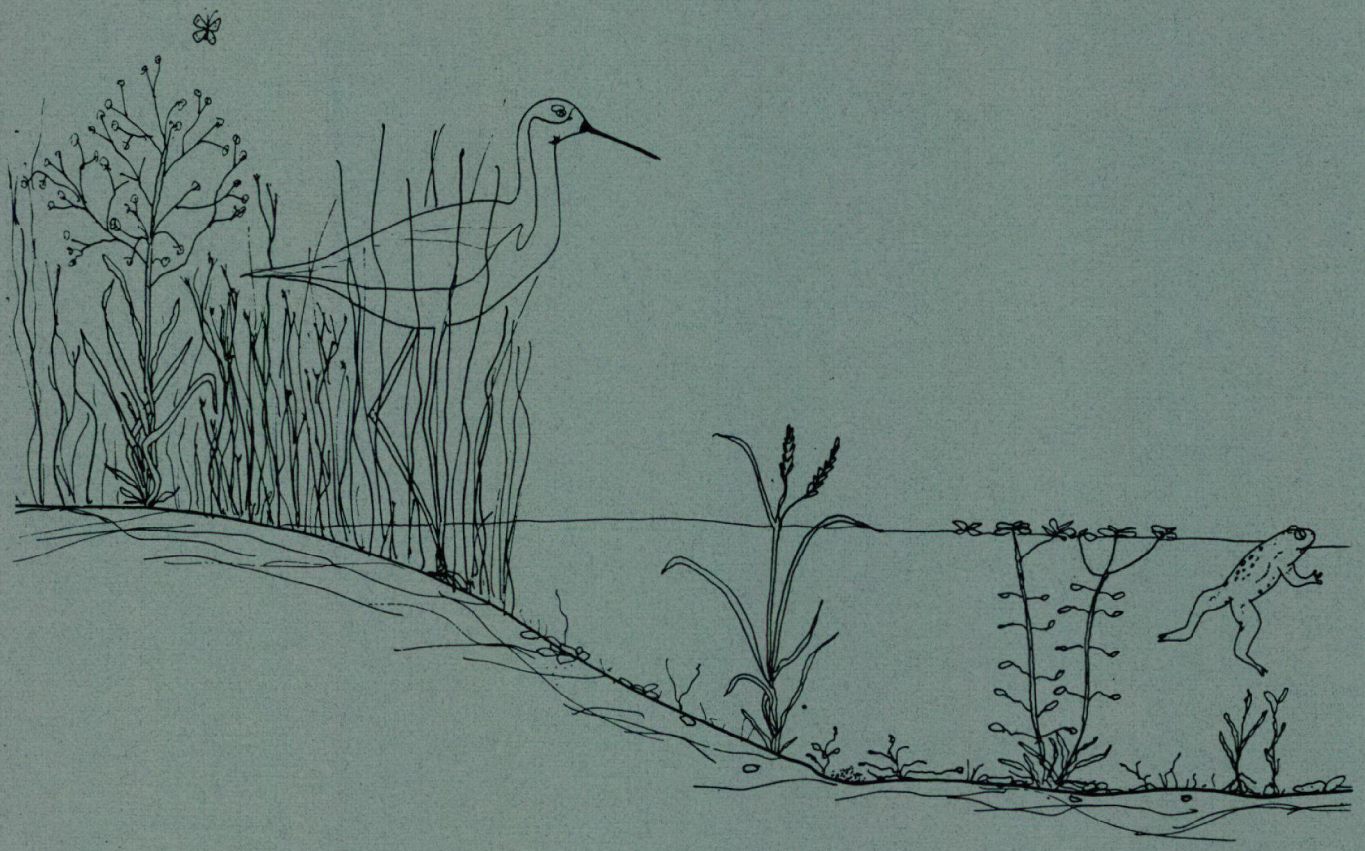
Final

Wetland Resource Planning Recommendations for Chico, Clovis, Fresno, and Surrounding Areas of Butte and Fresno Counties



Submitted to:

U.S. Environmental Protection Agency
Region IX
San Francisco, California

Contract #68D30010
Work Assignment #3

Submitted by:

Jones & Stokes Associates, Inc.
Sacramento, California

September 30, 1994

Final

Wetland Resource Planning Recommendations for Chico, Clovis, Fresno, and Surrounding Areas of Butte and Fresno Counties

Submitted to:

U.S. Environmental Protection Agency
Region IX
75 Hawthorne Street
San Francisco, CA 94105
Contact: Jane Freeman
415/744-1978

Submitted by:

Jones & Stokes Associates, Inc.
2600 V Street, Suite 100
Sacramento, CA 95818-1914
Contact: Paul Cylinder
916/737-3000

September 30, 1994

This document should be cited as:

Jones & Stokes Associates, Inc. 1994. Wetland resource planning recommendations for Chico, Clovis, Fresno, and surrounding areas of Butte and Fresno Counties. Final. September 30, 1994. (JSA 93-196.) Sacramento, CA. Submitted to U.S. Environmental Protection Agency, Region IX. San Francisco, CA.

Table of Contents

List of Tables

List of Figures

Chapter 1. Introduction and Objectives

INTRODUCTION

The U.S. Environmental Protection Agency (EPA) seeks to support local wetlands conservation planning by providing data on the locations of wetland resources and future development in rapidly growing portions of Butte and Fresno Counties and the Cities of Chico, Fresno, and Clovis. Wetlands were mapped within the Sacramento Valley region of Butte County (Figure 1-1) and within the San Joaquin Valley east of Fresno Slough in Fresno County (Figure 1-2). Planned development was mapped for areas surrounding the Cities of Chico (Figure 1-1), Fresno (Figure 1-2), and Clovis (Figure 1-2). These study areas were chosen because of the large amount of wetland resources, especially vernal pools, present; the rapid development expected; and the receptivity of local agencies to wetlands planning. Mapping the locations of vernal pools in relationship to potential future development was a prime goal of this project. Vernal pools are a uniquely Californian wetland resource that has been greatly reduced in extent from historical times. The loss of vernal pools is continuing under the pressure for urban expansion.

EPA seeks to provide local planning agencies with a range of wetland conservation and land use planning programs and techniques that effectively address the retention of wetland resources in urbanizing areas. An overview of habitat conservation concepts as they may be applied to wetlands is presented in Appendix A.

OBJECTIVES OF STUDY

The objectives of this study were to:

- map the locations of wetland and riparian habitats;
- map the locations of parcels that are planned for future development, classified by the point in the planning process (i.e., the stage in the approvals and permit process) that each development site has reached as of September 1994;
- identify a range of planning programs and techniques for addressing wetland resource issues; and

- provide recommendations to local agencies on wetland conservation planning in the Chico area and the Fresno-Clovis area.

The resulting maps can be used to identify potential land use conflicts and identify suitable conservation planning programs.

The purpose of this report is to encourage advanced planning and effective implementation for wetland resource preservation and management in areas proposed for development and to provide information on applicable planning programs and techniques. Compiling an integrated wetland resource and land development database is an effective technique to identify where urbanization may encroach into areas where wetlands exist. Wetlands preservation and long-term management can occur if the appropriate planning programs and techniques are applied in a timely manner.

This report provides a range of planning programs and techniques for addressing wetland resource issues. A variety of programs are discussed to give local planners the tools necessary to address wetland issues at all stages of planning and development review.

WETLAND TYPES MAPPED

Natural wetlands, riparian habitats, and open water bodies that have not been substantially disturbed by human activities were the focus of the mapping effort. Depending on the size of specific wetland sites, wetlands were mapped either individually or as high density (greater than 1% of areal cover) areas supporting many small wetlands scattered through upland habitats. The following types of wetlands were mapped in this effort:

- concentrations of vernal pools and swales,
- other seasonal wetlands,
- alkali wetland complexes,
- riparian forest and scrub habitats,
- freshwater marsh (perennial herbaceous wetland), and
- isolated open water bodies (excluding maintained excavated water bodies, such as flood detention basins, evaporation or percolation ponds, and sewage treatment facilities).

Artificial and disturbed wetlands were not included as part of the mapping effort. Wetlands and other water bodies excluded from the mapping effort are:

PAGE NOT

AVAILABLE

DIGITALLY

- farmed wetlands,
- agricultural or other irrigation and drainage ditches,
- stream systems (except where significant riparian habitat is present), and
- disturbed wetlands within developed areas.

No attempt was made to map nonwetland waters, such as stream systems, in either a natural or disturbed condition. Some open water habitats were included in the mapping. In addition to sites supporting wetlands, sites supporting large stands (greater than 10 acres) of riparian habitats were mapped.

The wetland maps were produced for general plan-level and regional-level planning and should not be used for site-specific planning. Areas where wetlands have not been identified in this study may support wetlands and other water bodies. Sites outside of mapped wetland areas may support artificial, farmed, and disturbed wetlands of various sizes and small, natural, undisturbed wetlands at low density. The locations and extent of these wetlands and their importance to wildlife and plants cannot be determined based on these maps. The wetland mapping was not intended to be, nor was any attempt made to conduct, a delineation of jurisdictional wetlands under Section 404 of the Clean Water Act. Methods used to map wetlands are described in Chapter 2, "Mapping Methods".

DEVELOPMENT MAPPING CATEGORIES

Existing, future, and potential future development sites were mapped for areas surrounding Chico, Clovis, and Fresno.

Chico Study Area

In the Chico study area, land uses were divided into the following categories:

- existing development,
- projects approved or permitted for construction,
- projects in the planning stages,
- potential development areas,
- preservation areas, and
- parks.

These development categories are defined below in Chapter 2, "Mapping Methods".

Fresno-Clovis Study Area

In the Fresno-Clovis study area, land uses were divided into the following categories:

- existing development,
- projects approved or permitted for construction,
- pending development,
- planned for development, and
- planned open space.

These development categories are defined below in Chapter 2, "Mapping Methods".

STUDY AREA BOUNDARIES

Wetland study areas were defined to include the lowland portions of Butte a Fresno Counties likely to support vernal pools and riparian habitats. Development stu areas were defined to include the areas expended to grow most rapidly.

Wetland Mapping Study Areas

The Butte County wetland study area encompasses the Central Valley alluvial areas and terraces to the upper elevational limit of geologic formations and soil associations that typically support vernal pools (Figure 1-1). The study area is bounded on the west by the Sacramento River, on the north by the Butte-Tehama County line, on the south by the Butte-Yuba County line, and on the east by the upper elevational limit of the portions of the Tuscan, Red Bluff, and Laguna geologic formations that support vernal pools. The eastern limit of the study area roughly corresponds to the edge of the oak woodland belt that surrounds the Central Valley.

The Fresno County wetland study area encompasses the Central Valley basin, alluvial areas, and terraces, extending from east of Fresno Slough to the upper elevational limit of geologic formations and soil associations that typically support vernal pools (Figure 1-2). The study area is bounded on the north by the Fresno-Madera County line, on the south by the Fresno-Kings County line, on the west by Fresno Slough, and on the east by the upper elevational limit of the portions of the Laguna and Riverbank geologic formations that support vernal pools. The eastern limit of the study area roughly corresponds with the Friant-Kern canal; however, some areas east of the canal with suitable geologic formations for vernal pools were also mapped.

Development Mapping Study Areas

Chico Study Area

The Chico study area is the Chico General Plan area, which includes all land east of the Sacramento River, south of Rock Creek, west of the Sierra Nevada foothills, and north of the Durham-Dayton Highway (Figure 1-1).

Additional Study Area in Butte County

Planned development was mapped for a portion of Butte County along Route 99 southeast of Chico (Figure 1-1). This study area was added to the project at the request of the City of Chico and Butte County Planning Departments.

Fresno Study Area

The Fresno study area is the Fresno Sphere of Influence, which includes all land west of DeWolf Avenue, south of the San Joaquin River, east of West Lawn Avenue, and north of American Avenue.

Clovis Study Area

The Clovis study area is the Clovis General Plan area, which includes all land west of Academy Avenue, south of Copper Avenue, east of the Fresno city limits, and north of East Shields Avenue (Figure 1-2).

Chapter 2. Mapping Methods

WETLAND MAPPING METHODS

Fresno County Study Area Materials

For the Fresno County wetlands study area, an iterative process was used to determine the location and boundaries of areas supporting wetlands. The first step was to review black-and-white aerial photographs at a scale of 1 inch = 800 feet that were taken in March 1992 for the Fresno-Clovis area and black-and-white aerial photographs at a scale of 1 inch = 2,000 feet that were taken in October 1992 for the remainder of the study area. Signatures on aerial photographs at a scale of 1 inch = 2,000 feet were examined under a magnifying stereoscope for ease of interpretation. All aerial photograph interpretation for Fresno County was correlated with information from the Fresno County Soil Survey (Huntington 1971). Maps of wetlands in Fresno County were also checked against National Wetland Inventory (NWI) maps prepared by the U.S. Fish and Wildlife Service (USFWS) to identify wetlands that may have been inadvertently overlooked in the review of the aerial photographs.

Butte County Study Area Materials

For the Butte County wetlands study area, an iterative process was also used to determine the location and boundaries of areas supporting wetlands. The first step was to review blueline copies of black-and-white aerial photographs at a scale of 1 inch = 400 feet (1 inch = 300 feet for the Chico planning area) that were taken on March 20 and 21, 1990.

Aerial Photography Interpretation

Aerial photograph signatures were interpreted by analyzing gross landform morphology, soil type, and landscape position. Further refinement was achieved through interpretation of signature tone, texture, and density.

The location and extent of low-lying areas that function as drainage or ponding components of the study areas' surface water system were readily identifiable on the

photographs. Wetland components of the surface water system were then divided by type and transfer-mapped onto U.S. Geologic Survey (USGS) 7.5-minute quadrangle maps at a scale of 1 inch = 2,000 feet. The minimum mapping unit size used for individual or aggregations of wetlands was 10 acres. To ensure accurate spatial placement of transferred polygons, the polygon edges were scaled from landmarks visible on both the aerial photograph and USGS map.

Since the aerial photographs for Butte and Fresno Counties were taken, some wetlands may have been filled and others created as mitigation for fill activities. No attempt was made to correct for these activities, and all mapped wetland information reflects the conditions present when the source aerial photographs were taken.

Land Cover Classification

A land cover classification was developed and used to attribute mapped polygons. The classification system included eight habitat types, 16 geomorphic and soil subtypes, seven habitat cover (percent aerial cover) classes, and two distinctive features (Table 2-1). Unattributed areas do not support natural, undisturbed wetlands of large size (greater than 10 acres) or at high concentration (e.g., vernal pool areas larger than 10 acres with >1% wetland cover). Unattributed sites are mostly upland habitats of grassland and oak woodland, agricultural land, and developed land. As discussed above, these areas may support artificial wetlands, farmed wetlands, disturbed wetlands, and small natural wetlands. The units of this classification system are described below in more detail.

Descriptions of Habitat Types Mapped

The following text describes the mapped habitat types used in this project and the means by which sites supporting these habitats were identified.

