to avoid impacts on certain species (e.g., covered plants) may be largely conserved within the UDA (see Chapter 5).

The impact analysis includes potential impacts of Participating Special Entities within the UDA, as described in Chapter 8, *Plan Implementation*.

4.3.3 Effects of Rural Infrastructure Projects outside the ULL

Up to 730 acres of natural land-cover types are anticipated to be affected by rural infrastructure projects (Tables 4-2 and 4-3). A large proportion of this impact comes from the proposed expansion of the Byron Airport (approximately 122 acres of impact on natural land-cover types). Other projects that cause substantial direct impacts on natural land-cover types are Vasco Road Widening (estimated at up to 200 acres) and Buchanan Bypass (estimated at up to 50 acres). Rural infrastructure projects will be responsible for all predicted impacts on alkali grassland (123 acres). Much of this impact (43 acres) is expected to result from planned expansion of the Byron Airport.

Some infrastructure projects may have substantial indirect effects on covered species by creating barriers or hazards to movement and dispersal and fragmenting habitat. For example, the Buchanan Bypass will create a new hazard south of Pittsburg for California red-legged frogs and California tiger salamanders that use the surrounding annual grassland for aestivation and movement. This road will also isolate approximately 275 acres of annual grassland between the new road and urban development in Pittsburg. Habitat values in this area will decrease because mobile animals such as California red-legged frog and California tiger salamander will be less likely to access the habitat between the road and Pittsburg.

As discussed above, increasing the number of lanes on Vasco Road will increase the existing barrier and hazard to wildlife movement across the entire southeastern portion of the inventory area. Approximately doubling the road width will reduce the effectiveness of the wildlife tunnels and reduce the ability of wildlife to cross the road safely.

4.3.4 Effects of Activities in HCP/NCCP Preserves

In almost all cases, activities within the Preserve System are designed to enhance and augment covered communities, wetlands, and streams. Overall, any detrimental effects on these land-cover types are expected to be negligible relative to the benefits of the conservation strategy. Construction of limited recreational facilities (e.g., trails, parking areas) and management facilities (e.g., field offices, access roads) is expected to have a total footprint within the Preserve System of no more than 50 acres. Much of this footprint would occur on land already disturbed, and would have negligible effects on natural land cover.

4.4 Effects on Covered Species

This section describes the potential direct and indirect effects on covered species under the Plan. The major direct effects will result from habitat loss associated with urban development. Because this Plan utilizes a habitat-based approach, the determination of direct and indirect effects on covered species is based on the habitat disturbed for each species. Table 3-10 and the species profiles (Appendix D) provide additional information on specific biological needs for each covered species. Examples of overlays of habitat models with the permit area are shown in Figures 4-1 through 4-4. Impacts are described below for each taxonomic group. Estimates of impacts on covered species with habitat models are provided in Tables 4-4 and 4-5 under the initial and maximum urban development areas, respectively.

4.4.1 Mammals

Two mammals are covered by the Plan: Townsend's western big-eared bat and San Joaquin kit fox. Few recent sightings of the bat have been reported, and there are no published records of Townsend's western big-eared bat within Contra Costa County. However, the species likely roosts in the inventory area in suitable abandoned mines, abandoned buildings, and caves. At least two mines exist in the inventory area (Black Diamond Mines and mines within Antioch adjacent to Black Diamond Mines Regional Park), but it is unknown if Townsend's western big-eared bat occurs in them. Covered activities are not anticipated to directly affect these habitat features. However, if abandoned mines are incorporated into the Preserve System, mine stabilization may be needed for

safety; stabilization measures may result in take of Townsend's western big-eared bat if this species occupies those sites. Similarly, stabilization of old buildings in the Preserve System occupied by bats may result in direct or indirect impacts to this species. Indirect impacts (Table 4-1), such as increased harassment or disturbance due to overall population growth or recreation within the preserves, may affect small numbers of individual bats that roost in buildings, bridges, or other structures within the inventory area. Although habitat for this species was not modeled, the loss of up to 4,363 acres of annual grassland and 263 acres of wetlands and wetland complexes would reduce available foraging habitat for this species.

Within the inventory area, core habitat for San Joaquin kit fox is defined as annual grassland, alkali grassland, and oak savanna contiguous with grassland. Secondary foraging habitat occurs in agricultural fields and row crops. Because habitat fragmentation is a significant threat to kit fox, preservation of contiguous habitat is of primary importance. Ideally, contiguous habitat would be preserved that is wide enough to serve both as local foraging and breeding habitat (i.e., support one or more kit fox home ranges) and as regional movement habitat. The inventory area represents the northernmost extension of the species' range, so maintaining connectivity to Alameda County to the south is critical to maintaining the species in the inventory area. Within the inventory area, four major movement routes, trending northwest-southeast, are thought to link known occurrences in Black Diamond Mines Regional Park to the portions of its range in southern Contra Costa County (see Figure 5-5 and further discussion in Chapter 5). The southward expansion of Pittsburg and Brentwood would affect small portions of core habitat for kit fox, while growth of Byron and infill in Brentwood would affect small portions of habitat defined as low use in the HCP/NCCP model. The expansion of the Byron Airport would affect core habitat for this species. The westward expansion of Pittsburg would affect areas modeled as core habitat for kit fox, but this area may be outside the species' range. Overall, approximately 5,000 acres of core kit fox habitat have the potential to be affected by covered activities under the maximum urban development area relative to a total of approximately 64,000 acres of habitat throughout the inventory area (less than 8%) (Tables 4-4 and 4-5; Figure 4-1).

Although not a covered activity, the expansion of Antioch to the south has the potential to significantly impair a primary movement route through the Sand Creek and Lone Tree Valleys. The expansion of the Los Vaqueros Reservoir will also eliminate core habitat for this species and reduce movement routes. These impacts are discussed in Section 4.6, *Cumulative Impacts*.

Numerous indirect effects resulting from human population growth and increased urbanization have the potential to affect kit fox along the urban-wildland interface (Table 4-1). The Vasco Road Widening project will remove core habitat for kit fox and has the potential to substantially reduce its movement from Alameda County into Contra Costa County. Recreational use on HCP/NCCP preserves that support active kit fox home ranges will be prohibited or limited to avoid or minimize adverse impacts on the species. Increased risk of fire

associated with a larger human population may also harm or kill kit foxes and temporarily remove habitat.

4.4.2 Birds

Four bird species—tricolored blackbird, golden eagle, western burrowing owl, and Swainson’s hawk—are covered by the Plan. The potential growth of Oakley into the northeastern portion of the inventory area and growth within Contra Costa County towards the northwestern portion of the inventory area would affect primary foraging or breeding habitat for covered birds. Expansion of Clayton would affect small portions of primary foraging habitat for all species. As much as approximately 6,000–11,000 acres of primary foraging habitat for covered birds would be affected by covered activities under the maximum urban development area (Table 4-5). Approximately 6,500 acres of limited-use habitat for western burrowing owl and 1,700 acres of secondary foraging habitat for tricolored blackbird could also be affected by covered activities under the maximum urban development area. Some foraging habitat, particularly for golden eagle, would be affected as the result of infill within the participating cities.

