Chapter 2
Methods

2.1 General Approach

Wetland types were mapped in the study area based primarily on the interpretation of black-and-white and color aerial photographs. Photointerpretation of wetland features was guided and verified with supplementary data sources, including National Wetland Inventory data, U.S. Geological Survey streams and roads data, and California Department of Water Resources land use data. These and other data sources are discussed below. The resulting draft wetland maps were ground-truthed through field reconnaissance surveys on public lands and from public roads during April and May 2004. Jones & Stokes ecologists and geomorphologists developed an understanding of WoUS types within their subbasin contexts through a functional analysis at the subbasin scale. WoUS functions were then described based on a qualitative analysis of physical characteristics, surrounding land use, and resulting biological characteristics. WoUS types were classified according to Cowardin et al. (1979) and assigned to a geomorphic unit according to Ferren et al. (1995).

2.2 Waters of the U.S. Mapping Methods

2.2.1 Data Sources

The following were the primary sources of information for WoUS mapping in the study area.

- Orthorectified black-and-white aerial photographs (provided by Contra Costa County, flown in May 2000) for the entire study area. (The scale in rural areas is 1 inch = 400 feet and in urban areas, 1 inch = 200 feet.)
- Color infrared photographs (scale 1:6,000) taken in June 1987 and 1988, which covered the study area except the southeastern corner (provided by Contra Costa Water District).
- National Wetlands Inventory Maps (scale 1:65,000) based on color-infrared photographs taken in 1985.

- U.S. Geological Survey (USGS) streams and roads data (USGS digital line graph data—various dates).
- California Department of Water Resources land use data (1995).

The ancillary data sources listed below were used to obtain information not available in the primary sources and to check the mapped information for accuracy.

- East Alameda–Contra Costa Biodiversity Study (Conservation opportunity mapping in eastern Contra Costa County) (Jones & Stokes Associates 1996).
- Habitat mapping within the Los Vaqueros Reservoir watershed (Jones & Stokes Associates 1994).
- Color aerial photographs (scale 1:6,000) taken in February 1987, which covered the southeastern corner of study area (Jones & Stokes file data).
- Soil survey mapping (Soil Conservation Service 1977).
- Vegetation maps of Contra Costa Water District (CCWD) interim service area (Contra Costa Water District 2000).
- Geologic maps of the San Francisco–San Jose Quadrangle (California Department of Conservation 1990).
- *Draft Environmental Impact Report for the Cowell Ranch Project General Plan Amendment and Related Actions* (Contra Costa County 1996a).
- Current residential development maps (provided by Contra Costa County).
- Recent WoUS delineations verified by USACE within the study area (Darwin Myers Associates 2003, US Army Corps of Engineers 2003).

2.2.2 Field Visits

In addition to using existing datasets, Jones & Stokes biologists conducted field visits. An initial field visit, December 7, 2001, was conducted to develop the land-cover classification and to perform preliminary verification of aerial photograph signatures. Two other field visits, January 10 and May 26, 2002, were conducted to verify WoUS types and consistency of mapping and to collect additional data for WoUS descriptions. Initial mapping was verified by visual inspection from locations accessible by public roads. Areas were selected for field verification on the basis of the WoUS types present and the accessibility of the area. Once field visits were conducted, WoUS mapping was revised on the basis of field findings. Intensive follow-up field surveys were conducted during April and May 2004, as described in detail below.

2.2.3 Mapping Procedures

WoUS maps were produced using the data sources listed above, according to methods outlined for the HCP/NCCP and summarized below. The East Contra Costa County HCP/NCCP provides more details on the methods used to create digital maps of WoUS in the project area (Jones and Stokes 2004).

Jones & Stokes biologists conducted extensive field surveys of the study area on February 17, 2004, and over 4 days between May 5 and June 2, 2004. The surveys were designed to substantially improve the land-cover data set used by the HCP/NCCP by locating

- additional alkali grasslands and alkali wetlands based on field conditions (rather than by soil type as mapped by SCS) and verifying the location of previously mapped alkali grasslands and wetlands;
- small WoUS (e.g., vernal pools, perennial wetlands, seasonal wetlands) and ponds that may have been missed during the original mapping; and
- additional riparian woodland/scrub in the field that may have been missed because of the difficulty of discerning that habitat type's signature in aerial photos.