Vernal Pool Areas

Description of Habitat. Vernal pool areas support concentrations of seasonal wetlands that have been called vernal pool "terrains", "landscapes", and "archipelagos". Vernal pool area habitat is a mosaic of wetland and upland habitat types and includes:

- vernal pools,
- swales,
- ephemeral drainages,

Table 2-1. Wetlands Land Cover Classification and Legend for Geographic Information System Database for Fresno and Butte Counties

A. Habitat Type

0 and 1	Upland (nonwetland)
2	Vernal pool areas
3	Other seasonal wetland
4	Perennial herbaceous wetland
5	Riparian forest
6	Riparian scrub
7	Open water
8	Managed wetlands (e.g., wildlife refuges)

B. Geomorphic and Soil Subtype

0	Floodplain, basin, and alluvial fan; includes artificial wetlands
1	Basin rim; saline-sodic (alkali) soil, playas, lime-cemented hardpans, endoaquic (rising groundwater saturation) within associated sand dune depressions (Fresno County only)
2	Young terrace, Riverbank Formation; claypan soil with no hardpan
3	Young terrace, Riverbank Formation; soils with silica-cemented hardpans with or without overlying claypans
4	Young terrace, Riverbank Formation; combination of soils 2 and 3
5	Old terrace, Red Bluff Formation; claypan soil with no hardpan (Butte County only)
6	Old terrace, Red Bluff Formation; soils with silica-cemented hardpans with or without overlying claypans (Butte County only)
7	Old terrace, Red Bluff Formation; combination of soils 5 and 6 (Butte County only)
8	Old terrace, Turlock Lake Formation; claypan soil with no hardpan (Butte County only)
9	Old terrace, Turlock Lake Formation; soils with silica-cemented hardpans with or without overlying claypans (Butte County only) (with underlying volcanic sediment - Fresno County only)
10	Old terrace, Turlock Lake Formation; combination of soils 8 and 9 (Butte County only)
11	Old terrace, Laguna Formation; claypan soils with no hardpan

12 Old terrace, Laguna Formation; soils with silica-cemented hardpans with or without overlying claypans

13 Old terrace, Laguna Formation; combination of soils 11 and 12

14 Volcanic bedrock, Tuscan Formation; no claypan or hardpan (Butte County only)

15 Other bedrock; miscellaneous soil types (Fresno County only)

C. Habitat Cover Class

1 (number not used)

2 1-5% wetland or riparian cover

3 6-10% wetland or riparian cover

4 11-25% wetland or riparian cover

5 26-50% wetland or riparian cover

6 51-75% wetland or riparian cover

7 76-100% wetland or riparian cover

D. Features

1 Mima mounds present (vernal pools only)

2 Alkali wetland (saline/sodic)

Note: Numbers refer to the attribute number code in the GIS. The attribute number coding in the GIS is arranged in the format "A.B.C.D" (i.e., type.subtype.cover.feature). For example, a polygon labeled "2.6.3.1" circumscribes an area that supports vernal pools (likely in association with swales and drainages), on old terrace Red Bluff Formation with a hardpan water restricting soil layer, with vernal pools comprising 6-10% cover within an upland matrix, and with Mima mound relief present within the mapped unit.

- intermittent drainages, and
- grasslands.

Each of these habitats is described in the following sections.

Vernal Pools. Vernal pools are seasonally flooded landscape depressions that support a unique plant community adapted to periodic or continuous inundation during the wet season and the absence of ponded water and wet soil during the dry season. Plant species that are commonly found in vernal pools include coyote thistle (*Eryngium* spp.), goldfields (*Lasthenia* spp.), popcornflower (*Plagiobothrys* spp.), downingia (*Downingia* spp.), foxtail (*Alopecurus* spp.), and spikerush (*Eleocharis* spp.). Vernal pools that frequently pond water or support saturated soil for a long duration meet the criteria for Section 404 jurisdictional wetlands. Most areas that support large numbers of vernal pools contain a mosaic of seasonal wetlands and drainages, including swales, ephemeral drainages, and intermittent drainages.

Swales. Swales are broad, shallow, seasonally wet areas that convey water in a somewhat defined channel during and shortly after rain events; they are often connected to vernal pools. Surface runoff collects in swales, wetting and saturating the soil for short periods. The primary distinction between swales and other seasonal wetlands, such as vernal pools, is that water ponds in the latter, while swales are inundated for short periods during and immediately after rainfall as water drains. Often, swales drain into ephemeral drainages. Swales are vegetated across their bed, while ephemeral and intermittent drainages are not. Typical plant species found in swales include Italian ryegrass (*Lolium* spp.), Mediterranean barley (*Hordeum geniculatum*), popcornflower, and clover (*Trifolium* spp.). Swales or portions of swales that frequently pond water or support saturated soil for a long duration meet the criteria for Section 404 jurisdictional wetlands; however, many swales do not meet the hydrologic or soil criteria for wetland status.

Ephemeral Drainages. Ephemeral drainages are small, shallow unvegetated or sparsely vegetated watercourses with well-defined beds and banks that convey surface runoff during and shortly after rainfall. Ephemeral drainages often drain into local intermittent drainages. Many of the ephemeral drainages have eroded to the hardpan or claypan, leaving gravel, stone, and cobble mixed with remaining soil material that supports only sparse vegetation. Ephemeral drainages support many of the same plant species associated with swales, including Italian ryegrass and Mediterranean barley. Ephemeral drainages may meet the criteria for jurisdictional waters of the United States, with some vegetated portions qualifying as jurisdictional wetlands.

Intermittent Drainages. Intermittent drainages are defined channels, V or U shaped in cross section, that carry storm runoff during the wet season but are dry for the remainder of the year. Some intermittent drainages are connected to seasonal wetlands, ponds, or freshwater marshes and fill and drain these wetland features. Where vegetation occurs in intermittent drainages, it is typically dominated by a mixture of the same plant

species found in ephemeral drainages and freshwater marshes. Intermittent drainages may meet the criteria for jurisdictional waters of the United States, with some vegetated portions qualifying as jurisdictional wetlands.

Grasslands. Grasslands are nonwetland habitats dominated by annual grasses and forbs. Typical dominant species are bromes (*Bromus* spp.), wild oats (*Avena* spp.), wild barleys (*Hordeum* spp.), and filarees (*Erodium* spp.). Grassland is the most extensive habitat in vernal pool areas and is the matrix within which vernal pools, swales, and drainages are distributed.

Mapping Method. The mapping category vernal pool areas habitat type includes vernal pools, swales, ephemeral drainages, occasionally intermittent drainages, and grasslands as described above. Sites mapped as vernal pool areas support vernal pools and associated wetlands at various densities in a matrix of annual grassland and occasionally oak woodland. The vernal pools and swales are wetlands, and the grassland and woodland are upland habitats. Vernal pools are found on surfaces with slopes in the range of 0-3% that are cut by ephemeral and intermittent drainages. Vernal pool terrain is generally found on landscapes well above the present and historically recent floodplain of nearby rivers and their tributaries.

On black-and-white aerial photographs, aggregations of vernal pools exhibit a dendritic pattern, and pool basins appear as light gray to nearly white at higher elevations. Vernal pools at lower elevations tend to be wetter and display darker gray colored basins on aerial photographs. In both cases, upland vegetation between pools tends to be medium light gray with a grainy texture, whereas pool textures tend to be smooth. Swale signatures varied from light gray, similar to that of adjoining vernal pools, to dark gray or black in broad swales that exhibit a high clay content.

Other Seasonal Wetland

Description of Habitat. Seasonal wetlands are ponded or saturated during the wet season and dry the remainder of the year. The category of "other seasonal wetland" includes all seasonal wetlands that are not part of the vernal pool area category described above. Seasonal wetlands occur within the annual grassland matrix in swales and shallow depressions underlain by slowly permeable soils. These wetlands may occur in isolation from other wetland habitats; within drainage systems; or adjacent to, and upslope from, permanent wetlands. Typical vegetation found in seasonal wetlands includes annual bluegrass (*Poa annua*), knotweed (*Polygonum* spp.), Italian ryegrass, Mediterranean barley, dock (*Rumex* spp.), sedge (*Cyperus* spp.), rushes (*Juncus* spp.), bird's foot trefoil (*Lotus corniculatus*), and spike primrose (*Epilobium* spp.). Seasonal wetlands may also contain components of the vernal pool vegetation described above. Seasonal wetlands are differentiated from vernal pools and swales by plant composition and landscape position. Seasonal wetlands are often found fringing seasonal water bodies in the zone of seasonal

water level fluctuation. Similarly, seasonal wetlands can be found in swales where the natural hydrology has been modified by blockage of the swale outlet. Other seasonal wetland may also include small areas of open water where the wetland does not completely dry out by the end of the season.

Mapping Methods. Interpretation of seasonal wetland signatures relied more on landscape position, landform morphology, and soil type than on signature tone, texture, or density. Seasonal wetland tone, texture, and density were similar to those of vernal pools. Seasonal wetlands were mapped within vernal pool terrain when there was evidence of modified hydrology that has increased significantly the duration of saturation or inundation of any vernal wetland feature. Typically, this occurred when roads were constructed through a swale or other gently sloping depression, creating a dam and preventing normal drainage. Seasonal wetlands were also mapped in floodplain depressions where vegetation was evident. Floodplain seasonal wetlands pond water during heavy storms or during flood events for sufficient duration to support hydrophytic vegetation.

Perennial Herbaceous Wetland

Description of Habitat. Perennial herbaceous wetlands are habitats characterized by a dominance of herbaceous emergent vegetation growing in permanently flooded or saturated soil conditions. Typical plant species include bulrushes or tules (*Scirpus* spp.), cattail (*Typha* spp.), arrowhead (*Sagittaria* spp.), and sedges (*Carex* spp.). Perennial herbaceous wetlands are often found fringing permanent lakes, ponds, or waterways. Within perennial herbaceous wetland there may be small inclusions of upland or open water that were too small to identify or segregate.

Mapping Methods. Perennial herbaceous wetlands are found on level to gently sloping landforms that permit permanent or semipermanent ponding. Generally, this wetland type is found in the lower landscape positions well below most of the local watershed. Aerial photograph signatures generally exhibited a mosaic of open water and vegetation. Vegetation generally had a mottled appearance and was relatively easy to discern. The presence of perennial herbaceous wetlands often corresponded with marshes mapped by USFWS and USGS.

Riparian Forest

Description of Habitat. Riparian forest habitats are characterized by a dominance of woody arborescent vegetation. Riparian forest lies within the floodplain of rivers and streams or fluctuating lake margins. Undisturbed mature riparian forest can be thought of as having three somewhat distinct vegetative layers: overstory, midstory, and understory. The overstory is dominated by winter deciduous trees that are adapted to frequent flooding and/or saturated soil conditions. Common trees in the overstory include Fremont's

cottonwood (*Populus fremontii*), black willow (*Salix goddingii*), sycamore (*Platanus racemosa*), Oregon ash (*Fraxinus latifolia*), and, on less frequently flooded sites, valley oak (*Quercus lobata*). Midstory trees, shrubs, and vines include Oregon ash, poison-oak (*Toxicodendron diversilobum*), boxelder (*Acer negundo*), California wild grape (*Vitis californica*), California blackberry (*Rubus ursinus*), and, close to the water's edge, buttonbush (*Cephalanthus occidentalis*). The understory is comprised of scattered forbs, such as miner's lettuce (*Claytonia perfoliata*), beggar's ticks (*Bidens* spp.), mugwort (*Artemisia douglasiana*), and western aster (*Aster chilensis*), and grasses, such as ripgut brome (*Bromus diandrus*) and creeping wildrye (*Leymus triticoides*). The riparian forest mapping category may also include small areas of riparian scrub, open water, seasonal wetland, or perennial herbaceous wetland that was too small to segregate or was obscured by the forest canopy.

Mapping Methods. Riparian forest is found along the bank and rarely in the bed of riverine systems. It is occasionally found bordering inland bodies of water and within dredge tailings deposited during placer mining operations early in the century. The riparian forest signature on aerial photographs was easily identified based on landscape position, texture of the forest canopy, and shadows thrown by the tall trees. Riparian forest often occurs on surfaces that do not undergo a significant amount of scouring during flood events. The texture of the riparian forest was rough and undulating because various species and ages of trees comprise the forest.

Riparian Scrub

Description of Habitat. Like riparian forest, riparian scrub is found within the floodplain of rivers and streams. Riparian scrub often occurs at sites that are more frequently flooded and subjected to scouring flows than is riparian forest. It is often found on sand or gravel bars or on riverbanks within a river system. Often, riparian scrub is successional to riparian forest and persists only in the presence of periodic disturbance. It is often comprised of a dense assemblage of willows (*Salix* spp.) with little or no understory. Sandbar willow (*Salix hindsiana*) and Arroyo willow (*Salix lasiolepis*) are typically dominant and often form impenetrable thickets. Riparian scrub can also contain components of buttonbush, California blackberry, and young cottonwood and willow trees. The riparian scrub mapping category may also include small areas of open water, seasonal wetland, or perennial herbaceous wetland that was too small to segregate or was obscured by the shrub canopy.

Mapping Methods. Riparian scrub signatures on aerial photographs were identified based on landscape position and texture of the shrub canopy. Riparian scrub is often found in areas that undergo a significant amount of scour during flood events. Riparian scrub can also be found growing in disturbed areas that once supported riparian forest. The texture of the riparian scrub signature was generally smooth and uniform in areas that were scoured by large flood events, creating an even-aged stand of shrubs.

Upland

Description of Habitat. Uplands are areas that are not frequently saturated or inundated for a significant duration during the growing season and that do not support hydrophytic vegetation. Uplands in the study area include urban areas and appurtenances, agricultural fields, grasslands, and oak woodlands. Common natural upland plant species include bromegrasses (*Bromus* spp.), wild oats (*Avena* spp.), wild barleys (*Hordeum* spp.), filaree (*Erodium* spp.), and oaks (*Quercus* sp.). Small areas of wetlands may be present within grasslands and woodlands identified as uplands in this study. These wetlands are expected to amount to less than 1% of the total area mapped as upland.

Mapping Methods. Sites were mapped as uplands when the aerial photographs showed no indications of wetland vegetation or the presence of water at the sites.

Open Water

Description of Habitat. Open water habitat is characterized by unvegetated permanent or semipermanent ponded or flowing water. Open water habitat may be the result of constructed impoundments or naturally occurring water bodies. Open water typically has a water depth greater than 2 feet and intergrades with perennial herbaceous wetland or other seasonal wetland at its fringes. Although the open water is relatively unvegetated, it occasionally has free-floating and submerged aquatic plants, including pondweeds (*Potomogeton* ssp.), duckweed (*Lemna* ssp.), mosquito fern (*Azolla filiculoides*), and water-milfoil (*Myriophyllum* spp.). The open water mapping category also may include small areas of perennial herbaceous wetland that was too small to segregate.

Mapping Methods. Open water habitat exhibited a dark blue texture on blueline prints of aerial photographs or was uniformly black on black-and-white photographs and usually was indicated on the USGS quads as open water bodies. In identifying open water, the rule used was to map only natural open water bodies or water bodies that were the result of the impoundment of a natural tributary system. The distinction between natural and maintained open water bodies was determined by consulting several sources. The aerial photographs were compared with NWI maps and older USGS maps. NWI maps include special modifiers that indicate whether the wetland was excavated or created by an impoundment. Older USGS maps were compared with aerial photographs to see if the water body in question existed at the time of USGS mapping, usually 20-30 years before the aerial photograph dates.

Managed Wetlands

Description of Habitat. Managed wetlands include wildlife refuges and sanctuaries operated by federal or state agencies, such as USFWS and California Department of Fish

and Game (DFG). Managed wetlands include wetland types such as perennial herbaceous, other seasonal, riparian scrub, riparian forest, and open water habitat. The managed wetland type was developed because many wildlife refuges and sanctuaries manage their wetlands in a variety of configurations that may change in type and location from year to year.

Mapping Methods. Wetland sites known to be under artificial hydrological control were mapped as managed wetlands.

Geomorphic and Soil Habitat Subtypes Mapped

Geomorphic and soil subtypes were used to differentiate wetlands that occur on different geomorphic surfaces and soils (Table 2-1). The development of the subtype category allowed for recognition of the variety of vernal pool habitat present in the study area. Sixteen subtypes were developed for use in this study. Ten of these 16 subtype categories are applicable in Fresno County, and 13 are applicable in Butte County.