While habitat for western burrowing owl is found throughout the inventory area, occurrences in the southeast portion of the inventory near the Byron Airport are best known (Glover pers. comm.). Within that area, expansion of unincorporated portions of the county near Byron and Discovery Bay have the potential to affect known populations and limited-use habitat². Expansion of the Byron Airport would also adversely affect a known population and its breeding habitat.

Within Contra Costa County, tricolored blackbirds forage and breed in freshwater marshes dominated by cattails or bulrushes or in areas with suitable willow, blackberry, thistle, or nettle habitat. Most core habitat for tricolored blackbird is outside the maximum urban development area (the core habitat along Marsh Creek is expected to remain intact, although it will decline in value as a result of increased urban development surrounding it). Approximately 13% of primary habitat (primary foraging and core habitat) for tricolored blackbird is within areas potentially affected by covered activities.

Although golden eagles are no-take species, this status applies only to take of individuals (e.g., nests). Take of foraging habitat is expected to be covered by the permits. Golden eagles forage in nearly all terrestrial natural land-cover types within the inventory area. Because most land-cover types outside the maximum urban development area are suitable for foraging, impacts from urban growth and other covered activities comprise a relatively small portion (approximately 13,000 acres, or 10%) of the total suitable habitat within the inventory area.

² *Limited-use habitat* for western burrowing owl is defined in the HCP/NCCP species distribution model as pasture or cropland land-cover types.

The predominant indirect effects on covered birds are increased harassment from people, increased vehicle-related disturbance (e.g., to breeding habitat near roads), and increased exposure to humans throughout the inventory area, including within HCP/NCCP preserves.

4.4.3 Reptiles

Four reptiles are covered by the Plan: silvery legless lizard, Alameda whipsnake, giant garter snake, and western pond turtle. Alameda whipsnake is endemic to the western and central portions of Alameda and Contra Costa Counties. Consequently, the inventory area constitutes an essential portion of the subspecies' existing habitat, which has been fragmented into five disjunct populations (U.S. Fish and Wildlife Service 2000, 2002). The HCP/NCCP inventory area encompasses approximately 75% of the Mount Diablo–Black Hills critical habitat unit, which supports one of these five populations.

Within the inventory area, core habitat for Alameda whipsnake is associated with open and low-growing shrubs, primarily chaparral, and surrounding grassland (Figure 4-2). Rock outcrops near these areas are also thought to be important for the subspecies. Alameda whipsnakes move relatively long distances between scrub patches (distances of up to 4 miles have been documented, but typical distances are closer to 1 mile), and habitat suitable for movement is important for the maintenance of healthy populations. Core and movement habitat types are scattered throughout the central and southwestern portions of the inventory area. The expansion of Clayton affects approximately 2 acres of core habitat, and rural infrastructure projects are expected to affect 5 acres of core habitat. Together this represents less than 1% of the total chaparral/scrub habitat within the inventory area. Expansion of these areas affects approximately 300 acres (less than 1%) of movement habitat in the inventory area.

The inventory area is known to provide significant habitat for silvery legless lizard. Within the inventory area, known occurrences of silvery legless lizard are restricted to the EBRPD Legless Lizard Preserve located east of the intersection of SR 4 and Big Break Road in Oakley. Based on the HCP/NCCP habitat model, suitable habitat for silvery legless lizard is restricted to sandy soils on less than 2,400 acres of the inventory area, scattered through the central and southeastern portions. Impacts on this suitable habitat are estimated at less than 1 acre.

Giant garter snake is known from the inventory area through one historic record near Antioch (Hansen pers. comm.) and on Dutch Slough in Oakley (Cain pers. comm.). Suitable habitat (breeding and movement) occurs in the sloughs and adjacent areas associated with agricultural fields. According to the HCP/NCCP model, approximately 386 acres of suitable habitat are found in the easternmost portion of the county. Within the inventory area, development west of Discovery Bay and the eastward expansion of Oakley have the greatest potential to affect garter snake habitat. Most suitable habitat is found within agricultural areas compatible with the biological needs of giant garter snake. Estimated impacts

under the maximum urban development area are 113 acres of breeding habitat and 2,600 acres of movement habitat (Table 4-5).

Western pond turtle is known to occur in the inventory area in the Marsh Creek and Kellogg Creek watersheds. Suitable core habitat is found in the many ponds scattered throughout the inventory area and along Marsh Creek and other streams and creeks. According to the HCP/NCCP model, there is 4,325 acres of core habitat outside of streams and approximately 33 miles of core habitat long streams. Movement habitat occurs along another 321 miles of streams. Impacts to perennial or intermittent streams will be restricted to less than one mile under both urban development scenarios, greatly limiting impacts to this species. Impacts will also be restricted to small stream crossings, so will not affect large blocks of habitat for western pond turtle. Urban development is estimated to affect up to 10% of core non-stream habitat for western pond turtle, primarily in urban areas along Marsh Creek. Urban development is estimated to affect up to 5% of non-stream movement habitat for the species.

4.4.4 Amphibians

Three amphibian species are covered amphibians by the Plan: California tiger salamander, California red-legged frog, and foothill yellow-legged frog. California tiger salamanders breed and lay their eggs primarily in stockponds, freshwater marsh, and seasonal wetlands that hold water long enough to support juvenile development. They also utilize terrestrial habitat for dispersal and aestivation. With both aquatic and terrestrial habitat needs, tiger salamanders often inhabit grasslands and the grassy understory of open woodlands near water (Jennings and Hayes 1994). Tiger salamanders disperse up to 1 mile between breeding (aquatic) and aestivation (upland) sites. It is estimated that urban growth and rural infrastructure projects outside the ULL have the potential to affect approximately 18 acres of breeding habitat (ponds and streams) and approximately 5,000 acres of movement or aestivation habitat. There is approximately 100,000 acres of potential suitable habitat (breeding, movement, and aestivation) available in the inventory area for this species.

The majority of known occurrences of California red-legged frog in the San Francisco Bay Area are within Contra Costa and Alameda Counties (U.S. Fish and Wildlife Service 2002a, 2004a). Breeding sites include both ponds and streams, and breeding adults are most often found in deep (more than 2 feet), still or slow-moving water with dense, shrubby riparian or emergent vegetation. Stockponds frequently provide suitable habitat. Any southward urban expansion of the participating cities has the potential to affect suitable stream or pond habitat. It is anticipated that stockponds throughout the inventory area could serve as suitable habitat if managed for proper hydroperiod, pond structure, vegetative cover, and control of nonnative predators. Because red-legged frogs can disperse over large distances (up to 2 miles), most portions of the inventory area that are currently undeveloped could serve as movement and/or aestivation habitat. It is estimated that urban growth has the potential to affect less than 6 acres of breeding habitat (ponds and streams) and less than 9,000 acres of

movement or aestivation habitat for California red-legged frog (Figure 4-3). Almost 113,000 acres of suitable breeding, migration, and aestivation habitat for California red-legged frog is estimated to exist within the inventory area.

Foothill yellow-legged frogs have the potential to occur in perennial segments of streams in the inventory area. These frogs require shallow flowing water in small to moderate-sized streams with at least some cobble-sized substrate. Foothill yellow-legged frogs would be affected by urban development and infrastructure projects that affect perennial streams. It is estimated that covered activities have the potential to affect approximately 1 acre, or 6%, of suitable core habitat for foothill yellow-legged frogs.