It should be noted that much of the mapped riparian woodland/palustrine forest is unlikely to be considered jurisdictional wetlands because it may not be inundated with sufficient frequency or for sufficient duration. It was not possible to map the boundary between wetland and non-wetland in this land cover type from aerial photos.

Draft WoUS maps for the study area were compared with recent wetland delineations verified by the USACE (Darwin Myers Associates 2003; USACE 2003). This comparison allowed for further improvement of photointerpretation methods. In addition, it gave an indication of expected differences between landscape-level and site-level WoUS mapping, discussed further below.

2.2.4 Waters of the U.S. Mapping Limitations

This study involved mapping WoUS types on a landscape scale throughout the inventory area, based on photointerpretation and limited fieldwork. Project-related WoUS impacts and mitigation would take place on a smaller, site-specific scale. Some WoUS features in the inventory area, such as freshwater seeps, could not be mapped because they were too small or could not be visited during the limited fieldwork. As a result, landscape-level mapping may underestimate the area of WoUS compared to a site-specific delineation, as in the case of Alves Ranch (USACE 2003). In other cases, such as the case of the Bailey Estate, landscape-level mapping identified areas as wetlands that were not determined to be jurisdictional in a site-specific delineation (Darwin Myers Associates 2003).

In addition, WoUS are dynamic systems that change over time and from season to season, depending on rainfall and temperature.

Despite these limitations, data in this report are adequate to provide a regional picture of WoUS conditions and functions throughout the inventory area. Site-specific investigations can benefit from the regional context and classification provided in this document, but they cannot rely on the regional mapping. Field delineations of features will be required for any project proponent to receive a permit under the RPP that this regional WoUS inventory supports.

2.3 Valuation

Within each subbasin, WoUS were evaluated by type, geomorphic region, and adjacent land use. The level and type of habitat, water quality, and hydrologic functioning of each WoUS type within a subbasin were described. The potential for wildlife and plant species to use a given WoUS type is described under habitat functioning. The potential for a WoUS type to improve or maintain water quality through such processes as filtration of contaminants and prevention of erosion is described under water quality functioning. The potential for a WoUS type to facilitate groundwater recharge and store floodwaters is described under hydrologic functioning. Taking this suite of functions into account, WoUS types were assigned a rank of high, moderate, or low for current quality. (See Appendix A, and Tables 5-1 through 5-15 in Chapter 5. [Note to reviewer: these tables will be provided in a subsequent appendix, though the information is presented in Chapter 5 text.]) A detailed discussion of the valuation process follows.

Landscape-level WoUS valuation was performed by assigning points to each WoUS based on the following five factors:

- Area of wetland;
- Geomorphic region (which served as a proxy for land use in the vicinity);
- Primary adjacent land cover;
- Secondary adjacent land cover; and
- Subbasin or site-specific factors, such as the presence of abandoned mines or reservoirs.

Note to reviewer: Data on area and adjacent land cover for stream reaches is currently not available for analysis. Valuation of stream reaches is pending.

Area

Based on the rationale that WoUS with greater area are generally higher functioning, habitat, water quality, and hydrology functional scores were increased for each WoUS that was greater than the median area for its WoUS

type. For example, the median area for alkali wetlands (PPEM-Alkali) in the inventory area is 3 acres, and the median area for seasonal wetlands (PPEM-Seasonal) is 0.8 acres. For alkali wetlands that are greater than 3 acres in extent and seasonal wetlands that are greater than 0.8 acres in extent, habitat, water quality, and hydrologic functional scores were increased (See Table 2-1). Median areas for other WoUS types in the inventory area are as follows. The median area of ponds (PAB/UB) is 0.2 acre. The median area of riparian woodland (Palustrine forest) is 2.1 acres. The median area of wetlands with undetermined inundation regimes (PPEM- Perennial or Seasonal) is 0.7 acre. The median area of sloughs/channels (riverine lower perennial) is 11 acres.

Geomorphic Region

The inventory area was classified into four geomorphic regions for the sake of this study. The four regions are: 1) Montane, 2) Foothills/Upper Valley, 3) Lower Valley/Plain, and 4) Sacramento-San Joaquin Delta (Delta). They are described in Section 3.2. While information on land uses adjacent to each WoUS was considered in the valuation procedure, geomorphic regions served as a proxy for land use in the greater vicinity of each WoUS. Habitat, water quality, and hydrologic function scores were increased for each WoUS in the Montane region, because land cover in this region is the least altered from natural conditions in the inventory area (Table 2-1).