The diversity of landscapes and soil types on which the remaining wetlands in Fresno and Butte Counties occur are a determining factor in the diversity of wetland types and associated floral and faunal species. Geomorphological formations and associated soil types determine a diversity of wetland types by variations in biogeochemistry, hydrology, microclimate, soil mineralogy, soil fertility, soil formation processes, and evolutionary timescale.

Holland (1986, 1990) recognized seven subtypes of vernal pools: northern hardpan, northern claypan, northern basalt flow, northern volcanic mudflow, southern interior basalt flow, San Diego mesa hardpan, and San Diego mesa claypan. Four of these seven vernal pools subtypes are represented in the two county study area: northern hardpan, northern claypan, northern basalt flow, and northern volcanic mudflow types.

Six different geomorphic formations still containing wetlands were identified within the two-county study area (Table 2-1). Two, the Red Bluff and Tuscan Formations, were identified only in Butte County; two others, the basin rim and other bedrock types, were identified with remaining wetlands only in Fresno County. Four formations, the Riverbank, Red Bluff, Turlock Lake, and Laguna, were subdivided according to varying associated water-restricting soil layers: claypan without hardpan, silica-cemented hardpan with or without overlying claypan, or a combination of claypan and hardpan.

In Fresno County, the primary source of information for geomorphic and soil substrate classification was the soil survey of the eastern Fresno area prepared by the U.S. Soil Conservation Service (SCS) (1971). The fieldwork for the survey was completed in 1962 but was conducted according to modern survey methods still in use. Correlation of soil

types with geomorphic formations was made based on information within the survey. Maps delineating wetland areas were compared to the soil survey maps, and attribution of geomorphology and soil type was made. Some wetland areas were subdivided along substrate boundaries. Mapped wetland areas may contain up to 20% of the total area as inclusions of other substrate types not attributed.

In Butte County, the sources of information for geomorphic and soil substrate classification as wetland attributes were a combination of geomorphic mapping and historic and modern soil surveys. The principal source of geomorphic mapping is the Helley and Harwood (1985) geologic map of late Cenozoic deposits of the Sacramento Valley. Existing soil surveys and correlation of geomorphic formations with soil types were a primary source of information for their mapping. In the case of Butte County, historic soil surveys conducted by the U.S. Bureau of Chemistry and Soils during the 1920s were used (Watson 1929, Carpenter 1930); no complete modern soil surveys are available for Butte County. A modern soil survey conducted by SCS is in progress. A soil-vegetation mapping program conducted by the California Department of Forestry and Fire Protection has also mapped soils in Butte County but mostly in the Sierra Nevada and Cascade Range foothills with only small portions mapped within the wetland mapping project boundary.

Correlation of wetland areas with soil types and geomorphic formations was made based on the information described above. Maps delineating wetland areas were compared to the draft soil survey maps currently being prepared by SCS and the Helley and Harwood map, and attribution of geomorphology and soil type was made. The currently available draft soil survey maps for the most part cover the floodplain, basin, and alluvial fan areas of Butte County, which are primarily in agricultural production. Alluvial terrace lands have so far been mapped only in the Honcut to Palermo area. For portions of the Butte County project area that are not covered by the draft soil survey maps, the historic soil survey maps from the 1920s were used. A discrepancy arose between the historic maps and the Helley and Harwood geomorphic maps. The latter maps identify many areas as Tuscan Formation that the soil surveys identified as Red Bluff Formation. The interpretation based on the historic soil surveys was given precedence. Some mapped wetland areas were subdivided along substrate boundaries. Mapped wetland areas may contain up to 20% of total area as inclusions of other substrate types not attributed.

Habitat Cover Classes Mapped

Six habitat cover classes were employed in mapping wetlands and riparian habitat for this project (Table 2-1). Cover class indicates the approximate areal coverage, measured as percent cover, of wetland or riparian habitat within polygons attributed as the given habitat type. The remaining area within the polygon is comprised of other land cover types, such as upland or open water habitats. Visual estimates were used to establish cover class for each habitat polygon. Black-and-white pattern graphics of known percent cover were

used as aids to estimating cover values. Cover estimates were routinely verified by direct measurement from the aerial photograph using either a digital planimeter or stratified random transects where linear distance occupied by wetlands was compared to linear distance occupied by uplands.

Distinctive Features Mapped

Two distinctive features of vernal pool areas and other seasonal wetlands were attributed to polygons where they occurred: Mima mound relief and alkali wetland (Table 2-1). Mima mound relief is also known as "patterned ground" or "mound-intermound topography" and appears as a regular array of small mounds across a landscape. Intermound areas typically support vernal pools. The alkali wetland feature category applies to seasonal wetlands in the Fresno County wetland study area only and encompasses both saline and sodic conditions.

Mima Mound Relief

The alternate shading of the regular pattern of Mima mound relief was readily recognizable on aerial photographs. Mima mound signatures tend to show up as darker colored circular-shaped patterns (mounds) and light gray intermound areas. Mima mound relief usually occurs on the relatively flat mesa tops on old alluvial terraces and is usually associated with vernal pool/swale complexes.

Alkali Wetland

Aerial photographs were examined for areas that exhibited bright white bare areas interspersed among areas with grassland or scrub vegetation. These areas were then verified as being saline or sodic using the soil map unit as indicated in the Fresno County soil survey (U.S. Soil Conservation Service 1971). Vernal pool areas found on soils that were indicated by SCS as being mildly or strongly alkaline were attributed as alkali wetland.

Ground Truthing

Indirect ground truthing of wetland data was conducted by comparing wetland signatures on aerial photographs with maps from existing on-ground wetland delineation reports (Table 2-2). Ground truthing was conducted to verify wetland types and cover classes. Direct on-ground truthing was also conducted by Jones & Stokes Associates staff when mapping personnel were incidentally at various sites within the study area.

Table 2-2. Wetland Delineation Reports Consulted for Ground Truthing Effort for Central Valley Wetland Habitat Mapping

Corps File Number	Year	Name	Wetland Types Identified in Delineation
Butte County			
19010989	1988	North Michigan Exploration	Emergent Marsh, Seasonal Wetlands
199000034	1990	Schmidbauer Property	Vernal Pools, Seasonal Wetlands
199000108	1990	Forks of Butte	Miscellaneous Wetlands
199000172	1990	Pleasant Valley Assembly of God	Vernal Pools, Seasonal Wetlands
199000655	1990	Bidwell Ranch	Vernal Pools, Seasonal Wetlands
199101115	1991	Drake Homes, Foothill Park	Vernal Pools, Seasonal Wetlands
199200327	1992	Nelson Avenue, 6th Street Project	Miscellaneous Wetlands
199200837	1992	Oroville Airport Expansion	Vernal Pools, Seasonal Wetlands
199300085	1993	McDaniel, Ned Jr.	Seasonal Wetland
199300175	1993	Sanctuary I-Llano Seco Unit-WI	Emergent Marsh?
199300447	1993	Firing Range Highway 149 Butte County	Vernal Pools, Seasonal Wetlands
199300534	1993	Blakely Western	Vernal Pools, Seasonal Wetlands
199300695	1993	Magalia Dam, Pond, and Pipeline	Miscellaneous small wetlands
N/A	1994	Chico Airport-Western Section	Vernal Pools, Seasonal Wetlands
Fresno County			
199300067	1993	Hughes Creek Diversion/ Fresno	Riparian Scrub, Riparian Woodland

Geographic Information System Data Entry

Wetland and riparian habitat boundaries (polygons) were digitized from the 7.5-minute USGS quadrangle sheets using state plain grid ties as tie-ins for the coordinate system. Polygons in the coverage were then attributed with the four-number coding system of the wetland landcover classification system (Table 2-1).

DEVELOPMENT MAPPING METHODS

Chico Development Mapping

Development mapping of Butte County involved mapping the extent of existing and planned development in the Chico General Plan planning area. City of Chico and Butte County planning staff assisted in identifying the developed areas in their jurisdictions as well as indicating the future plans and directions of development (Sellers and Hogan pers. comms.). The study area for this project, for development mapping purposes, included the City of Chico and portions of Butte County within the Chico General Plan planning area (Figure 1-1). In addition, planned development was mapped in a portion of the county along the Highway 99 corridor (Figure 1-1).

Definition of Development Types

Individual parcels and groups of parcels were categorized by type. Lands in the study area were defined as land that was either set aside for open space or in continued agricultural use, developed, proposed for development, in the process of development, or designated for future growth. These parcels and groups of parcels were placed into development categories as defined below.

Open Space/Agricultural Lands. These are parcels that are in agricultural or open space use. This designation also identifies areas that are considered for agricultural preservation; however, this designation does not distinguish between parcels that do not have any designations and those that are to be preserved for agricultural use. Parcels west of developed portions of Chico are mostly agricultural and parcels east of Chico are not designated or are mostly used for grazing and minor agricultural uses.

Existing Development. These are existing developed parcels within the study area. The extent of development was based on a review of aerial photographs taken of the area and information obtained from general plans and planning staff.

Projects Approved or Permitted for Construction. This designation includes parcels that have been approved and/or permitted for development or are currently under construction. This information is based on input from planning personnel and permit activity.

Parcels with this designation would be expected to have only minimal changes to their designated land uses based on construction and use modifications and would be expected to be built within the next couple of years. This category includes properties for which a final map has been submitted or is currently being drawn, as well as parcels where permitted grading activities are currently underway.

Projects in the Planning Stages. This designation includes parcels with some form of development submittal, but with no existing approvals or permits. This designation also includes parcels with anticipated submittals, including specific plan proposals, or that have been the subject of discussions for development. This information is based on input from planning personnel.

If permitted for development, parcels with this designation would be expected to be developed by the year 2000. This category includes properties for which a tentative map has been submitted, as well as those parcels whose owners have discussed development options with the city and have indicated that site planning is in progress.

Potential Development Areas. This designation includes parcels that have the possibility of being developed within the general plan timeframe, as well as parcels that have been identified for future studies to assess development potential. General plan maps and planning staff have designated these parcels as areas with potential for development, but currently they remain undeveloped with no specific plans in progress.

Many of these parcels have been designated and/or zoned for future residential land uses by the City of Chico or by Butte County. These areas may also be a part of special study areas that have been identified by the jurisdiction as areas where development may occur within identified constraints. This category includes parcels that have gone through or are currently in the preapplication process.

Preservation Areas. This designation applies to areas that are either planned or existing wetlands preserves, including Butte County meadowfoam preserves. Locations of preservation areas are based on information obtained from Chico planning staff.

Parks. This designation includes major park areas such as Bidwell Park and the Bidwell Park buffer.

Aerial Photography Interpretation

Aerial photographs obtained from the City of Chico were used to determine the extent of the existing developed portions of the study area. The photographs were taken in March 1990 and had sufficient detail to determine the edge of development, as it existed in March 1990. This information was then transferred to a USGS 7.5-minute quad map that was used as the base map for all development mapping.

Classification

Through the use of aerial photographs, the developed areas of the study area were defined as they existed in 1990. Meetings with the planning director of the City of Chico and the planning manager of Butte County provided more detailed information, including an update of the developed portions of the study area as of early 1994 (Sellers and Hogan pers. comms.). These meetings also provided information and locations of projects that had approved permits, parcels with development potential, and future development study areas. All information obtained was transferred to the USGS 7.5-minute quad sheets that were used as the base for our mapping efforts.

The development categories were defined with the assistance of Chico and Butte County planning staff to encompass all possible development scenarios for undeveloped parcels in the study area. Development was not classified by type of development, such as industrial, commercial, or residential, but only by whether the parcel would be disturbed by some form of activity related to development of the parcel.

Fresno and Clovis Development Mapping

For development mapping purposes, the study area for this project included the Clovis General Plan area and the Fresno Sphere of Influence. These areas include unincorporated portions of Fresno County. Planning staff members from the City of Fresno, City of Clovis, and Fresno County assisted in identifying the developed areas within their jurisdictions and indicating the future plans and directions of development. (Brock, Waiczis, and Tweedie pers. comms.)

Definition of Development Types

Individual parcels and groups of parcels were categorized by type. Lands in the study area were defined as nondesignated, developed, in the process of development, proposed for development, designated for future growth (including areas for further study), or land

that was either set aside for open space or in continued agricultural use. These parcels and groups of parcels were placed into one of five development categories as defined below.

Nondesignated Lands. These are parcels that do not have any land use designations based on reviews of general plans and conversations with planning personnel.

All of the parcels with this designation were located within the City of Fresno sphere area. These areas were identified as vacant parcels on the Planned Land Uses for Agricultural and Vacant Lands map, which was prepared by the City of Fresno Planning Department.

Existing Development. These are existing developed parcels in the study area. The extent of development was based on a review of aerial photographs taken of the area and information obtained from general plans and planning personnel.

Parcels with this designation are primarily located within what is considered the greater urbanized areas of Fresno and Clovis. Most parcels with this designation are contiguous, and only in a few areas are these parcels isolated from the rest of the developed areas.

Approved/Permitted Development. This designation includes parcels that have been approved and/or permitted for development or are currently under construction. This information is based on input from planning personnel and permit activity.

Parcels with this designation would be expected to have only minimal changes to their designated land uses based on construction and use modifications and would be expected to be built within the next couple of years. This category includes properties for which a final map has been submitted or is currently being drawn, as well as parcels where permitted grading activities are currently underway.

Pending Development. This designation includes parcels with some form of development submittal, but with no existing approvals or permits. This designation also includes parcels with anticipated submittals, including specific plan proposals, or have been the subject of discussions for development. This information is based on input from planning personnel.

If permitted for development, parcels with this designation would be expected to be developed by the year 2000. This category includes properties whose owners have submitted a tentative map as well as those parcels whose owners have discussed development options with the city and have indicated that site planning is in progress.

Planned for Development. This designation includes parcels that have the possibility of being developed within the general plan timeframe. General plans and planning personnel have designated these parcels as areas with potential for development, but that currently remain undeveloped with no site planning in progress.

Many of these parcels have been designated and/or zoned for future residential land uses by the Cities of Fresno and Clovis. These areas may also be a part of special study areas that have been identified by the jurisdiction as areas where development may occur within identified constraints. This category includes parcels that have gone through or are currently in the preapplication process.

Planned Open Space. This designation includes all parcels that have been identified as areas that would remain in agricultural production or would remain as open space areas for the timeframe of the general plan.

Parcels with this designation are those areas that have been designated as agriculture or open space by the Cities of Fresno and Clovis. These are properties that most likely would not be developed in the near future but would be preserved as agricultural land because of their economic value as agricultural land in active production, or would remain as open space in the forms of dedicated developed and undeveloped parklands for use by the area residents.

Aerial Photography Interpretation

Aerial photographs obtained from the Fresno Metropolitan Flood Control District were used to determine the extent of the existing developed portions of the study area. The photographs were taken in March 1991 and contained sufficient detail to determine the boundaries of existing development as of March 1991.

Classification

Through the use of aerial photographs, the developed areas of the study area were defined as they existed in 1991. Meetings with planners from the City of Fresno, City of Clovis, and Fresno County provided more detailed information, including updates of the developed portions of the study area as of early 1994 (Brock, Waiczis, and Tweedie pers. comms.). These meetings also provided information and locations of projects that had approved permits, parcels with development potential, and future development study areas. The Cities of Fresno and Clovis were also able to provide maps identifying future planned land uses of many of the vacant and agricultural areas adjacent to the cities. All of the information obtained was transferred to the USGS 7.5-minute quad sheets that were used as the base for our mapping efforts.

The six development categories were defined with assistance from both the cities and the county to encompass all possible development scenarios for undeveloped parcels in the study area. Development was not classified by type of development, such as industrial, commercial, or residential, but by whether the parcel would be disturbed by some form of activity related to development of the parcel.