Because amphibians require both terrestrial and aquatic environments, and because they migrate between the two habitat types, they can be particularly sensitive to the effects of urbanization or other growth-related changes that permanently alter or expose either of these environments. Indirect effects that affect streams or ponds, including increased runoff of urban pollutants, spread of nonnative plants, and spread of nonnative predators, can adversely affect covered amphibians. Human activities or impacts that increase as the human population grows can also indirectly affect covered amphibians within the inventory area. These effects include light pollution, human disturbance, increased numbers of domestic predators (dogs and cats), introduction of other nonnative predators (e.g., bullfrogs), increased vehicle-related disturbance, and increased risk of wildfire.

4.4.5 Invertebrates

Four invertebrate species are covered by this Plan: longhorn fairy shrimp, vernal pool fairy shrimp, midvalley fairy shrimp, and vernal pool tadpole shrimp. The distribution of shrimp species within the inventory area is poorly known due to a paucity of surveys for the species and their habitats. Seasonal wetlands and vernal pools provide core habitat for all the covered shrimp species except longhorn fairy shrimp. Longhorn fairy shrimp occurs in ephemeral pools in sandstone rock outcrops. Although 121 acres of seasonal wetland complexes were mapped within the inventory area, an additional 490 acres of undetermined wetlands were identified, many of which may be suitable for covered shrimp species. Because these habitat features are difficult to identify from air photos and because access to private lands for field verification was restricted, habitat models for covered shrimp were not developed.

Most vernal pools in the inventory area are thought to be located either on public lands (Los Vaqueros Watershed, Cowell Ranch State Park; see Chapter 3) or near the Bryon Airport. Most of the seasonal wetlands around the Bryon Airport, including vernal pools, are within the Byron Airport Habitat Management Lands (e.g., Stromberg and Ford 2003). Small, scattered pools may occur in unsurveyed areas of the lower-elevation grassland habitat south of Antioch and Brentwood. Areas in which additional vernal pools could be found are expected to experience limited impacts both in absolute acreage and relative to the overall

proportion of available vernal pool habitat. Of the 605 acres of seasonal wetland complexes and undetermined wetlands identified in the inventory area, up to 134 acres (22%) would be lost to covered activities. This represents the maximum amount of habitat loss for all covered shrimp (assuming all 134 acres are suitable) except longhorn fairy shrimp.

Within the inventory area, longhorn fairy shrimp is known only from the Vasco Caves Regional Preserve and one rock outcrop immediately adjacent to it on private land. Accordingly, no direct impacts on longhorn fairy shrimp habitat are expected unless additional occupied areas are discovered within the permit area outside the Vasco Caves Regional Preserve. Indirect impacts to longhorn fairy shrimp may occur as a result of management and monitoring activities within the Preserve System.

Indirect effects on covered shrimp species include altered hydrology from runoff of covered activities, potential effects of the spread of exotic wildlife and plants, and an increased risk of wildfire from increased human presence (Table 4-1).

4.4.6 Plants

Determining the effects of activities on covered plants is complicated by the limited information regarding the exact locations of special-status plant populations. As was done for the analysis of wildlife impacts, habitat losses were estimated on the basis of known habitat attributes and the total area potentially disturbed, where this information was available. Species distribution models were developed for eight of the 11 covered plants: Mount Diablo manzanita, brittlescale, big tarplant, Mount Diablo fairy lantern, recurved larkspur, round-leaved filaree, Diablo helianthella, and Brewer's dwarf flax. These models predict the habitat in which covered plants may be found.

Impacts on the predicted ranges of these eight species are shown in Tables 4-4 and 4-5. With the maximum urban development area, a small fraction (less than 2%) of suitable range for five of the seven modeled covered plants (Brewer's dwarf flax, Diablo helianthella, Mount Diablo fairy lantern, Mount Diablo manzanita, recurved larkspur [Figure 4-4]) would be directly affected by covered activities. Up to approximately 10% of the suitable range for big tarplant and round-leaved filaree (primary and secondary habitat for both species) could be affected under the maximum urban development area. Habitat models could not be developed for San Joaquin spearscale, showy madia, or adobe navarretia because of the difficulty in predicting suitable habitat on the basis of land-cover types and other regional features.

Impacts were also estimated for all covered plants based on the number of known occurrences that could be removed by covered activities (Table 4-6). Known occurrences are based on CNDDDB data and surveys of large tracts (e.g., Jones & Stokes 1989; Mundie & Associates and City of Antioch 2002). Occurrences within large urban areas are assumed to be extirpated; all remaining occurrences are assumed to be extant. No known occurrences of Mount Diablo manzanita,

Mount Diablo fairy lantern, Diablo helianthella, Brewer's dwarf flax, showy madia, or adobe navarretia are expected to be lost as a result of covered activities within the UDA. Only one or two occurrences each of the other five covered plants is expected to be lost as a result of covered activities within the UDA. Covered activities outside the UDA, including road grading, road expansion, utility construction and maintenance, and habitat restoration could directly affect populations of all covered plants, but location data are not sufficient to precisely determine impacts.

Covered plants could be subject to indirect adverse effects through increases in human use of recreational areas (e.g., trampling), the spread of invasive nonnative plants, or the increased risk of wildfire associated with a growing human population (Table 4-1).

4.5 Effects on Critical Habitat

Critical habitat is designated in formal rules by USFWS and NOAA Fisheries for specific areas that have the physical and biological features essential to the conservation and recovery of listed species. Section 7 of the ESA prohibits the destruction or adverse modification of designated critical habitat by any activity authorized by a federal agency. Because USFWS will be issuing a federal permit to participating jurisdictions, the Plan's effects on critical habitat must be evaluated against these regulatory standards.

Critical habitat for two species covered by this HCP/NCCP is found in the inventory area: vernal pool fairy shrimp and longhorn fairy shrimp. Critical habitat for Contra Costa goldfields, a no-take species, is also found. Potential impacts on critical habitat are evaluated below.

4.5.1 Vernal Pool Fairy Shrimp and Longhorn Fairy Shrimp

In August 2003, USFWS designated critical habitat for four vernal-pool crustaceans and 11 vernal pool plants (U.S. Fish and Wildlife Service 2003)³. Critical habitat for vernal pool fairy shrimp, longhorn fairy shrimp, and vernal pool tadpole shrimp was designated at this time. All three species are covered by this Plan, but only critical habitat for vernal pool fairy shrimp and longhorn fairy shrimp is found within the inventory area. Critical habitat for these species is defined as areas consisting of primary constituent habitat elements within a 1.2-million-acre region. These elements are similar for the two species and are further defined by USFWS as complexes of vernal pools, swales, and other ephemeral wetlands that retain water long enough for the species to successfully

³ On December 22, 2004, the USFWS reopened public comment on critical habitat for vernal pools in Butte, Sacramento, Madera, Solano, and Merced Counties that was excluded from the 2003 final rule. The uncertainty regarding vernal pool critical habitat surrounding this notice does not affect critical habitat in Contra Costa County.

reproduce and possibly disperse through overland flow. In Contra Costa County, both species are generally found in sandstone outcrop pools. For vernal pool fairy shrimp this occurrence represents the only known location that supports vernal pool fairy shrimp within sandstone outcrop pools. Similarly, critical habitat for longhorn fairy shrimp in Contra Costa County is also found in sandstone rock outcroppings, which represent a unique habitat type for the species and helps maintain a diversity of habitat types in which the species can be found across its known range.