Geographic Information System Data Entry

Based on geographic information system parcel map coverages obtained from Butte and Fresno Counties, parcels were attributed to correspond to the development classification system described above. Political, planning, and study area boundaries were added to the database.

Chapter 3. Results

WETLAND MAPPING

Results of the wetland and development mapping efforts are presented in tabular and graphic form (Tables 3-1 to 3-11 and Exhibits 1-9). Estimates of the extent of wetlands in the study area are presented in the tables as well as estimates of the extent of wetland that could be affected by planned development. Exhibits 4, 8, and 9 depict the distribution of wetlands and planned development for the Chico, Clovis, and Fresno study areas, respectively.

Butte County

The Butte County wetland study area comprises 488,220 acres of the lowland areas of the county. In the Butte County study area, wetland and riparian habitats were found to occur in sites totaling 44,516 acres (Table 3-1).

Vernal Pools

Vernal pools are concentrated in Butte County along the eastern side of the Sacramento Valley (Exhibit 1). Approximately 23,483 acres of vernal pool areas occur in Butte County (Table 3-1). As described in Chapter 2, these areas support a mosaic of vernal pool, swale, drainage, and grassland habitats.

Approximately 4,056 acres of vernal pool areas occur in the Chico General Plan area (Table 3-1). These areas amount to 17% of the total vernal pool terrain in Butte County. Nearly all the vernal pools on volcanic substrate are in the Chico General Plan area (Tables 3-2 and 3-3, Exhibits 2 and 3). Nearly all nonvolcanic vernal pools in the Chico area are hardpan vernal pools on Red Bluff Formation (Tables 3-2 and 3-3; Exhibits 2, 3, and 4). The remainder of the county supports a rather even mix of hardpan and claypan vernal pools. In the southern part of the county, vernal pools occur on Turlock Lake, Riverbank, and Laguna Formations (Exhibit 3).

Table 3-1. Butte County Study Area Wetland Acreage

Habitat Type	Chico General Plan Area	Additional Butte County Planning Study Area	Remainder of County Wetland Study Area	Total Amount of Habitat in Study Area
Vernal pool areas [a]	4,055	7,675	11,753	23,483
Other seasonal wetlands	535	285	1,141	1,961
Perennial herbaceous wetlands	0	19	830	849
Riparian forest	908	45	2,273	3,226
Riparian scrub	30	109	4,161	4,300
Open water	0	345	4,834	5,179
Managed wetlands	0	0	10,697	10,697
Nonwetlands	93,367	54,582	290,576	438,525
Total wetland and riparian habitats [b]	5,528	8,133	30,855	44,516
Overall total	98,895	63,060	326,265	488,220

[a] Vernal pool areas include vernal pool, swale, drainage, and grassland habitats.

[b] This acreage does not include open water habitat.

Table 3-2. Acreage of Vernal Pool Areas by Water-Restricting Soil Layer in the Butte County Study Area

Water-Restricting Soil Layer	Chico General Plan Area	Additional Butte County Planning Study Area	Remainder of County	Total
Silica-cemented hardpan	2,786	197	4,822	7,805
Claypan	10	4,874	36	4,920
Mix of silica-cemented hardpan and claypan	56	2,537	6,895	9,488
Volcanic bedrock	1,204	68	0	1,272
Total vernal pool areas	4,056	7,676	11,753	23,485

Note: Vernal pool areas include vernal pool, swale, drainage, and grassland habitats.

Table 3-3. Acreage of Vernal Pool Areas by Geologic Formation in the Butte County Study Area

Geologic Formation	Chico General Plan Area	Additional Butte County Planning Study Area	Remainder of County	Total
Red Bluff	2,842	7,255	8,547	18,644
Riverbank	0	0	705	705
Laguna	0	13	1,376	1,389
Turlock Lake	0	0	1,107	1,107
Tuscan	1,204	68	0	1,272
Floodplain, basin, and alluvial fan	10	340	18	368
Total vernal pool areas	4,056	7,676	11,753	23,485

Note: Vernal pool areas include vernal pool, swale, drainage, and grassland habitats.

Table 3-4. City of Chico General Plan Area
Development and Wetland Acreage

Habitat Type	Open Space/ Agricultural Lands	Existing Development	Projects Approved or Permitted for Construction	Projects in the Planning Stages	Potential Development Areas	Preservation Areas	Parks [a]	Total
Vernal pool areas [b]	1,032	177[c]	64	1,726	503	360	192	4,054
Other seasonal wetlands	432	0	0	15	< 1	0	88	535
Perennial herbaceous wetlands	0	0	0	0	0	< 1	0	0
Riparian forest	560	75	0	0	15	< 1	258	908
Riparian scrub	30	0	0	0	0	0	0	30
Open water	0	0	0	0	0	0	0	0
Managed wetlands	0	0	0	0	0	0	0	0
Nonwetlands	66,804	13,428	720	5,196	3,211	61	3,948	93,368
Total wetland and riparian habitats [d]	2,054	252	64	1,741	518	360	538	5,528
Overall total	68,858	13,680	784	6,937	3,729	421	4,486	98,895

[a] Includes major parks and portions of creekside greenways designated in the general plan.

[b] Vernal pool areas include vernal pool, swale, drainage, and grassland habitats.

[c] Mostly at Chico Airport.

[d] This acreage does not include open water habitat.

Table 3-5. Fresno County Study Area Wetland Acreage

Habitat Type	Clovis General Plan Area	Fresno Sphere of Influence	Fresno Southeast Study Area	Fresno Northeast Study Area	Remainder of County Study Area	Total Amount of Habitat in Study Area
Vernal pool areas[a]	3,951	0	0	2,609	3,929	10,489
Other seasonal wetlands	271	0	0	56	335	662
Perennial herbaceous wetlands	67	19	0	36	971	1,093
Riparian forest	0	20	0	231	1,643	1,894
Riparian scrub	0	7	0	5	442	454
Open water	66	0	0	0	545	611
Managed wetlands	0	0	0	0	3,039	3,039
Nonwetlands	42,483	88,808	13,292	13,173	642,850	800,706
Total wetland and riparian habitats[b]	4,289	46	0	2,937	10,359	17,631
Overall total	46,938	88,854	13,292	16,110	653,754	818,948

[a] Vernal pool areas include vernal pool, swale, drainage, and grassland habitats.

[b] This acreage does not include open water habitat.

Table 3-6. Acreage of Vernal Pool Areas by Water-Restricting Soil Layer in the Fresno County Study Area

Water-Restricting Soil Layer	Clovis General Plan Area	Fresno Sphere of Influence	Fresno Southeast Study Area	Fresno Northeast Study Area	Remainder of County Study Area	Total Amount of Habitat in Study Area
Lime-cemented hardpan or sodic claypan	0	0	0	0	3,012	3,012
Silica-cemented hardpan	497	0	0	939	272	1,708
Claypan	177	0	0	257	54	488
Mix of silica-cemented hardpan and claypan	2,962	0	0	1,316	569	4,847
Other	315	0	0	96	22	433
Total vernal pool areas	3,951	0	0	2,608	3,929	10,488

Note: Vernal pool areas include vernal pool, swale, drainage, and grassland habitats.

Table 3-7. Acreage of Vernal Pool Areas by Geologic Formation in the Fresno County Study Area

Geologic Formation	Clovis General Plan	Fresno Sphere of Influence	Fresno Southeast Study Area	Fresno Northeast Study Area	Remainder of County Study Area	Total Amount of Habitat in Study Area
Floodplain, basin, and alluvial fan	73	0	0	0	0	73
Basin rim	0	0	0	0	3,012	3,012
Riverbank	3,636	0	0	2,433	651	6,720
Turlock Lake	0	0	0	65	0	65
Laguna	0	0	0	14	244	258
Other bedrock	242	0	0	96	22	360
Total vernal pool areas	3,951	0	0	2,608	3,929	10,488

Note: Vernal pool areas include vernal pool, swale, drainage, and grassland habitats.

Table 3-8. City of Clovis General Plan Area
Development and Wetland Acreage

Habitat Type	Development Categories						Total
	Nondesignated	Existing	Approved/ Permitted	Pending	Planned	Open Space	
Vernal pool areas [a]	33	0	0	0	1,339	2,579	3,951
Other seasonal wetlands	2	0	0	0	0	269	271
Perennial herbaceous wetlands	< 1	0	0	0	53	14	67
Riparian forest	0	0	0	0	0	0	0
Riparian scrub	0	0	0	0	0	0	0
Open water	0	0	0	0	51	15	66
Managed wetlands	0	0	0	0	0	0	0
Nonwetlands	3,007	6,793	1,321	876	22,172	8,414	42,583
Total wetland and riparian habitats [b]	35	0	0	0	1,392	2,862	4,289
Overall total	3,042	6,793	1,321	876	23,615	11,291	46,938

[a] Vernal pool areas include vernal pool, swale, drainage, and grassland habitats.

[b] This acreage does not include open water habitat.

Table 3-9. City of Clovis Northeast Urban Center Specific Plan
Area Development and Wetland Acreage

Habitat Type	Development Categories						
	Nondesignated	Existing	Approved/ Permitted	Pending	Planned	Open Space	Total
Vernal pool areas[a]	28	0	0	0	1,005	1,554	2,587
Other seasonal wetlands	0	0	0	0	0	0	0
Perennial herbaceous wetlands	< 1	0	0	0	39	14	53
Riparian forest	0	0	0	0	0	0	0
Riparian scrub	0	0	0	0	0	0	0
Open water	0	0	0	0	0	0	0
Managed wetlands	0	0	0	0	0	0	0
Total wetland and riparian habitats[b]	28	0	0	0	1,044	1,568	2,640

[a] Vernal pool areas include vernal pool, swale, drainage, and grassland habitats.

[b] This acreage does not include open water habitat.

Table 3-10. City of Fresno Sphere of Influence Development and Wetland Acreage

Habitat Type	Development Categories						
	Nondesignated	Existing	Approved/ Permitted	Pending	Planned	Open Space	Total
Vernal pool areas [a]	0	0	0	0	0	0	0
Other seasonal wetlands	0	0	0	0	0	0	0
Perennial herbaceous wetlands	1	12	< 1	1	5	0	19
Riparian forest	12	4	0	0	< 1	4	20
Riparian scrub	1	6	0	0	0	0	7
Open water	0	0	0	0	0	0	0
Managed wetlands	0	0	0	0	0	0	0
Nonwetlands	9,496	54,855	1,580	1,596	14,245	7,036	88,808
Total wetland and riparian habitats [b]	25	11	< 1	1	5	4	46
Overall total	9,510	54,877	1,580	1,597	14,250	7,036	88,854

[a] Vernal pool areas include vernal pool, swale, drainage, and grassland habitats.

[b] This acreage does not include open water habitat.

Table 3-11. City of Fresno General Plan Update Northeast Study Area (Copper-Friant Triangle) Wetland Acreage

Habitat Type	Area in Acres
Vernal pool areas [a]	2,609
Other seasonal wetlands	56
Perennial herbaceous wetlands	36
Riparian forest	231
Riparian scrub	5
Open water	0
Managed wetlands	0
Nonwetlands	13,173
Total wetland and riparian habitats [b]	2,937
Overall total	16,110

[a] Vernal pool areas include vernal pool, swale, drainage, and grassland habitats.

[b] This acreage does not include open water habitat.

Other Wetland Habitats

The Butte County wetland study area supports approximately 2,810 acres of other seasonal wetlands and perennial herbaceous wetlands (Table 3-1, Exhibit 1). Approximately 10,697 acres of managed wetlands are present at the Gray Lodge Waterfowl Management Area (Table 3-1, Exhibit 1).

Riparian Habitats

Approximately 7,527 acres of riparian forest and scrub habitats occur in the study area (Table 3-1). Riparian forest and scrub habitats occur mainly along the Sacramento River and associated sloughs and at the Oroville Wildlife Area (Exhibit 1).

Fresno County

The Fresno County wetland study area comprises 818,948 acres, extending from Fresno Slough to the Sierra Nevada foothills. In the Fresno County study area, wetland and riparian habitats were found to occur in sites totaling 17,631 acres (Table 3-5).

Vernal Pools

Vernal pool areas are concentrated in the northeastern and northwestern portions of the study area (Exhibit 5). The northwestern part of the study area supports saline-sodic vernal pools with lime-cemented hardpans and sodic claypans on the basin rim geomorphic surface (Exhibits 6 and 7). A large portion of these saline-sodic vernal pool areas are in the Kerman Ecological Reserve. The eastern San Joaquin Valley in the northwestern part of the study area supports freshwater vernal pools with a variety of water-restricting soil layers on Riverbank, Laguna, and Turlock Lake Formations and other bedrock types (Exhibits 6 and 7). Vernal pool areas encompass 10,488 acres, with 3,012 acres of saline-sodic vernal pool areas and 7,476 acres of freshwater vernal pools (Tables 3-6 and 3-7). As described in Chapter 2, these areas support a mosaic of vernal pool, swale, drainage, and grassland habitats.

The Clovis General Plan area supports 3,951 acres of vernal pool areas, mostly on the Riverbank Formation (Table 3-5; Exhibits 5, 7, and 8). These vernal pool areas constitute approximately 38% of the total area remaining in the county. In contrast, no areas of undisturbed vernal pool concentrations remain within the Fresno Sphere of Influence.

Other Wetland Habitats

The study area supports approximately 1,755 acres of other seasonal wetlands and perennial herbaceous wetlands (Table 3-5, Exhibit 5). Approximately 3,039 acres of managed wetlands are present in the Mendota Wildlife Area (Table 3-5, Exhibit 5).

Riparian Habitats

Approximately 2,348 acres of riparian forest and scrub habitats occur in the Fresno study area (Table 3-5). Riparian forest and scrub habitats occur mainly along the Kings River, San Joaquin River, and Fresno Slough (Exhibit 5).

DEVELOPMENT MAPPING

Chico Study Area

A breakdown of development categories by acreage for the Chico General Plan area is provided in Table 3-4. Of the 98,895-acre study area, 13,680 acres are existing development, 784 acres are approved or permitted for construction, 6,937 acres are in project planning stages, and 3,729 acres may potentially be developed (Table 3-4, Exhibit 4).

Only one development site was identified in the additional study area in Butte County: the Rancho Esquon project site (Exhibit 4). It totals approximately 5,713 acres and was categorized as a potential development area.

Clovis Study Area

A breakdown of development categories by acreage for the Clovis General Plan area is provided in Table 3-8. Of the 46,938-acre study area, 6,793 acres are existing development, 1,321 acres are approved/permitted for development, 876 acres are pending approval for development, and 23,615 acres are planned for development (Table 3-8, Exhibit 10). Approximately 11,291 acres have been designated for open space.

Fresno Study Area

A breakdown of development categories by acreage for the Fresno Sphere of Influence is provided in Table 3-10. Of the 88,854-acre study area, 1,580 acres are approved/permitted for development, 1,597 acres are pending approval for development, and 14,250 acres are planned for development (Table 3-10, Exhibit 9). Approximately 7,036 acres have been designated for open space.

CONFLICTS BETWEEN WETLANDS AND FUTURE DEVELOPMENT

Chico Study Area

Significant conflicts between future development and wetland resources, particularly vernal pools, can be anticipated if the development were to proceed as envisioned in the Chico General Plan of August 1994 (Table 3-4, Exhibit 4). Approximately 64 acres of vernal pool areas occur in parcels with approved or permitted residential and commercial development projects. Approximately 1,726 acres of vernal pool areas occur in parcels with development projects in the planning stages. Approximately 503 acres of vernal pool areas occur in parcels within Chico's urban limit boundary that could potentially be developed. A total of 2,293 acres of vernal pool areas could be lost to development in the Chico General Plan area. This amount constitutes 57% of the total amount of vernal pool areas in the general plan area and 10% of vernal pool areas in Butte County.