Longhorn fairy shrimp has approximately 300 acres of designated critical habitat in the inventory area wholly within Vasco Caves Regional Preserve (Unit 1A). Critical habitat for vernal pool fairy shrimp within the inventory area is found in two subunits. Subunit 19A is located south of Brentwood near the Marsh Creek Reservoir. Subunit 19B is located north, west, and south of the Byron Airport.

Limited urban growth or covered rural infrastructure projects will occur in the area where critical habitat is designated. Covered rural infrastructure projects that may affect critical habitat include the Vasco Road Widening, the Vasco Road–Byron Highway Connector (depending on its siting), and expansion of the Byron Airport. Table 4-7 shows the estimated overlap of critical habitat for vernal pool fairy shrimp in subunits 19A and 19B and activities covered by the Plan. There is 2.4 acres of overlap between covered activities and wetland land-cover types that may support critical habitat for this species. Another 35.3 acres of annual grassland and alkali grassland within critical habitat for vernal pool fairy shrimp may be affected by covered activities. Small wetland features within these grassland types may also constitute critical habitat for this species.

4.5.2 Contra Costa Goldfields

Contra Costa goldfields (*Lasthenia conjugens*) is considered a no-take species in this Plan (see Chapter 5 and Table 6-2 for a discussion of this special category). As the name suggests, take of this species is not authorized under this Plan. USFWS has designated 3,406 acres in the inventory area as critical habitat for Contra Costa goldfields in and around Bryon Hot Springs and the Byron Airport (Unit 7; U.S. Fish and Wildlife Service 2003). Habitat for this species at this site may include alkali grassland, annual grassland, and seasonal wetland. Up to 1.1 acres of critical habitat for Contra Costa goldfields may be affected by covered activities (Table 4-7).

4.6 Cumulative Impacts

As described above, the impacts of covered activities were assessed relative to existing conditions in the inventory area. Covered activities were defined as inclusively as possible to encompass a wide variety of projects related to urban development (see Chapter 2). Some activities and projects that are outside the scope of this HCP/NCCP may nonetheless contribute to cumulative impacts on

covered species. Specific projects and activities not covered by this Plan that may, in conjunction with this Plan, have an impact on covered species are described below. Additional potential cumulative impacts can be found in the EIR/EIS for this Plan.

4.6.1 Urban Development in Antioch

Under its current General Plan, the City of Antioch would expand urban development through a combination of infill and building up to its southern city limit. Table 4-8 summarizes the impacts of this development on land-cover types in the inventory area. While infill development primarily affects ruderal land cover, build-out to the southern city limit would remove up to 2,607 acres of annual grassland.

The potential expansion of urban development in Antioch would affect several species covered by this Plan. The southward expansion of Antioch would affect core habitat for San Joaquin kit fox and degrade or potentially eliminate the widest and best-functioning potential movement route for the species (see Chapter 5 for a more detailed evaluation of these movement routes). All four covered bird species would be affected by Antioch's expansion. Suitable California red-legged frog and California tiger salamander habitat is present within the proposed expansion area; urban development would remove or isolate ponds and degrade streams. A small amount of core habitat as well as movement habitat for Alameda whipsnake is located within Antioch. Primary and secondary habitat for both big tarplant and Brewer's dwarf flax are found in the proposed expansion area.

4.6.2 Los Vaqueros Reservoir Expansion

The Los Vaqueros Reservoir was initiated in 1988 when voters approved bonds for the development of a new reservoir to improve water quality and provide emergency storage. The Los Vaqueros facility, owned by CCWD, captures and stores Delta water for the residents of Contra Costa County. Planning for expansion of the existing reservoir is currently underway. The planned expansion has the potential to affect several covered plant and animal species as well as covered vegetation communities. The cumulative effects of the project will be considered before mitigation is developed.

The expansion project anticipates potential disturbance of up to 2,595 acres of all land-cover types⁴. The largest anticipated impacts would be on annual grasslands (up to 2,081 acres), with smaller impacts occurring on oak woodlands (309 acres), agriculture (189 acres), and chaparral/scrub (11 acres). The following covered species would be subject to cumulative effects from the reservoir

⁴ All impact estimates of the Los Vaqueros Reservoir expansion project are from the project web site: www.lvstudies.com.

expansion and implementation of the Plan: San Joaquin kit fox, golden eagle, western burrowing owl, Swainson's hawk, Alameda whipsnake, western pond turtle, California tiger salamander, California red-legged frog, big tarplant, round-leaved filaree, and Brewer's dwarf flax.

Of the covered species potentially affected by the reservoir expansion, San Joaquin kit fox and Alameda whipsnake have the greatest potential to experience substantial cumulative effects. Expansion of the reservoir has the potential to remove movement habitat along the southern, western, and northern edges of the current reservoir. Reducing the available habitat will reduce the chance that kit foxes can successfully disperse between Contra Costa and Alameda Counties. Expansion of the reservoir will also reduce the available breeding and foraging habitat for kit fox in an area known to support them.

Alameda whipsnake, a species of very limited habitat association, is vulnerable to cumulative effects because of its restricted range. Almost all suitable habitat removed in the area would constitute an impact on the species throughout its range. Between 5 and 11 acres of chaparral/scrub habitat, which may be suitable for Alameda whipsnake, will be affected by the reservoir expansion. An additional 2 acres of core habitat may be affected by implementation of the HCP/NCCP, for a total of 13 acres of core habitat potentially removed by both projects. This combined total comprises less than 1% of the existing core habitat in the inventory area.

4.6.3 Ongoing and Routine Agriculture

Ongoing and routine agricultural activities in the inventory area not eligible for the NLA program are not covered by this Plan. However, it is anticipated that the effects of ongoing agricultural activities on covered species will be relatively low. There is the potential for cumulative effects on covered species to accrue over a larger regional scale. Ongoing ranching operations may limit or degrade habitat for riparian species such as western pond turtle, California tiger salamander, California red-legged frog, and foothill yellow-legged frog. Rodent control on grazing lands may adversely affect golden eagle, western burrowing owl, California tiger salamander, and California red-legged frog. Some ongoing cultivated agricultural activities may limit or degrade habitat for tricolored blackbird, western burrowing owl, Swainson's hawk, and giant garter snake. Cumulative effects on covered plants could result from trampling by cattle or changes in agricultural practices that diminish currently available habitat for covered species.

4.6.4 Wind Turbine Operation and Repowering

Wind turbines are common in the southeastern corner of the inventory area in the rolling hills west of the Byron Airport on either side of Vasco Road (see Figure 2-3). Operation of wind turbines is not a covered activity under this Plan. The

area supporting wind turbines provides important breeding and foraging habitat for many raptors, including golden eagle and western burrowing owl. However, operation of these wind turbines is a serious hazard to many birds, especially red-tailed hawk, American kestrel, western burrowing owl, and golden eagle (Orloff and Flannery 1992, 1996; Thelander and Rugge 2000; National Wind Coordinating Committee 2001; Thelander et al. 2003). Construction of turbines and their access roads also removes or degrades habitat for terrestrial species such as San Joaquin kit fox, California red-legged frog, and California tiger salamander. Monitoring activities associated with wind turbine use may disturb species such as San Joaquin kit fox.

There are projects underway in Contra Costa County to replace older turbines with fewer, larger turbines. This “repowering” may reduce adverse impacts on native and special-status species because of improved turbine design and siting. Despite these improvements, adverse effects are expected to continue and contribute to a cumulative impact in the region to the following covered species: golden eagle, western burrowing owl, San Joaquin kit fox, California red-legged frog, and California tiger salamander.

4.6.5 Use of Existing Roads

As described above, the construction of rural roads covered by this Plan is expected to increase mortality of covered species such as San Joaquin kit fox, California red-legged frog, and California tiger salamander. Continued use of existing rural roads (i.e., those not covered by the Plan) will contribute to a cumulative impact on these species through continued mortality and injury. The magnitude of this cumulative impact is unknown.

Chapter 4

Tables

Table 4-1. Potential Indirect Adverse Impacts on Covered Species from Urban Development and Operation of the HCP/NCCP Preserve System

	Lights in New Urban Areas	Harassment, Disturbance from More People	Harassment or Injury from Additional Pets	More Noise	Increased Vehicle-Related Disturbance and Mortality	Spread of Invasive Exotic Plants or Wildlife	Increased Risk of Wildfire ¹	Increased Runoff of Urban Pollutants	Increased Recreation in Preserves	HCP/NCCP Restoration Activities ²	HCP/NCCP Monitoring
Approx. Location of Impact											
Outside Preserves	✓	✓	✓	✓	✓	✓	✓	✓ ³			
Within HCP/NCCP Preserves		✓	✓		✓	✓	✓		✓	✓	✓
Within existing parks/open space		✓	✓		✓	✓	✓		✓	✓	
Covered Species Potentially Affected											
Townsend's western big-eared bat	✓ ⁴	✓			✓				✓		✓
San Joaquin kit fox	✓	✓	✓	✓	✓		✓		✓	✓	✓
Tricolored blackbird		✓							✓	✓	✓
Golden eagle		✓		✓	✓		✓		✓		✓
Western burrowing owl		✓	✓		✓		✓		✓	✓	✓
Swainson's hawk		✓			✓				✓		✓
Silvery legless lizard		✓	✓		✓	✓	✓		✓	✓	✓
Alameda whipsnake		✓	✓		✓		✓	✓	✓	✓	✓
Giant garter snake		✓	✓		✓	✓		✓	✓	✓	✓
Western pond turtle		✓	✓		✓	✓	✓	✓	✓	✓	✓
California tiger salamander		✓	✓		✓	✓	✓	✓	✓	✓	✓
California red-legged frog	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Foothill yellow-legged frog	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓
Shrimp species			✓			✓	✓	✓	✓	✓	✓
Mount Diablo manzanita		✓				✓	✓		✓ ⁵		✓
Brittlescale		✓				✓	✓	✓	✓ ⁵	✓	✓
San Joaquin spearscale		✓				✓	✓	✓	✓ ⁵	✓	✓
Big tarplant		✓				✓	✓		✓ ⁵		✓
Mount Diablo fairy lantern		✓			✓	✓			✓ ⁵		✓
Recurved larkspur		✓				✓		✓	✓ ⁵		✓
Round-leaved filaree		✓				✓	✓		✓ ⁵		✓
Diablo helianthella		✓				✓	✓		✓ ⁵		✓
Brewer's dwarf flax		✓				✓	✓		✓ ⁵		✓
Showy madia		✓				✓	✓		✓ ⁵		✓
Adobe navarretia		✓				✓	✓		✓ ⁵		✓

Notes:
¹Includes grading, clearing, disking, mowing, irrigation and other fire suppression activities, plus the temporary damage done by the wildfire itself
²Restoration would occur within existing public land only if opportunities were not available within HCP/NCCP Preserves. Adverse impacts from restoration activities on covered species are expected to be temporary; long-term effects of restoration will be beneficial.
³Impacts from increased runoff of urban development downstream of urban development would be confined to streams and channels and would not affect terrestrial covered species.
⁴Increased lights may benefit Townsend's Western big-eared bat.
⁵Potential impacts if recreational users go off-trail.

Table 4-2. Direct Impacts on Land-Cover Types and Covered Natural Communities under Initial Urban Development Area Scenario (acres)

Land-Cover Type	Total in Inventory Area	Outside Parks, Open Space ¹ (% of total)	Estimated Direct Impact			Remain Outside Parks and Open Space
			Urban Development in Initial UDA	Rural Infrastructure	Total Impact (% outside Parks, Open Space)	
Terrestrial Land-Cover Types²						
Annual grassland	59,133	34,082 (58%)	1,892	485	2,377 (7%)	31,705
Alkali grassland	1,997	1,564 (78%)	0	123	123 (8%)	1,442
Rock outcrop ³	119	5 (4%)	0	0	0 (0%)	5
Ruderal	6,470	6,045 (93%)	1,437	20	1,457 (24%)	4,588
Subtotal Grassland Vegetation Community ⁴	67,719	41,696 (62%)	3,329	628	3,957 (9%)	37,739
Oak savanna	5,894	3,200 (54%)	40	14	54 (2%)	3,146
Oak woodland	24,198	11,914 (49%)	23	38	61 (1%)	11,853
Subtotal Oak Woodland Vegetation Community ⁴	30,092	15,114 (50%)	63	52	115 (1%)	14,999
Chaparral/scrub	3,016	791 (26%)	0	5	5 (1%)	786
Riparian woodland/scrub	448	351 (78%)	20	10	30 (9%)	321
Wetlands, Ponds, and Streams						
Wetland (undetermined)	484	387 (80%)	88	10	98 (25%)	289

Land-Cover Type	Total in Inventory Area	Outside Parks, Open Space ¹ (% of total)	Estimated Direct Impact			
			Urban Development in Initial UDA	Rural Infrastructure	Total Impact (% outside Parks, Open Space)	Remain Outside Parks and Open Space
Alkali wetland complex	380	196 (52%)	10	19	29 (15%)	167
Seasonal wetland complex	121	107 (89%)	21	0	21 (20%)	86
Aquatic	3,240	1,806 (56%)	12	5	17 (1%)	1,789
Pond	165	116 (70%)	6	1	7 (6%)	110
Slough/channel	213	204 (96%)	72	1	73 (36%)	131
Subtotal	4,604	2,817 (61%)	209	36	244 (9%)	2,572
Mapped streams (miles) ⁵	408.9	257.6 (63%)	0.4	0.2	0.6 (0%)	257.0
Unmapped ephemeral creeks (miles) ⁵	n/a	n/a	3.0	1.0	4.0	n/a
Subtotal All Natural Land-Cover Types	105,879	60,768 (57%)	3,620	730	4,351 (7%)	56,418
Cultivated Land-Cover Types						
Cropland	21,221	20,963 (99%)	2,552	120	2,672 (13%)	18,291
Pasture	4,645	3,754 (81%)	1,212	426	1,638 (44%)	2,117
Orchard	4,187	4,185 (100%)	693	12	706 (17%)	3,479
Vineyard	2,141	1,902 (89%)	749	10	759 (40%)	1,143
Subtotal	32,194	30,804 (96%)	5,205	569	5,774 (19%)	25,030