Of 1,272 acres of vernal pool areas in the county occurring on volcanic substrate, 1,204 acres, or 95%, are in the Chico General Plan area and 344 acres are in areas expected to be developed under the general plan (Tables 3-2 and 3-3; Exhibits 2, 3, and 4). Approximately 29% of the volcanic substrate vernal pools in the general plan area (27% of the county total) could be removed.

Of the 14,091 acres of hardpan or mixed hardpan and claypan vernal pool areas on Red Bluff Formation in the county, 2,850 acres, or 20%, are in the Chico General Plan area and 1,949 acres, or 14%, are in areas expected to be developed under the general plan (Tables 3-2 and 3-3; Exhibits 2, 3, and 4). Approximately 68% of the hardpan vernal pools within the general plan area could be removed, and 551 acres are at existing or designated preserve or park sites.

The 5,713-acre Rancho Esquon potential project site, outside of the Chico General Plan area, supports 140 acres of vernal pool areas and 28 acres of areas supporting other

seasonal wetlands (Table 3-1, Exhibit 1). Claypan and hardpan vernal pools occur at this site, which is on the Red Bluff Formation.

Clovis Study Area

Major conflicts between future development and wetland resources, particularly vernal pools, can be anticipated if the development were to proceed as envisioned in the Clovis General Plan (Table 3-8). Although no vernal pool areas occur in areas of approved/permitted or pending developments, approximately 1,339 acres of vernal pool areas are in parcels planned for development. Approximately 2,579 acres of vernal pool areas are in parcels designated as open space. An open space designation, however, does not ensure protection of vernal pool habitats because many forms of development in open space areas (e.g., landscaped parks, golf courses, ball fields, and flood control basins) can result in the loss of vernal pools.

The Clovis northwest and southeast urban center specific plan areas do not support natural, undisturbed wetland resources. No significant conflicts with wetland resources are expected if development proceeds in these areas.

The Clovis northeast urban center specific plan area supports a large amount of wetlands, especially vernal pools (Table 3-9). Approximately 1,005 acres of vernal pool areas occur in parcels planned for development. Approximately 1,554 acres of vernal pool areas occur within parcels designated as open space. As discussed above, however, an open space designation alone does not serve to protect wetland resources. Major conflicts between development and wetland resources can be expected if development proceeds in this area as indicated in the general plan.

Fresno Study Area

No strong conflicts exist in the Fresno Sphere of Influence between future development and wetland resources because only a small amount of natural, undisturbed wetland and riparian habitats remain in this area (Table 3-10, Exhibit 9). Approximately 46 acres of perennial herbaceous wetland and riparian habitats were found in this study area (Table 3-10). No concentrations of undisturbed vernal pools remain in the Fresno sphere. All the historical vernal pool terrains were removed for agricultural and urban development.

No remaining natural undisturbed wetlands were found in Fresno's southeast general plan study area. Future development in this area would not result in conflicts with natural wetland resources.

Fresno's northeast general plan study area, also known as the Copper-Friant Triangle, supports a large amount of wetlands, including 2,609 acres of vernal pool areas (Table 3-11). Approximately 25% of the county's remaining vernal pool areas occur there. If future development is directed into this region, significant conflicts with wetland resources, and particularly vernal pools, can be expected.

Chapter 4. Planning Recommendations

INTRODUCTION

This chapter discusses the variety of planning tools that can be used by local agencies to conserve wetland resources and provides specific recommendations for the Chico and Fresno-Clovis study areas.

The first section, "Wetlands Regulation", presents a brief overview of local, state, and federal regulations that provide wetland protection. The "Planning Tools" section presents a variety of tools available to local agencies that can be used to conserve wetlands and plan for development that may encroach on sites supporting wetland resources. Following the section on planning tools are two sections that describe specific recommendations for the use of these planning tools in the Chico and Fresno-Clovis study areas. These planning recommendations, along with Exhibits 1-9, are provided to assist the cities and counties in avoiding conflicts between planned development and wetland resources. The "Closing Remarks" section presents concluding statements concerning the results of this study.

WETLANDS REGULATION

Wetlands protection is provided at the local, state, and federal levels. This section provides a brief overview of local, state, and federal environmental review processes and regulations that are triggered when public or private actions could result in adverse effects on wetland resources.

The primary wetlands protection regulation used at the local level is the California Environmental Quality Act (CEQA). Every development project that is not exempt from CEQA must be analyzed by the lead agency to determine the potential environmental effects of the project. Ideally, the local development permit process is coordinated with the CEQA environmental review process. The CEQA document, either a negative declaration or an environmental impact report (EIR), should identify all the permits that will be required for a project and should include the input of the permitting agencies, the public, the applicant, and the land use decision agency in one document.

State agencies regulate the public and private use of state land and resources. Wetland protection is typically provided by the DFG through the CEQA process and through the issuance of lake and streambed alteration agreements under Sections 1600-07

of the California Fish and Game Code. Any construction activity that would alter the natural state of any river, stream, or lake in California is required to obtain a lake or streambed alteration agreement from the DFG. When applying for the agreement, developers are expected by DFG to provide evidence of compliance with CEQA.

The primary source of federal protection of wetlands is the permit process conducted under Section 404 of the Clean Water Act. Section 404 specifically regulates the discharge of dredged or fill material into the waters of the United States, a broad category of water bodies including oceans, bays, lakes, rivers, streams, and wetlands. Under Section 404, it is illegal to discharge dredged or fill material into wetlands without first receiving a permit from the U.S. Army Corps of Engineers (Corps). The Section 404 permit program is administered jointly by EPA and the Corps.

PLANNING TOOLS

This section describes a range of planning tools available to cities and counties for addressing wetland conservation issues. Each of the planning tools is described in terms of methods and techniques for wetland preservation and management. All the programs described here were considered in preparing planning recommendations for the Fresno-Clovis and Chico development areas. Several tools were not recommended because they do not adequately address circumstances in the study area. However, discussions of these tools have been retained in this section of the report because of their overall utility for wetlands conservation and their potential use in the future.

The most effective method of resource planning in urbanizing areas is to identify wetland resource issues early in the planning process. Considering wetland resources when preparing long-range plans for urbanizing areas is often the first opportunity for local agencies to adopt resource preservation and management policies. These policies lay the groundwork for more specific management and preservation practices that can be implemented through regional plans, city and county general plans, specific plans, zoning regulations, and federal-local partnerships.

Regional Plans

Regional plans can be effective in promoting natural resource management programs for multiple political jurisdictions. Examples of regional planning programs that have been effective for managing natural resources include:

- habitat conservation/management planning programs,
- the Natural Community Conservation Planning Program,

- watershed management plans, and
- open space programs.

Typically, these programs are the products of cities, counties, special districts, and regional agencies working together for a common objective. Wetland resources often cross political boundaries and can be more effectively managed when the affected agencies coordinate their efforts. Joint agency agreements and special management entities can be instrumental in implementing long-term resource management.

Habitat Conservation/Management Plans

The habitat conservation plan (HCP) and habitat management plan (HMP) processes are planning tools developed to protect, within a defined area, individual species or multiple species that are listed as threatened or endangered under the federal or California Endangered Species Act. HCPs are defined under Section 10 of the federal Endangered Species Act. "HMP" is the term used for conservation plans developed under Section 2081 of the California Endangered Species Act. HCPs and HMPs are typically prepared as "reactive" planning documents where already proposed projects would affect state-listed or federally listed species and are a requirement for private individuals and local agencies to obtain "take" permits from USFWS and DFG, respectively.

HCPs and HMPs, however, can be developed as "proactive" planning documents that identify the locations of threatened and endangered species and their habitat; designate appropriate development in those areas; and obtain agreements from USFWS, DFG, local agencies, and private landowners. "Prelisting" HCPs and HMPs can be developed for rare wildlife and plant species that are not officially listed as threatened or endangered and can reduce the likelihood that those species would become listed by stabilizing or enhancing population size and habitat extent.

HCPs and HMPs can be used to protect wetlands if they are focused on species that require wetland habitat for survival or reproduction. A multispecies HCP/HMP for threatened and endangered plants and wildlife that occur in vernal pools could be an effective tool for vernal pool conservation.

Natural Community Conservation Plans

A natural community conservation plan (NCCP) developed under the California Natural Community Conservation Planning Act (California Fish and Game Code, Section 2800) is a type of conservation plan that focuses on a biological community rather than an individual species. NCCPs provide for regional protection and perpetuation of natural communities while allowing compatible and appropriate development and growth. The goal of natural community conservation planning is to protect species of plants and animals and

their habitats before they decline to the point where designation as threatened or endangered under the California Endangered Species Act becomes necessary. NCCPs are expected to:

- promote coordination and cooperation among public agencies, landowners, and other private interests;
- provide a mechanism by which landowners and development proponents can effectively participate in the resource planning process;
- provide a regional planning focus that can effectively address cumulative impact concerns and minimize wildlife habitat fragmentation;
- promote multispecies management and conservation;
- provide an option for identifying and ensuring appropriate mitigation for impacts on fish and wildlife; and
- promote the conservation of broad-based natural communities and species diversity (California Fish and Game Code, Section 2800).

The first and only NCCP in California is being prepared for southern California coastal sage scrub in San Diego, Orange, Riverside, San Bernardino, and Los Angeles Counties.

An NCCP for vernal pools could be developed for Butte County, Fresno County, or for multicounty areas, such as the Sacramento Valley or the San Joaquin Valley. An NCCP would be an effective tool for Butte or Fresno County to plan the pattern of future development to avoid significant conflicts with vernal pool resources.

Watershed Management Plans

Watershed management plans provide wetland conservation policies and management practices for drainage basins that often span jurisdictional boundaries. They can be effective planning tools, with joint local and regional agency cooperation, for conserving wetland areas, along with water quality, water supply, and other natural resources. Watershed plans also provide a tool for differentiating the functions and values of wetlands in the watershed. For example, although wetlands throughout a watershed provide a variety of functions and values, in some cases preserving and managing wetlands in the upper reaches may primarily benefit water quality and flood control, while preserving wetlands in lower reaches may primarily benefit groundwater recharge and wildlife habitat.

The Santa Clara River Watershed Management Plan, being prepared under the joint authority of Los Angeles and Ventura Counties and local cities and water districts, and the Santa Margarita River Watershed Management Plan, being prepared under the joint authority of San Diego and Riverside Counties and local cities and water districts, are two examples of watershed planning programs in California for which wetland and habitat conservation and management are important objectives.

To be effective, watershed management plans should be prepared using an ecosystem approach that identifies wetland functions and determines the relative values of sites in the watershed for wetland preserves, mixed land use, and development.

Open Space Management Plans

Open space management plans establish policies and management practices for the preservation of open space and the conservation of wetlands and other natural resources. Open space and resource conservation areas are designated land use types on a land use diagram prepared as part of a regional or local general, community, or specific plan. Planned open space areas are described in terms of habitat, topography, hydrology, and other physical characteristics. These characteristics, and the sensitive resources they support, become the focus of management policies and practices. The following are examples of open space and resource conservation types considered in management plans:

- conservation of sensitive environmental features, including wetlands;
- conservation and enhancement of wildlife habitat, including habitat for wetland species;
- preservation of agricultural uses in areas of prime soils;
- conservation of water resources and control of water quality;
- flood control and stormwater detention; and
- establishment of community identity characteristics and provision of passive and active recreation, including bicycle and pedestrian paths.

Open space plans can merge the conservation of wetlands with compatible uses on the same site, such as flood control, utility corridors, livestock grazing, and recreation.

City and County General Plans

Cities and counties in California are mandated to prepare long-range plans. The California Legislature has declared the following:

> Decisions involving the future growth of the state, most of which are made and will continue to be made at the local level, should be guided by an effective planning process, including the local general plan, and should proceed within the framework of officially approved statewide goals and policies directed to land use, population growth and distribution, development, open space, resource preservation and utilization, air and water quality and other related physical, social and economic development factors. (Government Code, Section 65030.1.)

The general plan conservation element, which typically emphasizes the use and the preservation of natural resources, is usually the most appropriate location to address natural resource issues. When provisions of the conservation element overlap with those of the open space and land use elements, development and resource protection can be considered simultaneously during preparation of the general plan (Office of Planning and Research 1990).

General Plans

Wetlands conservation can be addressed in the general plan by mapping the resource; describing its habitat value; and developing conservation goals, policies, and action or implementation programs. Conservation of wetland resources can also be addressed in a general plan programmatic EIR. Such an EIR assesses impacts on wetland resources and includes mitigation measures and monitoring programs for losses of wetlands.

Mapping wetland resources is a key step that can be accomplished early in the planning process and incorporated with other natural resource information, such as the hydrological characteristics that support them. Designating wetland areas as open space in the general plan land use element is the most effective means of conservation. This designation must be supported by wetland conservation policies and implementation programs to avoid conflicts with uses such as active recreation or agriculture, which could potentially degrade the resource.

Specific Plans

Specific plans are tools for systematic implementation of the general plan. Typically, they are applied to portions of the general plan where more detailed planning is needed to facilitate development. At a minimum, a specific plan must state its relationship to the general plan and include the following:

- the distribution, location, and extent of uses of land, including open space, within the area covered by the plan;
- the proposed distribution, location, extent, and intensity of major components of public and private transportation, sewage, water, drainage, solid waste disposa energy, and other essential facilities proposed to be located within the ar covered by the plan and needed to support the land uses described in the pla
- standards and criteria by which development will proceed and standards for tl conservation, development, and use natural resources, where applicable; and
- a program of implementation measures, including regulations, programs, publ works projects, and financing measures necessary to carry out the provisions the preceding three items. (Government Code, Section 65451[a].)

Specific plans are a mechanism for linking resource preservation and management to development. Phasing programs, adopted as part of specific plans, can tie the dedication of resource lands, establishment of buffers, initiation of management programs, and other conservation concepts to development permit approvals.

Though smaller than the areas covered by general plans, land areas covered by a specific plan are typically large enough to offer flexibility in the location and intensity of land uses. Specific plans are also a means of establishing open space and conserving wetlands while planning for development. Wetland resources within a specific plan area can be designated as preserves with plan guidelines to maintain these resources in areas separate from development. The ownership of these resource areas can be conveyed to the local agency with jurisdiction, a private resource conservation organization, or a special district with the funding necessary to carry out long-term conservation management.

Zoning Regulations

Zoning regulations for wetlands protection can take the form of written criteria establishing buffers and other preservation features or mapped districts where wetlands are a defined and protected use. Regulations may be adopted as separate ordinances designed

solely to protect wetland values or as part of a more comprehensive program regulating several activities and areas in addition to wetlands and adjacent buffer zones (Burke et al. 1988). Wetland protection through zoning districts can include:

- specific wetland protection districts,
- natural resource protection districts, and
- combined floodplain/wetland districts.

The use of zoning overlays can also be an effective means of wetland protection where wetlands can coexist with other uses, such as agriculture, parks, and open space.

Zoning ordinances and mapped districts typically have the greatest enforcement of the local planning programs referenced in this report. Model ordinance language has been developed specifically for wetland protection. Some of the key sections of a wetland preservation ordinance are:

- **findings of fact and purpose,** which help the public and courts understand the rationale for protecting wetlands;

- **descriptions of the lands to which this ordinance applies,** which allow for the incorporation of wetland maps into the zoning ordinance;

- **discussion of permit requirements and enforcement,** which specifies permit requirements for activities conducted in a wetland area and within a specified distance from a wetland;

- **discussion of uses by right and special permit uses in a wetland,** which establishes permit requirements and identifies which uses are allowed outright; and

- **discussion of standards and procedures for special permit uses,** which specifies the information necessary for permit application and the agency's regulatory review process.