Land-Cover Type	Total in Inventory Area	Outside Parks, Open Space ¹ (% of total)	Estimated Direct Impact			Remain Outside Parks and Open Space
			Urban Development in Initial UDA	Rural Infrastructure	Total Impact (% outside Parks, Open Space)	
Other Land Cover Types						
Nonnative woodland	51	44 (87%)	24	0	25 (56%)	19
Wind turbines	217	124 (57%)	0	0	0 (0%)	124
Turf	1,477	1,210 (82%)	99	2	102 (8%)	1,109
Subtotal	1,745	1,378 (79%)	124	3	126 (9%)	1,252
TOTAL	139,818	92,951 (66%)	8,949	1,302	10,251 (11%)	82,700

¹ Parks and Open Space are defined in Table 2-2; they represent lands that are permanently protected for conservation purposes

² Number may not add exactly due to rounding

³ Some rock outcrops occur within oak savannah or oak woodland but all are assigned to the grassland community for the purposes of this analysis

⁴ Excludes wetland land cover types

⁵ Stream data not included in impact totals because it is an overlay data set (i.e., it overlaps with the land cover type data).

Table 4-3. Direct Impacts on Land-Cover Types and Covered Natural Communities under Maximum Urban Development Area Scenario (acres)

Land Cover Type	Total in Inventory Area	Outside Parks, Open Space ¹ (% of total)	Estimated Direct Impact			
			Urban Development in Maximum UDA	Rural Infrastructure	Total Impact (% outside Parks, Open Space)	Remain Outside Parks and Open Space
Terrestrial Land Cover Types²						
Annual grassland	59,133	34,082 (58%)	3,878	485	4,363 (13%)	29,719
Alkali grassland	1,997	1,564 (78%)	0	123	123 (8%)	1,442
Rock outcrop ³	119	5 (4%)	0	0	0 (0%)	5
Ruderal	6,470	6,045 (93%)	1,512	20	1,532 (25%)	4,513
Subtotal Grassland Vegetation Community ⁴	67,719	41,696 (62%)	5,390	628	6,018 (14%)	35,678
Oak savanna	5,894	3,200 (54%)	163	14	177 (6%)	3,023
Oak woodland	24,198	11,914 (49%)	75	38	113 (1%)	11,801
Subtotal Oak Woodland Vegetation Community ⁴	30,092	15,114 (50%)	238	52	290 (2%)	14,824
Chaparral/scrub	3,016	791 (26%)	2	5	7 (1%)	784
Riparian woodland/scrub	448	351 (78%)	25	10	35 (10%)	316
Wetlands, Ponds, and Streams						
Wetland (undetermined)	484	387 (80%)	90	10	100 (26%)	287

Land Cover Type	Total in Inventory Area	Outside Parks, Open Space ¹ (% of total)	Estimated Direct Impact			
			Urban Development in Maximum UDA	Rural Infrastructure	Total Impact (% outside Parks, Open Space)	Remain Outside Parks and Open Space
Alkali wetland complex	380	196 (52%)	12	19	32 (16%)	165
Seasonal wetland complex	121	107 (89%)	34	0	34 (32%)	73
Aquatic	3,240	1,806 (56%)	12	5	17 (1%)	1,789
Pond	165	116 (70%)	7	1	8 (7%)	108
Slough/channel	213	204 (96%)	72	1	73 (36%)	131
Subtotal	4,604	2,817 (61%)	228	36	263 (9%)	2,553
Mapped streams (miles) ⁵	408.9	257.6 (63%)	0.5	0.3	0.8 (0%)	256.8
Unmapped ephemeral creeks (miles) ⁵	n/a	n/a	4.0	1.0	5.0	n/a
Subtotal All Natural Land Cover Types	105,879	60,768 (57%)	5,882	730	6,612 (11%)	54,156
Cultivated Land Cover Types						
Cropland	21,221	20,963 (99%)	4,177	120	4,297 (20%)	16,666
Pasture	4,645	3,754 (81%)	1,212	426	1,638 (44%)	2,117
Orchard	4,187	4,185 (100%)	803	12	815 (19%)	3,370
Vineyard	2,141	1,902 (89%)	1,003	10	1,013 (53%)	889
Subtotal	32,194	30,804 (96%)	7,195	569	7,763 (25%)	23,041

Land Cover Type	Total in Inventory Area	Outside Parks, Open Space ¹ (% of total)	Estimated Direct Impact			
			Urban Development in Maximum UDA	Rural Infrastructure	Total Impact (% outside Parks, Open Space)	Remain Outside Parks and Open Space
Other Land Cover Types						
Nonnative woodland	51	44 (87%)	24	0	25 (56%)	19
Wind turbines	217	124 (57%)	0	0	0 (0%)	124
Turf	1,477	1,210 (82%)	99	2	102 (8%)	1,109
Subtotal	1,745	1,378 (79%)	124	3	126 (9%)	1,252
TOTAL	139,818	92,951 (66%)	13,201	1,302	14,502 (16%)	78,449

¹ Parks and Open Space are defined in Table 2-2; they represent lands that are permanently protected for conservation purposes

² Number may not add exactly due to rounding

³ Some rock outcrops occur within oak savannah or oak woodland but all are assigned to the grassland community for the purposes of this analysis

⁴ Excludes wetland land cover types

⁵ Stream data not included in impact totals because it is an overlay data set (i.e., it overlaps with the land cover type data).

Table 4-4. Direct Impacts on Covered Species under Initial Urban Development Area Scenario (acres)

Species	Total in Inventory Area	Outside Parks and Open Space (% of total)	Estimated Direct Impact			Remain outside Parks and Open Space
			Urban Development in ULL	Rural Infrastructure	Total Impact (% outside Parks and Open Space)	
Mammals						
San Joaquin kit fox						
core habitat	64,508	38,904 (60%)	2,166	365	2,530 (7%)	36,373
low-use habitat	16,964	14,963 (88%)	1,593	881	2,475 (17%)	12,488
Subtotal	81,472	53,867 (66%)	3,759	1,246	5,005 (9%)	48,862
Birds						
Tricolored blackbird						
core habitat	1,199	874 (73%)	175	24	199 (23%)	676
primary foraging habitat	87,117	61,223 (70%)	5,676	816	6,493 (11%)	54,730
secondary foraging habitat	6,335	6,087 (96%)	1,442	22	1,464 (24%)	4,623
Subtotal	94,651	68,184 (72%)	7,293	862	8,155 (12%)	60,029
Golden eagle						
foraging habitat	132,347	86,762 (66%)	7,423	846	9,619 (11%)	77,143
Western burrowing owl						
breeding and foraging habitat	69,415	43,910 (63%)	3,449	357	3,805 (9%)	40,105
low-use habitat	25,866	24,717 (96%)	3,764	463	4,227 (17%)	20,490
Subtotal	95,281	68,628 (72%)	7,212	820	8,032 (12%)	60,595
Swainson's hawk						
breeding habitat	177	131 (74%)	20	0	20 (15%)	111
foraging habitat	31,895	29,912 (94%)	3,919	743	4,661 (16%)	25,251
Subtotal	32,072	30,044 (94%)	3,938	743	4,681 (16%)	25,363

Species	Total in Inventory Area	Outside Parks and Open Space (% of total)	Estimated Direct Impact			Remain outside Parks and Open Space
			Urban Development in ULL	Rural Infrastructure	Total Impact (% outside Parks and Open Space)	
Reptiles						
Silvery legless lizard						
modeled habitat	3,563	1,367 (38%)	420	0	420 (31%)	948
Alameda whipsnake						
core and perimeter habitat	9,332	3,197 (34%)	2	0	2 (0%)	3,195
movement habitat (non-stream)	37,928	20,780 (55%)	117	0	117 (1%)	20,662
Subtotal	47,260	23,977 (51%)	120	0	120 (0%)	23,857
Giant garter snake						
core habitat (miles of stream)	151	137 (91%)	0.2	0.1	0.3 (0%)	137
movement and foraging habitat (upland acres)	14,016	12,947 (92%)	1,454	135	1,589 (12%)	11,358
Western pond turtle						
core habitat (acres of non-stream)	4,325	3,195 (74%)	436	31	467 (15%)	2,728
core habitat (miles of stream)	33	31 (92%)	0	0.1	0.1 (0%)	31
movement habitat (upland acres)	6,745	3,710 (55%)	180	49	229 (6%)	3,482
movement habitat (miles of stream)	321	179 (56%)	0.1	0.1	0.2 (0%)	178
Amphibians						
California tiger salamander						
breeding habitat	538	260 (48%)	35	15	50 (19%)	210
migration/aestivation habitat	102,034	59,689 (58%)	2,652	805	3,457 (6%)	56,232
Subtotal	102,572	59,948 (58%)	2,687	820	3,507 (6%)	56,442

Species	Total in Inventory Area	Outside Parks and Open Space (% of total)	Estimated Direct Impact			Remain outside Parks and Open Space
			Urban Development in ULL	Rural Infrastructure	Total Impact (% outside Parks and Open Space)	
California red-legged frog						
breeding habitat (acres of ponds)	137	95 (69%)	1	1	2 (2%)	93
breeding habitat (miles of stream)	361	217 (60%)	0.4	0.1	0.5 (0%)	217
movement habitat (upland acres)	114,140	70,625 (62%)	4,825	829	5,654 (8%)	64,972
movement habitat (miles of stream)	36	35 (97%)	0.1	0	0.1 (0%)	35
Foothill yellow-legged frog						
breeding habitat (miles of stream)	22	20 (87%)	0.1	0	0.1 (0%)	0
migration habitat (miles of stream)	272	146 (53%)	0.5	0	0.5 (0%)	145
Plants						
Mount Diablo manzanita						
modeled habitat	2,011	737 (37%)	0	0	0 (0%)	737
Brittlescale						
modeled habitat	1,633	1,169 (72%)	6	75	81 (7%)	1,088
Big tarplant						
modeled habitat	34,265	19,376 (57%)	821	32	853 (4%)	18,523
modeled low-potential habitat	22,091	14,495 (66%)	1,071	205	1,276 (9%)	13,219
Subtotal	56,356	33,871 (60%)	1,892	237	2,129 (6%)	31,742
Mount Diablo fairy lantern						
modeled habitat	48,848	24,646 (50%)	254	7	261 (1%)	24,386
Recurved Larkspur						
modeled habitat	2,322	1,815 (78%)	2	23	25 (1%)	1,790

Species	Total in Inventory Area	Outside Parks and Open Space (% of total)	Estimated Direct Impact			Remain outside Parks and Open Space
			Urban Development in ULL	Rural Infrastructure	Total Impact (% outside Parks and Open Space)	
Round-leaved filaree						
primary habitat	11,250	5,762 (51%)	532	4	536 (9%)	5,226
secondary habitat	4,772	3,567 (75%)	345	66	411 (12%)	3,156
Subtotal	16,021	9,329 (58%)	877	70	947 (10%)	8,381
Diablo helianthella						
modeled habitat	28,126	13,460 (48%)	19	0	19 (0%)	13,441
Brewer's dwarf flax						
modeled habitat	41,178	19,441 (47%)	97	0	97 (0%)	19,343

Notes: Numbers may not add due to rounding.

Table 4-5. Direct Impacts on Covered Species under Maximum Urban Development Area Scenario (acres)

Species	Total in Inventory Area	Outside Parks and Open Space (% of total)	Estimated Direct Impact			Total Impact (% outside Parks and Open Space)	Remain outside Parks and Open Space
			Urban Development in ULL	Rural Infrastructure			
Mammals							
San Joaquin kit fox							
core habitat	64,508	38,904 (60%)	4,211	365	4,576 (11%)	34,328	
low-use habitat	16,964	14,963 (88%)	1,655	881	2,475 (17%)	12,488	
Subtotal	81,472	53,867 (66%)	5,866	1,246	7,051 (13%)	46,816	
Birds							
Tricolored blackbird							
core habitat	1,199	874 (73%)	180	24	204 (23%)	670	
primary foraging habitat	87,117	61,223 (70%)	8,805	816	9,621 (16%)	51,602	
secondary foraging habitat	6,335	6,087 (96%)	1,811	22	1,833 (30%)	4,254	
Subtotal	94,651	68,184 (72%)	10,796	862	11,658 (17%)	56,526	
Golden eagle							
foraging habitat	132,347	86,762 (66%)	10,768	846	13,491 (16%)	73,271	
Western Burrowing Owl							
breeding and foraging habitat	69,415	43,910 (63%)	5,399	357	5,755 (13%)	38,155	
low-use habitat	25,866	24,717 (96%)	4,999	463	5,463 (22%)	19,254	
Subtotal	95,281	68,628 (72%)	10,398	820	11,218 (16%)	57,409	
Swainson's hawk							
breeding habitat	177	131 (74%)	20	0	20 (16%)	111	
foraging habitat	31,895	29,912 (94%)	5,154	743	5,897 (20%)	24,015	
Subtotal	32,072	30,044 (94%)	5,175	743	5,917 (20%)	24,126	

Species	Total in Inventory Area	Outside Parks and Open Space (% of total)	Estimated Direct Impact		Total Impact (% outside Parks and Open Space)	Remain outside Parks and Open Space
			Urban Development in ULL	Rural Infrastructure		
Reptiles						
Silvery legless lizard						
modeled habitat	3,563	1,367 (38%)	420	0	420 (31%)	948
Alameda whipsnake						
core and perimeter habitat	9,332	3,197 (34%)	29	0	29 (1%)	3,168
movement habitat (upland)	37,928	20,780 (55%)	341	0	341 (2%)	20,439
Subtotal	47,260	23,977 (51%)	370	0	370 (2%)	23,607
Giant garter snake						
core habitat (miles of stream)	151	137 (91%)	0.3	0.1	0.4 (0%)	137
movement and foraging habitat (upland acres)	14,016	12,947 (92%)	2,538	135	2,674 (21%)	10,274
Western pond turtle						
core habitat (acres of non-stream)	4,325	3,195 (74%)	467	31	498 (16%)	2,697
core habitat (miles of stream)	33	31 (92%)	0	0.1	0.1 (0%)	31
movement habitat (upland acres)	6,745	3,710 (55%)	350	49	398 (11%)	3,312
movement habitat (miles of stream)	321	179 (56%)	0.1	0.1	0.2 (0%)	178
Amphibians						
California tiger salamander						
breeding habitat	538	260 (48%)	53	15	68 (26%)	192
migration/aestivation habitat	102,034	59,689 (58%)	4,766	805	5,571 (9%)	54,118
Subtotal	102,572	59,948 (58%)	4,819	820	5,639 (9%)	54,310
California red-legged frog						
breeding habitat (acres of ponds)	137	95 (69%)	3	1	3 (3%)	92