Transfer of Development Rights

The transfer of development rights recognizes that parcels of land can be assigned the right to develop. This right can be established by a local agency's general plan or zoning ordinance. The transfer of development rights allows an agency to consider development rights as a commodity that can be transferred from one location to another. A transfer of development rights program would identify parcels transferring rights as "sending sites" and parcels receiving the transferred development as "receiving sites". Preservation of natural

resource areas, such as wetlands, is one of the benefits that can be realized by having a transfer of development rights program in place.

Federal-Local Partnerships for Wetland Planning

EPA and the Corps have regulatory and nonregulatory programs to assist local, state, and federal agencies in wetland conservation planning. Regulations and policies promulgated under Section 404 of the Clean Water Act provide mechanisms for partnerships between local agencies and EPA and the Corps, the federal agencies that regulate activities in wetlands under Section 404. Advanced identification (ADID), general permits, and special area management plans (SAMPs) are three tools that can be used to plan for wetland conservation through federal-local partnerships in areas of rapid development.

ADIDs, general permits, and SAMPs are discussed below. However, it should be noted that less formal means of federal-local wetland planning partnerships can be conducted. EPA and the Corps can provide wetland conservation planning assistance without using the formal ADID or SAMP processes. In many cases, it may be more efficient and flexible to use an informal planning process that follows the concepts of ADIDs and SAMPs without entering into the official processes.

Advanced Identifications

Advanced identification is a method, in accordance with EPA's Section 404(b)(1) Guidelines, of identifying the suitability of wetland sites for the future disposal of dredged or fill material. Two types of sites are identified under the ADID process:

- possible future disposal sites, including existing disposal sites and nonsensitive areas, and

- areas generally unsuitable for disposal site specifications (e.g., sites unsuitable for placement of dredged or fill material). (40 CFR 230.80.)

Classifying sites in either of these categories provides information that can be used to facilitate the process for individual or general Section 404 permits. The identification of areas as "possible future disposal sites" does not constitute a permit for the discharge of dredged or fill material into wetlands but serves as an indicator to potential developers that the issuance of a permit is likely. Conversely, the designation of a site as generally unsuitable for disposal serves as a warning to developers that issuance of a permit is unlikely or that extensive conditions will likely accompany a permit.

Information provided in an ADID allows EPA and the Corps to focus their regulatory efforts to reduce wetland losses where resource values and scarcity are greatest and come into conflict with development pressures. The ADID:

- enables more effective advanced planning;
- increases public awareness of the importance and value of aquatic ecosystems; and
- provides the regulated community with an indication of the likelihood of permit issuance (Sullivan and Richardson 1993).

Local agencies may request that EPA initiate an ADID in their area after consultation with the state.

EPA Region 9 has recently completed an ADID for the Verde River and its tributaries located northeast of Phoenix, Arizona. A detailed assessment of the functions and values of wetland resources of the Verde River was prepared (Sullivan and Richardson 1993). The Verde River was selected for an ADID based on three key factors:

- high wetland and riparian functions and values,
- a high probability of wetland loss or degradation without proper management and planning, and
- the opportunity to participate and work cooperatively in other comprehensive planning efforts (Sullivan and Richardson 1993).

These key factors identified for the Verde River area are present in the Chico and Fresno-Clovis planning areas. ADIDs for these planning areas, developed as federal-local (and possibly state) agency partnerships, would be appropriate tools for wetlands conservation and streamlining of the development process.

An ADID can be made more effective as a wetland conservation and development planning tool if it is followed by Corps issuance of a general permit that streamlines regulatory requirements in nonsensitive sites. One disadvantage of an ADID is that it can be labor intensive and time consuming to complete, requiring a substantial amount of coordination among various agencies and interest groups.

General Permits

General permits are Section 404 permits issued by the Corps on a regional, statewide, or nationwide basis designed to apply to categories of discharge activities that are similar

in nature and will cause only minimal adverse environmental effects. General permits serve to streamline the permitting process, avoiding the more complex and sometimes extended process of issuing individual permits. Special and general conditions are part of the general permit and must be met by the project proponent for the general permit to be applicable. Local agencies and the Corps can work in partnership to develop appropriate regional general permit conditions.

Regional general permits may be issued by the Corps where local ordinances, or a combination of state and local agency ordinances and regulations, provide protections for wetlands that achieve the objectives of the Section 404 permit program. The Corps must still verify that proposed actions are authorized under the general permit, but the local agency essentially can assume portions of the Corps' wetland regulatory responsibility for their area. For example, General Permit no. 16 was issued, effective August 1, 1994, by the Corps' Sacramento District for construction, modification, and repair work in wetlands and other waters in the Lake Tahoe region. The region covered by the general permit is the same as the jurisdictional boundaries for the Tahoe Regional Planning Agency (TRPA). Discharges into wetlands and other waters are authorized if the activities meet the requirements of TRPA, state and local agencies, and the general permit.

General permits are reviewed by the Corps every 5 years and at that point may lapse or be reauthorized with or without modification.

Special Area Management Plans

Special area management plans were authorized under amendments to the 1980 Coastal Zone Management Act. The process is defined as:

> A comprehensive plan providing for natural resource protection and reasonable coastal-dependent economic growth containing a detailed and comprehensive statement of policies, standards, and criteria to guide public and private uses of lands and waters; and mechanisms for timely implementation in specific geographic areas within the coastal zone.

Although the SAMP process was originally intended to be applied to the coastal zone, Corps guidance issued in 1986 (and extended in 1992) for the use of SAMPs stated that the process of collaborative interagency planning within a geographic area of special sensitivity is just as applicable in noncoastal areas (Corps Regulatory Guidance Letter 86-10).

A successfully developed SAMP can:

- reduce the problems associated with the traditional case-by-case review of wetland impacts and mitigation and individual permit applications,

- provide some predictability to the development process, and
- address individual and cumulative impacts on wetlands in the context of broad ecosystem needs.

One disadvantage of a SAMP is that it can be labor intensive and time consuming to develop, requiring a substantial amount of coordination among various agencies and interest groups.

According to Corps guidance, the advantages of a SAMP may outweigh the disadvantages if the following elements exist before a SAMP is proposed:

- the area is environmentally sensitive and under strong developmental pressure,
- a sponsoring local agency ensures that the plan fully reflects local needs and interests,
- full public involvement is encouraged in the planning and development process, and
- all parties express a willingness at the outset to conclude the SAMP process with a definitive regulatory product. (Corps Regulatory Guidance Letter 86-10.)

According to Corps guidance, the ideal SAMP concludes with two products:

- appropriate local/state approvals and a Corps general permit or abbreviated processing procedure for activities in specifically defined situations and
- a local/state restriction and/or an EPA Section 404(c) restriction (preferably both) for undesirable activities. (Corps Regulatory Guidance Letter 86-10.)

Under Section 404(c), EPA may veto Corps issuance of a discharge permit. A Section 404(c) restriction is an EPA action to prevent discharges before a permit application is even submitted. Although the Corps may still be requested to issue individual permits for activities that do not fall into either category above, individual permits should represent a small number of the total permit actions within the area covered by the SAMP.

An example of a SAMP considered to be successful is the Anchorage, Alaska SAMP enacted in 1982 (Salvesen 1990). Under this SAMP, wetlands were classified into four categories:

1. **preservation:** sites where no development is allowed except in special cases;
2. **conservation:** sites where some development is allowed;

3. **developable:** sites where development is not hindered by wetlands present; and

4. **special study:** sites with wetlands that require additional study before they can be classified into categories 1, 2, or 3.

Under this SAMP, a general permit was issued by the Corps for sites designated as developable, while sites designated as preservation or conservation are permitted by the Corps on a project-by-project basis (Salvesen 1990). Since enactment of the Anchorage SAMP, most development has occurred in sites designated as developable (Salvesen 1990).

In California, the Corps' Sacramento District is presently involved in the development of one SAMP and regional general permit for a 6-square-mile area around the City of Bridgeport in Mono County. The purpose of the Bridgeport SAMP is to:

- provide guidance to landowners, developers, and agencies;
- protect wetland resources; and
- allow for orderly community growth while preserving, protecting and, where possible, enhancing wetland functions and values (U.S. Army Corps of Engineers public notice no. 1993000607, November 1, 1993).

The Bridgeport SAMP is being developed in accordance with Corps regulatory guidance on SAMPs and the Mono County General Plan Update. A general wetlands map of the SAMP area has been prepared and accepted by the Corps for the area. The SAMP is expected to include three categories of wetlands:

1. wetlands of high values that are generally considered unsuitable for disposal of dredged or fill material;

2. wetlands of low values with poor potential for enhancement (certain types of fill may be allowed in these wetlands, provided impacts are minimized and full mitigation conducted); and

3. wetlands where additional evaluation is needed to determine whether to include them in category 1 or 2.

The SAMP will require a minimum of 1:1 compensation of functions and values for all wetlands lost in the area. The use of mitigation banks will be addressed in the SAMP. Anticipated signatory agencies to the final SAMP are the Corps, USFWS, Mono County Planning Department, and Lahontan Regional Water Quality Control Board. (Corps public notice no. 199300607, November 1, 1993.)

Comparison of ADIDs, General Permits, and SAMPs

Wetlands designated under ADIDs are nonregulatory. The approval process for SAMPs, however, end with Corps and EPA regulatory decisions designating sites where the streamlined general permit process applies and sites where discharges into wetlands are restricted. ADIDs provide land developers and local agencies with valuable information for land purchase and planning decisions. Although the practice is not encouraged, permit applications can still be filed and permits approved for fill in wetland sites designated under an ADID as "unsuitable" for placement of fill material. Conversely, fill permits may still be denied for wetlands designated as "non-sensitive" under an ADID.

SAMPs provide much of the same wetland locational information as ADIDs, but with regulatory restrictions attached. SAMPs may designate wetland sites legally restricted from fill activities (Section 404[c] restrictions). In addition, the SAMP specifically designates wetland sites where general permits developed under the SAMP are applicable.

General permits may be issued without undergoing an ADID or SAMP process. However, completion of an ADID prior to the formulation of a general permit provides valuable information for establishing the local agency responsibilities and the scope and conditions of the general permit. By providing specific data on wetland extent, location, and value within a region, an ADID also lends credibility to the local wetland regulations established, activities approved under the general permit program, and the special and general conditions of the general permit.

RECOMMENDATIONS FOR THE CHICO STUDY AREA

Background Information

Wetlands became an issue of concern in Chico after the 1976 general plan was adopted. In the early 1970s the primary issue in Chico was the protection of prime agricultural land. Population growth estimates prepared in 1974 for the general plan update indicated that the population of the city and immediate surrounding urban area would increase by 9,300-23,900 people from 1975 to 1995, suggesting a total population range from 56,500 to 71,100 by 1995. One of the principal problems identified in the general plan update was where to allow and encourage the new development to locate without encroaching into the prime agricultural soils located primarily west and south of the city. In the general plan update, the city directed growth away from the prime agricultural soils to the nonprime soils located primarily northeast and east of the city. These areas, referred to as the Tuscan soils and Scab Lands areas, were determined suitable for development; however, development had been limited because of the lack of subdrainage and the extreme hardness of the soils.

The general plan was adopted in 1976. Shortly after adoption, however, new information about rare plants and wetlands located in the areas east of the city became available. Biological surveys conducted for the initial Foothill Park project identified rare plants within the project area. Butte County meadowfoam was discovered and linked to vernal pool habitat. DFG and the Corps increased their involvement in the permitting of projects. In particular, the Corps' involvement in wetlands permitting increased in Chico and in other areas of California. Community groups also became more interested and involved in wetlands issues.

Most of the projects in Chico that included the filling of vernal pools and other wetlands have proceeded under nationwide general permits with the city that require the developers to obtain Corps approval as a condition of development. This project-by-project approach has resulted in the loss and fragmentation of wetland resources.

Existing Wetland Conservation Tools Used in the Chico Study Area

City of Chico Programs

The primary wetlands protection tools used by the City of Chico are specific plans, Corps permits, and the CEQA process. The specific plan process has been used for Foothill Park and Bidwell Ranch, two major developments in north Chico. Each of these project sites has high-quality wetlands, and the specific plans have proposed large wetland preserve areas. Through the specific plan process, the city has required developers to identify wetland resources early in the project design with the goal of preserving as much of the resource as possible. During the environmental review, the city then evaluates the adequacy of the design and preserve in protecting wetlands and minimizing impacts.

The city also requires Corps permits as a condition of development. The city coordinates site visits among the various agencies involved in wetland protection (i.e., city, DFG, and the Corps) to obtain concurrence about the qualities of the resources and the adequacy of proposed mitigation.

The last major wetland protection tool used by the city is environmental review under the CEQA process. Other wetland protection tools include the general plan and zoning designations.

These wetland protection tools have resulted in the following wetland preserve areas that are permitted or in the planning stages in Chico:

- Doe Mill - 15-acre preserve owned by the City of Chico,
- North Enloe - 32-acre preserve proposed by the developer,

- Foothill Park - 230-acre preserve permitted by the Corps, and
- Bidwell Ranch - 350-acre preserve proposed by the developer.

Butte County Wetland Mitigation Bank

The Butte County Fish and Game Commission is developing a wetlands mitigation banking program intended to give project proponents the option of compensating for wetland habitat loss through cash payments. The program is funded through lake and streambed alteration agreements reached under Sections 1601 and 1603 of the California Fish and Game Code between project proponents and DFG. The mitigation bank land will provide restoration and management of wetlands with the money collected as mitigation for wetlands and riparian habitat affected by projects that require the alteration of lakes or streambeds.

The Butte County Fish and Game Commission is conducting the following tasks in developing the wetland mitigation bank:

- identify and rank wetland habitats that will require banking systems;
- research land parcels for availability, price, and terms for potential mitigation bank sites; and
- estimate the costs of acquisition, restoration, and long-term management of mitigation bank sites.

DFG is actively collecting mitigation funds from Sections 1601 (public agency actions) and 1603 (private actions) agreements for projects in Butte County. This money is being held in a trust account for Butte County. These funds must be spent on acquiring mitigation bank lands, restoring or creating wetlands, and conducting mitigation bank operations and management directly related to the wetland impacts described and mitigation requirements set forth in the 1601 and 1603 agreements.

The Butte County Fish and Game Commission expects to initiate in the near future the following tasks:

- negotiate terms of agreements with landowners to develop wetland mitigation banks,
- conduct restoration of wetland habitats at bank sites, and
- manage the operation of mitigation banks.

Recommended Planning Programs for Chico

The objective of the study was to map the locations of areas of high-quality wetlands, identify potential land use conflicts, and recommend conservation planning tools to protect the high-quality wetlands. The current wetlands protection approach in Chico has resulted in a net loss of wetlands because of the resource-by-resource and project-by-project approach.

The wetland identification and mapping portion of this study identified high-quality wetlands in and around Chico. Most of these sites are vernal pool areas supporting a mosaic of vernal pool, swale, drainage, and grassland habitats. These resources are found primarily east and southeast of the city. Additional high-quality wetlands, such as other seasonal wetlands and riparian forest, are found in the general plan area; however, the predominant resource is vernal pool areas.

Development areas were identified by the planning staff at the city and county. More than 24 projects were identified in the Chico planning area (Table 4-1). Developments were identified by the different stages in the development process. Projects range from approved or permitted for construction to projects in the planning stages to areas identified for potential development.

High-quality wetland resources have been mapped in the Chico General Plan area. Some of these resources are in areas that are approved or permitted for development, some resources are in areas that are proposed for development (projects in the planning stages), and some are outside the urban development boundary. Recommended planning tools for each phase of development planning are presented below.

Projects Approved or Permitted for Construction

Of the seven projects identified as either approved or permitted for construction, only two projects, Carriage Park and a section of Hillview Terrace, have high-quality wetlands as identified in this study. By definition, these projects are approved or permitted for construction. Few, if any, planning programs can be used at this stage to protect wetlands. If these projects do not proceed with development, it may be possible to reevaluate the project design and protect more of the wetland resources.

Projects in the Planning Stages

Seventeen projects were identified as projects in the planning stages. High-quality wetland resources were mapped on several of these project sites. The primary conflict areas are projects, such as County Service Area (CSA) 87, Airport Environs Special Development

Table 4-1. Development Information Provided by the City of Chico for Projects in the Chico General Plan Area

	Project Name and Corresponding Map Number	Total Acres	Type of Development	
			Residential (dwelling units)	Commercial, Business Park, or Industrial (acres)
Projects Approved or Permitted for Construction				
1.	Canyon Oaks	750	350	0
2.	Carriage Park	40	550	2
3.	Doe Mill Highlands East	20	80	0
4.	Doe Mill Highlands West	20	80	0
5.	Hillview Terrace	35	100	0
6.	Humboldt Road School and Park	60	0	60
7.	Sophia Estates	20	66	0
Projects in the Planning Stages				
8.	Airport Environs SDA	1,800	1,800-2,500	300-400
9.	Bell Muir SDA	600	750	0
10.	Bidwell Ranch	750	1,500	10-20
11.	CSA 87	2,100	2,700	Uncertain
12.	Enloe Hospital	240	900	120
13.	Foothill Park	180	750	0
14.	Foothill Park East	172	560	0
15.	Gateway	350	640	151
16.	Humboldt Road SDA	400	1,500	40
17.	Schmidbauer West	200	1,000	15

Table 4-1. Continued

	Project Name and Corresponding Map Number	Total Acres	Type of Development	
			Residential (dwelling units)	Commercial, Business Park, or Industrial (acres)
18.	Schmidbauer East	120	500	0
19.	Stonegate	170	750	0
20.	Webb Homes	40	220	0
21.	Westside South SDA	120	0	120
22.	Yosemite Heights East	90	220	0
23.	Falcon Pointe	?	25	0
24.	Chico Canyon Estates	?	35	0
Preservation Areas				
A.	Doe Mill - owned by Chico	15	NA	NA
B.	Foothill Park - approved by the Corps	230	NA	NA
C.	Bidwell Ranch - proposed by developer	350	NA	NA
D.	North Enloe - proposed by developer	32	NA	NA

NA = not applicable.

Sources: Sanders and Sellers pers. comms.

Area (SDA), Enloe Hospital, Bidwell Ranch, Foothill Park, and Gateway; however, some smaller projects, such as Schmidbauer West and Stonegate, also have mapped resources. These projects are proceeding on a project-by-project basis; however, the city is using various planning programs to protect wetland resources. For example, Bidwell Ranch is proceeding under a specific plan and includes a large wetland preserve area. The Airport Environs SDA is also similar to a specific plan. Both of these major projects include a large resource identification and protection element. Other smaller projects, such as Enloe Hospital, also have included a wetland preservation area. For all practical purposes, the city is informally implementing the resource management plan approach as recommended in the general plan update.

Potential Development Areas

The last development planning category that has been identified is the potential development areas. In Chico, these areas are located within the urban development boundary and do not have specific development proposals. The primary conflict areas for these development areas occur around the airport in the north section of the city and south of the city just north of the Gateway project.

In the general plan update currently underway, the city has identified a conservation strategy that focuses on habitat conservation as the most effective way to protect individual special-status species; minimize impacts on sensitive biological resources, including wetlands; and preserve plant and animal diversity. The proposed general plan identifies sensitive habitats, including wetlands, as either Resource Conservation or Resource Management Areas.

Resource Conservation Areas contain the most sensitive and valuable habitat that requires protection and would be conserved in perpetuity. Sites identified as Resource Conservation Areas in the proposed general plan are either under public ownership or will be preserved by project proponents as a condition of development approval. These areas may be used for limited passive recreation, educational purposes, scientific study, or offsite mitigation banking when onsite habitat preservation for development projects proves infeasible. It is expected that most Resource Conservation Areas will be dedicated as environmental mitigation or exaction.

Resource Management Areas contain resources that merit long-term preservation, but further study is necessary before a precise delineation of acreage to be preserved can take place. Portions of some of the Resource Management Areas shown in the proposed general plan include wetlands that may be appropriate for onsite preservation and management or for incorporation into a Resource Conservation Area.

The proposed general plan also includes the following policy, which relates directly to wetlands:

OS-G-9 Provide for no net loss of overall wetland acreage; where such losses may be unavoidable at the project level, require mitigation that meets the no net loss goal.

Various other policies relate to the protection of wetland resources through the preservation and protection of wildlife corridors; provision of open space corridors along creeks; preservation of existing riparian vegetation; and protection of watersheds for wetlands, creeks, and vernal pools. The proposed general plan also recommends amending the Chico Zoning Ordinance to include a resource conservation zoning district and habitat protection standards, particularly buffering, for sites abutting Resource Conservation Areas.

To conserve wetland resources in the Chico area, preparation of a comprehensive habitat management plan is recommended. The process of developing this habitat management plan would include the following steps:

- The wetlands mapping information developed as part of this project should be combined with the habitat information and special-status species locations developed as part of the general plan update process.

- The habitat conservation strategy identified by the city should be used to protect wetlands in and just outside the city's planning area, particularly in the southeast area of the city.

- The City of Chico and Butte County should work together on a regional approach that would allow for long-term preservation of large areas of wetlands.

- The habitat management plan should include a wetland preserve and wetland mitigation bank that preserve and enhance wetlands while allowing logical community growth. The location, size, shape, and regional configuration of habitat conservation areas should be determined early in the process to ensure that wetland functions providing important ecological values are maintained.

- Careful attention should be paid to providing connections between wetland preserves and mitigation sites. The Butte County wetlands mitigation bank program should be incorporated into this process.

Development of the regional habitat conservation and management plan should include the following steps:

- compilation of the wetlands and special-status species information contained in the master environmental assessment prepared for the general plan update and the wetlands information prepared for this project;
- identification of data gaps for natural resources and acquisition of information to fill these gaps;
- field verification, if necessary, of the resource areas to identify sites or areas that should be preserved and areas that may be filled; and
- identification of the agencies that need to be involved in the process, including the Corps, EPA, USFWS, and DFG;
- identification of a public involvement process that includes substantial involvement by the environmental groups and development interests that need to be represented to reach a consensus;
- identification of the definitive regulatory products that would be achieved at the end of the process (e.g., issuance or streamlining of Corps permits, streambed alteration agreements, and agreement on what constitutes adequate mitigation under CEQA); and
- identification and agreement among the participants of the study of the standards as to the amount to mitigate and measures of success.

Conclusions

A large amount of undeveloped land supporting high densities of vernal pools is located east of the City of Chico in the path of future development. For projects in the planning stages, the city is using several planning tools, including specific plans and the general plan update process, to protect and preserve the known wetland resources. The opportunity also exists to protect resources in potential development areas and areas that have not been proposed for development. The general plan update also identifies a conservation strategy that focuses on habitat conservation, including wetlands, as the most effective way to protect sensitive species. Wetland resources information presented in this study should be combined with habitat and sensitive species information gathered during the general plan process to develop a regional habitat management plan for the protection of multiple habitats and species. This comprehensive habitat management plan should include

planning tools and programs that the city, Butte County, state and federal agencies, and the public can support.

RECOMMENDATION FOR THE FRESNO-CLOVIS STUDY AREA

Background Information

Fresno County has prepared several regional plans to address natural resources. The San Joaquin River Parkway Plan includes goals, objectives, and policies for resource conservation, use, and management along the river corridor. The county has also adopted a regional plan for the Kings River corridor, which contains the largest concentration of riparian forest mapped as part of this project. The county has not yet used the regional plan process to address wetland areas.

The Cities of Fresno and Clovis have typically addressed wetland issues during the general plan process. The City of Clovis General Plan, adopted in 1993, includes conservation policies and action statements for wetland resources. The Clovis General Plan Environmental Impact Report, certified in 1993, includes a map of potential vernal pool areas and a habitat map.

The full range of wetland conservation planning tools described earlier in this report were considered for their applicability to the developing areas of the Cities of Fresno and Clovis and Fresno County. Selected combinations of tools are recommended for consideration because of their ability to promote wetland conservation under specific circumstances. The selected tools are considered to be the most applicable for the wetland resources and for the stage of planning and development of the Fresno-Clovis study area.

Existing Wetland Conservation Tools Used in Fresno-Clovis Study Area

Wetland resource protection in Fresno County is primarily in the form of regional plans for the Kings and San Joaquin Rivers. Fresno County's regional plan for the San Joaquin River is limited to the area from river centerline to the southerly bluffs. This includes riparian vegetation along the river but does not include vernal pool areas south and east of the bluffs. No wetland resource conservation plans are currently in place for Fresno County or the Cities of Fresno and Clovis.

Recommended Planning Programs for Fresno and Clovis

The objective of this study was to map the locations of high-quality wetlands, identify potential land use conflicts, and recommend conservation planning tools to protect these wetlands. The current protection approach in Fresno and Clovis has resulted in a net loss of wetlands because of the project-by-project approach.

The wetland mapping portion of this study identified most of the high-quality wetlands east and north of Clovis. Most of these sites are vernal pool areas supporting a mosaic of vernal pool, swale, drainage, and grassland habitats. Additional high-quality wetlands, such as other seasonal wetlands and riparian forest, also are located here.

The following four planning recommendations have been developed for the Cities of Fresno and Clovis and Fresno County to address specific wetland preservation and management issues, for their respective planning areas.

City of Clovis General Plan

The City of Clovis General Plan Open Space and Conservation Chapter addresses the management and preservation of wetland resources. The following goal, policy and actions are excerpted from that chapter:

Goal: Conserve natural resources through protection and enhancement of permanently preserved open space.

Policy: Preserve vegetation and associated wildlife habitat in the Clovis project area.

Action: The City shall cause to be undertaken a field based inventory of wetlands, vernal pools and their associated sensitive species in the project area during the appropriate season, where urban development is proposed in sensitive areas as identified in the Habitat Map.

Action: Require innovative site design where feasible to avoid the impact to vernal pools and wetlands of development.

The City of Clovis will be able to use information contained in this report to update its habitat map. Implementation of the action plans listed above, especially for the northeast portion of the general plan area, is recommended.

City of Clovis Proposed Urban Center Specific Plan Areas

The Clovis General Plan identified three future urban centers that warranted a more detailed level of planning. These sites were identified as proposed urban center specific plan areas in the Clovis General Plan. Development of these sites will require implementation of a specific plan or joint authority agreements between the City of Clovis and Fresno County to ensure future effective implementation of general plan policy (Clovis General Plan, 1993). The Clovis General Plan envisioned that the specific plan process would:

- facilitate high-quality development;
- allow for coordination of planning efforts among several property owners;
- allow for infrastructure cost-sharing arrangements; and
- provide developments that are sensitive to the environment and integrate open space and recreation facility requirements.

Southeast and Northwest Urban Center Specific Plan Areas. The southeast (3,306 acres) and northwest (2,627 acres) specific plan areas do not contain wetland resources mapped for this project. Both of these areas are adjacent to the City of Clovis Sphere of Influence and represent appropriate locations for future urban growth.

Northwest Urban Center Specific Plan Area. This is the largest specific plan area (6,977 acres) designated in the Clovis General Plan. Located furthest from existing urban development, it will likely be the last of the three designated urban center specific plan areas (UCSPAs) to be developed. Approximately 2,640 acres of mapped wetlands are in the northwest UCSPA, with approximately 1,044 on lands planned for development and the remainder on lands designated for open space or agricultural uses (Exhibit 5). Most of the wetlands are located north of Tollhouse Road.

The Northwest UCSPA is located southeast of the proposed University of California, San Joaquin Valley site at Academy. This campus site is one of three being considered by the University of California in the San Joaquin Valley. The proposed Academy site is a consideration because infrastructure linking the campus with the Fresno-Clovis area would pass through the UCSPA.

Most of the UCSPA land north of Tollhouse Road is already designated as agriculture and open space (City of Clovis General Plan). The Corps recently increased the capacity of a Dry Creek flood control structure in the northwest portion of the UCSPA (Waiczis pers. comm.). Flood inundation mapping shown in the Clovis General Plan encroaches into planned residential areas shown on the general plan. These same areas

contain concentrations of vernal pools. To conserve wetland resources within the UCSPA, the following steps are recommended for consideration:

- An environmental database should be prepared for the site that includes the wetland resources identified in this report.

- The wetland conservation concepts that are applicable in this setting should be considered, including:

  - maximizing the size of the area designated for wetland conservation;

  - maintaining the wetland conservation area in a rural setting at the periphery of high-density development; and

  - connecting the area to other wetland conservation areas, including the City of Fresno's northeast study area to the north, with full consideration of buffering, ecologically meaningful linkages, and future growth patterns.

- An open space district should be established to manage the flood control facilities, wetland resources, and agricultural uses in the northerly portion of the UCSPA.

If these recommendations are implemented, the residential and employment center uses planned north of Tollhouse Road might be relocated to the south, where wetlands are not present. They also could be cause for reconsideration of the proposed transit center site and possible relocation to the Shepard Avenue/Tollhouse Road intersection.

Wetland resources, mostly vernal pools, are mapped in the southeasterly portion of the UCSPA. The wetlands are located in an area designated for low-density residential development by the Clovis General Plan. The wetland resources cover only a portion of the low-density residential area. The following recommendations are made to integrate wetland preservation with residential development:

- redesignate wetlands as open space and increase residential density in the remaining residential area to mitigate the loss of units,

- design buffers to protect the wetland area from threats residential development poses to wetland functions and values, and

- link vernal pool preserves in the UCSPA with vernal pool areas immediately to the east to ensure that the watershed of the pools is maintained.

Recommendations for both the northerly and southeasterly portions of the UCSPA could result in the redesignation or redistribution of areas planned for development in the

Clovis General Plan. Implementing these recommendations with a transfer of development rights program, for landowner compensation, would allow for a more equitable distribution of development benefits within the UCSPA.

City of Fresno General Plan Update

As part of the general plan update process, the City of Fresno is considering two areas outside its existing sphere of influence for future growth of the city: the southeast and northwest study areas.

Southeast Study Area. This study area is approximately 13,292 acres in size, adjacent to planned development areas within the city sphere and adjacent to growth areas within the City of Clovis General Plan area. The study area contains no wetland areas mapped as part of this report and appears to be an appropriate growth area for the City of Fresno. There also appears to be the potential for joint planning of the City of Fresno's southeast study area and the City of Clovis' southeast urban center specific plan area.

Northeast Study Area. This study area is approximately 16,110 acres in size and also known as the Copper-Friant Triangle. The study area includes the San Joaquin River's southerly bluffs and areas of riparian forest between the bluffs and the river (Exhibit 7). Within the study area east of the bluffs, there are approximately 2,609 acres of vernal pool areas. Fresno's general plan update process includes designating land uses for areas east of the bluffs where vernal pools exist. The following recommendations could be considered to integrate wetlands conservation with the general plan update process:

- The San Joaquin River Parkway Plan should be reviewed to determine whether the plan boundaries should be extended to include vernal pool areas in the Copper-Friant triangle. This would expand the diversity of habitats within the regional plan.

- An environmental database or master environmental assessment should be prepared that maps and describes wetland resource as part of the general plan update process.

- A vernal pool preserve should be established within the study area, based on habitat quality, watershed integrity, compatibility with adjacent uses, and presence of special-status species.

- A mitigation bank should be established within the study area to mitigate the loss of smaller and more isolated vernal pool areas.

Recommendations for the northeast study area could result in the redesignation or redistribution of areas planned for development in the Fresno General Plan update process.