Species	Total in Inventory Area	Outside Parks and Open Space (% of total)	Estimated Direct Impact		Total Impact (% outside Parks and Open Space)	Remain outside Parks and Open Space
			Urban Development in ULL	Rural Infrastructure		
breeding habitat (miles of stream)	361	217 (60%)	0.5	0.1	0.6 (0%)	217
movement habitat (upland acres)	114,140	70,625 (62%)	6,956	829	7,785 (11%)	62,841
movement habitat (miles of stream)	36	35 (97%)	0.2	0	0.2 (1%)	35
Foothill yellow-legged frog						
breeding habitat (miles of stream)	22	20 (87%)	0.1	0	0.1 (0%)	0
migration habitat (miles of stream)	272	146 (53%)	0.6	0	0.6 (0%)	145
Plants						
Mount Diablo manzanita						
modeled habitat	2,011	737 (37%)	2	0	2 (0%)	735
Brittlescale						
modeled habitat	1,633	1,169 (72%)	6	75	81 (7%)	1,088
Big tarplant						
modeled habitat	34,265	19,376 (57%)	1,976	32	2,008 (10%)	17,367
modeled low-potential habitat	22,091	14,495 (66%)	1,794	205	1,999 (14%)	12,496
Subtotal	56,356	33,871 (60%)	3,770	237	4,007 (12%)	29,864
Mount Diablo fairy lantern						
modeled habitat	48,848	24,646 (50%)	554	7	561 (2%)	24,086
Recurved Larkspur						
modeled habitat	2,322	1,815 (78%)	2	23	25 (1%)	1,790
Round-leaved filaree						
primary habitat	11,250	5,762 (51%)	884	4	888 (15%)	4,874
secondary habitat	4,772	3,567 (75%)	494	66	560 (16%)	3,007

Species	Total in Inventory Area	Outside Parks and Open Space (% of total)	Estimated Direct Impact		Total Impact (% outside Parks and Open Space)	Remain outside Parks and Open Space
			Urban Development in ULL	Rural Infrastructure		
Subtotal	16,021	9,329 (58%)	1,378	70	1,448 (16%)	7,881
Diablo helianthella modeled habitat	28,126	13,460 (48%)	85	0	85 (1%)	13,375
Brewer's dwarf flax modeled habitat	41,178	19,441 (47%)	255	0	255 (1%)	19,185

Notes: Numbers may not add due to rounding error.

Table 4-6. Known Occurrences of and Potential Impacts on Covered Plants in the Inventory Area

Species	Number of Known Occurrences ¹	Number of Occurrences in Public Lands	Known Occurrences that May Be Removed by Covered Activities ²
Mount Diablo manzanita	12	10	0
Brittlescale	9	4	1
San Joaquin spearscale	32	31	0
Big tarplant	12	6	1
Mount Diablo fairy lantern	12	11	0
Recurved larkspur	4	1	1
Round-leaved filaree	7	0	2
Diablo helianthella	30	28	0
Brewer's dwarf flax	13	10	0
Showy madia	0 ³	0	0
Adobe navarretia	0 ⁴	0	0
Total	124	101	5

Notes:

- ¹ Known occurrences within the inventory area are based on CNDDDB data and recent surveys of large tracts (e.g., Jones & Stokes 1989; Mudie & Associates and City of Antioch 2002); occurrences shown in the CNDDDB within large urban areas are assumed to be extirpated and are excluded from this table. All remaining occurrences are assumed to be extant, except where noted. Occurrence records may or may not be the same as individual populations.
- ² The potential impacts to known occurrences of covered plants are the same with the initial urban development area and the maximum urban development area.
- ³ A historic record of showy madia listed in the CNDDDB in Antioch was not re-located during recent surveys (Mudie & Associates and City of Antioch 2002).
- ⁴ The only known records of this species in the inventory area are from two historic collections in and near Antioch. We assume these occurrences have been extirpated.
-

Table 4-7. Estimated Overlap of Critical Habitat with HCP/NCCP Covered Activities (acres)

Land Cover Type Overlap ¹	Contra Costa Goldfields	Vernal Pool Fairy Shrimp (VPFS)		
	Unit 7	Unit 19A	Unit 19B	Total for VPFS
Annual grassland ²	1.1	23.5	4.6	28.1
Alkali grassland ²	—	—	7.2	7.2
Alkali wetland complexes ²	—	—	1.6	1.6
Wetland (undetermined) ²	—	0.8	—	0.8
Ruderal	—	0.7	—	0.7
Cropland	—	—	0.8	0.8
Vineyard	—	—	0.3	0.3
Oak savanna	—	1.5	—	1.5
Pond	—	0.1	—	0.1
Urban	—	—	3.3	3.3
Total	1.1	26.9	17.8	44.7

Notes

¹ Overlap does not imply impact. Actual habitat for Contra Costa goldfields and vernal pool fairy shrimp is expected to be restricted to a subset of habitats within the land cover types listed above. Overlap is presented to illustrate the maximum possible impact on these land cover types within designated critical habitat.

² Land cover type may support habitat for Contra Costa goldfields or vernal pool fairy shrimp.

Table 4-8. Potential Impacts on Land-Cover Types from Urban Development in Antioch¹

Land-Cover Type	Amount (acres)
Grassland	
Annual grassland	2,607
Alkali grassland	22 ²
Ruderal	1,259
Chaparral and scrub	3
Oak savanna	171
Oak woodland	189
Riparian woodland/scrub	32 ³
Wetland (undetermined)	11
Seasonal wetland	0
Alkali wetland	0
Aquatic	0
Stream (miles)	25 ⁴
Pond	9
Slough/channel	0
Rock outcrops	1
Irrigated agriculture	
Cropland	88
Pasture	0
Orchard	149
Vineyard	48
Other land-cover types	
Nonnative woodland	6
Total	4,575

Notes:

¹ Based on current General Plan (City of Antioch 1988) development designations. The City of Antioch is currently revising their General Plan (City of Antioch 2004). Development under the draft 2003 General Plan would substantially expand urban development south of the current ULL.

² No alkali grasslands were mapped in Antioch for the HCP/NCCP. However, 22.0 acres of alkali grassland were found during extensive field surveys of the area (see references in Mundie & Associates and City of Antioch 2002).

³ This is an overestimate of the impact to riparian woodland/scrub because most riparian habitat is expected to be retained in urban areas.

⁴ Because development designations overlay streams (even in areas that are built out), this is a large overestimate of the true potential impact to streams under the Antioch General Plan.