Implementing these recommendations with a transfer of development rights program, for landowner compensation, would allow for a more equitable distribution of development benefits within the study area.

Rural Residential Land Division Review for Fresno County

Fresno County has designated unincorporated areas east of the city of Clovis and west of the Friant Kern Canal as Rural Residential. The Rural Residential designation allows a minimum 2-1/2-acre lot size. Land divisions in this area are often done in two- to four-parcel maps.

Wetlands, primarily vernal pools, are present in this area. A review of the wetland area maps accompanying this report is recommended to determine where Rural Residential land divisions may affect wetland resources and to propose appropriate mitigation during CEQA review.

Conclusions

A large amount of undeveloped land on the eastern edge of the San Joaquin Valley supports high densities of vernal pools. Recommendations presented in this report for wetlands conservation have been directed primarily at lands in these unincorporated areas of Fresno County being considered for urban growth by the Cities of Fresno and Clovis. Joint city-county planning for these areas would seem to have the greatest likelihood for success. There is a precedent for this type of joint authority. A working relationship between the City and County of Fresno and Madera County was established to oversee preparation of the San Joaquin River Parkway Plan (San Joaquin Parkway Task Force 1992) to address natural resources of mutual concern.

CLOSING REMARKS

Planning recommendations have been presented in this report based on a single natural resource, wetlands. Obviously, good planning must be based on multiple variables, including public demands, physical features, infrastructure, economics, safety, and natural resources other than wetlands. However, serious potential conflicts between existing wetland resources and future development as envisioned under the Chico and Clovis General Plans have been identified in this report. Because of the declining status of wetland habitats, especially vernal pools, in California's Central Valley as a result of the same types of development planned in Chico and Clovis, local agencies in these areas should consider implementing some of the recommended programs presented in this report.

Implementing wetland conservation programs discussed in this report can avoid much of the conflict that will result if each new project is required to deal with wetland issues individually, without the guidance and regulatory streamlining that can be provided by local or regional conservation programs. Project-by-project review may be time consuming and expensive for both the project proponent and the regulating agencies.

Wetland distribution data, planned development patterns, and recommended wetland conservation programs have been provided by EPA in this report to assist local agencies in their planning efforts.

Chapter 5. Citations

PRINTED REFERENCES

Burke, D. G., E. J. Meyers, R. W. Tiner Jr., and H. Groman. 1988. Protecting nontidal wetlands. American Planning Association. Chicago, IL.

Carpenter, E. J. 1930. Soil survey of the Oroville area, California. U.S. Bureau of Chemistry and Soils. Washington, DC.

Helley, E. J., and D. S. Harwood. 1985. Geologic map of the late Cenozoic deposits of the Sacramento Valley and northern Sierra foothills, California. MF-1790. U.S. Geological Survey. Denver, CO.

Huntington, G. L. 1971. Soil survey of the eastern Fresno area, California. U.S. Soil Conservation Service. Washington, DC.

Office of Planning and Research. 1990. State of California general plan guidelines. November. Sacramento, CA.

Salvesen, D. 1990. Wetlands: mitigating and regulating development impacts. The Urban Land Institute. Washington, DC.

San Joaquin Parkway Task Force. 1992. San Joaquin parkway plan. Fresno, CA.

Sullivan, M. E., and M. E. Richardson. 1993. Functions and values of the Verde River riparian ecosystem and an assessment of adverse impacts to resources: a supporting document for the initiation of the Verde River advanced identification. U.S. Fish and Wildlife Service. Phoenix, AZ. Prepared for U.S. Environmental Protection Agency, Region 9, San Francisco, CA.

Watson, E. B. 1929. Soil Survey of the Chico area, California. U.S. Bureau of Chemistry and Soils. Washington, DC.

PERSONAL COMMUNICATIONS

Brock, Sandra. Planner. City of Fresno Development Department. Fresno, CA. January 14 and April 4, 1994 - meetings at City of Fresno offices.

Farrel, William. Director of Development Services. Butte County Department of Development Services. Oroville, CA. January 25, 1994 - letter to Kim Smith, Jones & Stokes Associates.

Hogan, Barry. Planning Manager. Butte County Department of Development Services. Oroville, CA. April 6, 1994 - meeting at Butte County offices.

Sanders, Craig. Associate planner. Butte County Department of Development Services. Oroville, CA. September 27, 1994 - telephone conversation with Kim Smith of Jones & Stokes Associates, Inc.

Sellers, Clif. Director of Planning Services. City of Chico Community Development Department, Chico, CA. February 11, 1994 - letter to Jane Freeman, U.S. Environmental Protection Agency; March 29, 1994 - meeting at City of Chico offices and various telephone conversations/map revisions; September 7, 1994 - meeting with Kim Smith of Jones & Stokes Associates, Inc.

Tweedie, Jeff. Environmental Program Manager. Fresno County Planning Department. Fresno, CA. January 14 and April 4, 1994 - meetings at County of Fresno offices.

Waiczis, Mike. Associate Planner. City of Clovis Planning Department. Clovis, CA. January 14 and April 4, 1994 - meetings at City of Clovis offices.

Chapter 6. List of Preparers

JONES & STOKES ASSOCIATES, INC.

Technical Team

Paul Cylinder	Project Manager
Kim Smith	Coordinator, Chico Planning
George Williamson	Coordinator, Fresno-Clovis Planning
Matt Gause	Wetlands Specialist
Christopher Cate	Land Use Planner
Chris DiDio	Geographic Information System Specialist
James Jokerst	Wetlands Specialist

Production Team

Jane Palik	Word Processing Operator
Jim Merk	Editor
Tony Rypich	Graphics Delineator
Beverly Fish	Report Reproduction

Appendix A. Habitat Conservation Concepts

INTRODUCTION

This appendix describes the concepts of habitat conservation that should be used to direct various aspects of land use planning. These concepts are applicable to developing goals and plans and serve as a basis for allocating land to various land use categories. Background information is provided on the principles of preserve design and wetland ecology, and concepts and planning considerations to use in the local and regional planning processes are summarized.

WETLAND PRESERVE DESIGN PRINCIPLES

The most important step in wetland conservation planning is determining which wetland values are the focus of the conservation strategy. Important considerations when selecting sites for the conservation of wetland functions and values are the wetlands landscape context, preserve size, preserve shape, and preserve connectivity.

Identification of Conservation Objectives

A critical step in habitat conservation planning is identifying ecological functions that are to be preserved. These desirable functions provide the wetland values that are the focus of the conservation planning. Each of the different functions provided by wetlands has different conservation requirements that must be considered. The location, size, shape, and regional configuration of habitat conservation areas should be determined to ensure that the wetland functions that are the object of the conservation effort are maintained.

Wetlands Landscape Concept

Wetlands do not exist in isolation. Wetland functions depend on surrounding landscapes. Wildlife that use wetlands often frequent or require nearby nonwetland habitats. Many of the important ecological functions and societal values provided by wetlands depend on a broader ecological context. For example, wetlands cannot provide

flood control and aquifer recharge benefits without a watershed, and watersheds produce and deliver the supply of water that sustains wetlands. In addition, many species that depend on wetlands reside primarily in the nonwetland habitats surrounding the wetlands, and the type and intensity of wildlife use of a wetland depends on the extent and human uses of undeveloped habitat surrounding the wetland.

Preserve Size

The size of an ecological preserve often determines the richness of species and habitat it contains and strongly influences a preserve's ability to maintain species populations and ecological functions. Large land areas generally support more species than do smaller areas of the same habitat type and generally support larger populations of the species present than smaller areas. If biodiversity conservation is a primary goal, then large preserves are preferable because they support a larger number of species and increase the probability that each species will persist there in perpetuity.

Large populations of wildlife and plants are less susceptible to extirpation than small populations. Small populations are more likely to be extirpated by random environmental changes; demographic effects, such as uneven age distributions or sex ratios; and population genetic effects, such as inbreeding depression and genetic drift. Large populations have a higher probability of persisting over the long term than smaller populations because of the ability to absorb a large loss of individuals without losing the entire population.

The vulnerability of populations of wildlife and plants in an isolated habitat fragment (such as preserves surrounded by urban or rural lands) to extirpation is related to habitat area. Preservation of large habitat areas increases the probability of population persistence compared to smaller habitat areas because of the direct relationship between population size and habitat area and because populations are more likely to escape short-term deleterious effects in larger preserves. For example, in a large preserve, only a portion of a population may be exposed to a negative effect, or individuals in a large preserve may temporarily relocate to undisturbed habitat to escape such an impact.

Preserve size is also important because of the possible effects of adjacent land use. Preserve edges are exposed to "edge effects", such as predation by domestic cats and dogs; exposure to herbicides and pesticides; changes in temperature, water regime, and wind patterns; and introduction of aggressive non-native plants and wildlife. Buffers, such as intervening habitat, suitable land uses, deep water, or fences between the preserve and developed lands, can be used to protect preserves from edge effects. With the exception of narrow, linear preserves, the protection of preserve interiors from edge effects increases with preserve size. The amount of land that can be protected against edge effects increases with preserve size.

Preserving populations of dependent species, including rare and endangered species, is often a principal goal of habitat conservation planning. A general rule of thumb in designing ecological preserves is that the desired species, and the desired functions and values, have a higher probability of persisting in larger rather than smaller preserves. This generalization is based, in part, on the following observations: the central portions of large preserves are more easily protected from the effects of adjacent land use and development, and large populations (i.e., the type associated with large land areas) are more easily maintained over the long term than are small populations.

Under some circumstances, small preserves may be of great value or may even be preferable to large preserves. For example, populations of some species can persist in properly managed small preserves, and some small habitat "islands" can support rich biotas. Where sensitive species are vulnerable to disease or predators, small, scattered preserves may be of greater value than a single large preserve. Ultimately, the decision on preserve size should be based on the amount of area required to sustain the targeted ecosystem functions and values and specific desired species habitat requirements in the face of existing and proposed future uses of the conservation area and adjacent lands.

One strategy to minimize the risk of losing populations of wildlife and plants is to distribute the risk by establishing preserves at several sites. This approach minimizes the potential for extirpation resulting from a single ecological catastrophe.

Preserve Shape

The shape of a preserve influences the effective size of the preserve. A higher proportion of a long, narrow preserve is exposed to edge effects than an equal-sized preserve with a lower edge-to-interior ratio. Edge effects increase susceptibility to disease, predation, and competition from unwanted invaders. Human and other disturbances at preserve edges decrease habitat values to certain species.

Preserve Connectivity

The susceptibility to extirpation of populations that occur in isolated habitat preserves can be reduced by maintaining connections between preserves. The exchange of individuals among habitat patches lessens the effect of natural fluctuations on small populations. Populations that have been reduced or eliminated by environmental catastrophes may be recovered if sufficient connections are provided for recolonization. Corridors connecting preserves can serve as both migration corridors and escape routes. Allowing for migration also helps maintain genetic fitness and diversity by allowing the periodic influx of new genotypes into established populations.

Designing connection between preserves is not necessarily as simple as maintaining an open space corridor. The connection must have the type of habitat that can be traversed or used by the desired species. Poor-quality habitat corridors can be counterproductive if they result in high dispersal mortality. A drawback of habitat connections is that they may encourage the immigration of undesirable species that could diminish habitat quality for desired species in the preserve. Connections among preserves have an intuitive ecological appeal, but they should be evaluated carefully in view of the goals and objectives of the preserve before time, effort, and money are invested in their design and establishment.

Vernal Pool Preserve Design Considerations

Vernal pools generally are found clustered in large numbers. These clusters are referred to in this report as "vernal pool areas" but have also been referred to as vernal pool "terrains", "landscapes", and "archipelagos". Some of the ecological functions provided by vernal pools (e.g., habitat for amphibians and migratory waterfowl) and some adaptations that ensure long-term persistence of species (e.g., recolonization by individuals of a plant or wildlife species extirpated from one pool via dispersal from nearby pools) require the close proximity of numerous pools with surface hydrologic connections.

One important ecological function of vernal pools is that they provide habitat for a host of plant and wildlife species. Numerous plant and invertebrate species spend their entire life in a single vernal pool. Some species, such as the conservancy fairy shrimp and Greene's tuctoria (a grass species), are so specialized to vernal pool habitat that they have never been observed in other types of wetlands. Amphibians such as the uncommon spadefoot toad and the rare California tiger salamander breed in vernal pools but also use other types of seasonal wetlands. These species also require nonwetlands to complete portions of their life cycle. A variety of mammals and migratory waterfowl and songbirds use vernal pools as foraging and resting habitat during their movements in the Central Valley.

The ecological relationships of species inhabiting vernal pools are complex. Developing strategies to conserve the range of species that depend on vernal pools requires an understanding of their ecological needs. Most of the important values associated with vernal pools require that the pools exist within open grasslands. Wide-ranging wildlife species that use vernal pools require or are attracted to sites with concentrations of pools in expansive grasslands. The presence of riparian habitat and oak woodlands interspersed within vernal pool terrains further enriches the number of wildlife species that use vernal pools. Grasslands are also required to sustain some species that live in vernal pools. Large aggregations of vernal pools may be required to sustain viable, self-perpetuating populations over the long term. Some bee species are so specialized that they require vernal pool plants for nectar and pollen and adjacent grasslands for nest sites.

Vernal pool preserves are susceptible to the same forces that threaten other preserve types. Edge effects threaten species and ecological functions, and demographic and genetic effects threaten species. Larger preserve sizes and larger wildlife and plant population sizes both appear advantageous in vernal pool preserves. The size of populations is generally related to the area and number of vernal pools. The number of pools in the preserve may also influence genetic diversity. Preserve size, together with pool area and number, should be considered when planning vernal pool preserves. Preserves should be of sufficient size to contain adequate nonwetland grassland habitat necessary to maintain existing vernal pool functions and values, buffer pools within the preserve interior from the adverse effects of land uses on adjacent property, maintain intact vernal pool watersheds, and maximize the number of species and the population sizes of those species. With these provisions, a vernal pool preserve has a relatively high probability of sustaining the vernal pool biological community, the species that depend on vernal pools, and the functions and values vernal pools provide.

WETLAND CONSERVATION CONCEPTS

The concepts listed below should be considered when determining where and how to apply planning tools that are designed to conserve wetland functions and values:

- Maximize the size of areas earmarked for the conservation of wetland functions and values.
- Locate conservation areas in rural settings at the periphery of high-density development.
- Avoid conserving areas as habitat islands in urbanized settings unless they support important, irreplaceable, or unique functions and values.
- Focus wetland conservation in areas with minimally developed or disturbed watersheds.
- Isolate preserve watersheds from adjacent developed areas unless if the preserve is designed specifically to store and use urban runoff.
- Design buffer widths to protect preserves from the threats that adjacent land use (existing and future proposed) pose to important wetland functions and values.
- Develop open space linkages between preserves that can function as wildlife movement corridors.

- Plan separate conservation strategies for each of the different types of wetlands in a jurisdiction.

- Design preserves based on the full consideration of their management requirements and the threats that preserves may pose to adjacent land. For example, fuels buildup from accumulated plant material in an unmanaged preserve may expose an adjacent developed area to a fire risk, and flooding from a wetland preserve may threaten adjacent developed areas.

- Maximize the diversity of habitats (wetland and upland) in the preserve to maximize the richness of species captured in the area.

- Select preserve areas in the context of a regionwide preserve system, with full consideration given to buffering, ecologically meaningful linkages, and future growth patterns.

- Select wetland preserve areas based on habitat quality, watershed integrity, defensibility against adjacent land uses, presence of special-status species, and appropriateness of site size and shape.

- For vernal pools, attempt to encompass a large number of pools, and a large total pool area, in each vernal pool preserve, and ensure that the watershed of the pools is maintained in an undeveloped manner.

PAGE NOT

AVAILABLE

DIGITALLY