Habitat, water quality, and hydrologic function scores were increased for each WoUS in the Foothills/Upper Valley region, but scores were increased less than for WoUS in the Montane Region (Table 2-1). This region is dominated by rangeland. In some areas, negative impacts to WoUS from overgrazing are evident. The Foothills/Upper Valley region features more extensive alteration from natural conditions than the Montane region, because of its larger areas of residential, agricultural, and commercial land use.

The Lower Valley/Plain region is characterized by urban and industrial development. Habitat and hydrologic function scores for WoUS in this region were not increased, due to its relative scarcity of habitat and its extensive hydrologic modifications, such as increased impervious surface and channelized and/or undergrounded stream reaches. Water quality scores were slightly increased for WoUS in this region (Table 2-1), because impacts to water quality from land uses in the region are less severe than impacts in the Delta region discussed below.

The Delta region is dominated by cropland. Habitat function scores were slightly increased for WoUS in this region (Table 2-1), because cropland provides habitat for a greater number of species than the urban and residential areas that dominate the Lower Valley/Plain region. Water quality function scores were not increased for WoUS in this region, because sediment, nutrient, and pesticide inputs associated with agricultural use degrade water quality. Hydrologic function scores were not increased in this region, because streams in this region have been

Table 2-1. Effects of Area, Geomorphic Region and Adjacent Land Cover on WoUS Valuation

	Effect on Function Scores		
Factor	**Habitat**	**Water Quality**	**Hydrologic**
Area			
Greater than median area for WoUS type	+2	+2	+2
Less than median area for WoUS type	None	None	None
Geomorphic Region			
Montane	+3	+3	+3
Foothills/Upper Valley	+2	+2	+2
Lower Valley/Plain	None	+1	None
Sacramento-San Joaquin Delta	+1	None	None
Primary Adjacent Land Cover			
Class I*	+3	+3	+3
Class II*	+2	+2	+2
Class III*	+1	None	+1
Class IV*	None	+1	None
Secondary Adjacent Land Cover			
Class I*	+2	+2	+2
Class II*	+1	+1	+1
Class III*	None	None	None
Class IV*	None	None	None

*Class I: Wetland or other native vegetation type (aquatic, aqueduct, alkali wetland, riparian, seasonal wetland, wetland, chaparral, oak woodland)
Class II: Potentially grazed vegetation type (oak savanna, grassland, alkali grassland)
Class III: Agricultural/non-native open space (Orchard, pasture, ruderal, turf, non-native woodland, cropland)
Class IV: Urban

channelized and many WoUS have longer inundation or flow periods due to inputs from return irrigation flows.

Adjacent Land Cover

For the purposes of the valuation, adjacent land cover was assigned to one of four classes, as follows:

- Class I: Wetland or other native vegetation type (aquatic, aqueduct, alkali wetland, riparian, seasonal wetland, wetland, chaparral, oak woodland)
- Class II: Potentially grazed vegetation type (oak savanna, grassland, alkali grassland)
- Class III: Agricultural/non-native open space (Orchard, pasture, ruderal, turf, non-native woodland, cropland)
- Class IV: Urban

In many cases, more than one land cover type is present adjacent to a WoUS. In these cases, the adjacent land cover with the greatest areal extent was recognized as the primary adjacent land cover. Other adjacent land covers were considered secondary adjacent land covers. Secondary land covers were considered to have the same type of effect on WoUS as primary land cover types, but to a lesser degree. Where more than one class of secondary land covers was present, the secondary land cover type with the greatest areal extent was used in the valuation procedure.

Class I land covers were considered to enhance or have no negative impacts on WoUS functioning. Habitat, water quality, and hydrologic function scores were significantly increased for WoUS with Class I primary adjacent land covers (Table 2-1). Habitat, water quality, and hydrologic function scores were moderately increased for WoUS with Class I secondary adjacent land covers.

Class II land cover types have greater potential for negative impacts to WoUS function that Class I land cover types due to the possibility of overgrazing. Habitat, water quality, and hydrologic function scores were moderately increased for WoUS with Class II primary adjacent land covers (Table 2-1). Habitat, water quality, and hydrologic function scores were slightly increased for WoUS with Class II secondary adjacent land covers.

Class III land cover types are characterized by open space with a moderate level of disturbance. While these land covers may be dominated by exotic invasive species, the open space associated with them provides some habitat value. Habitat function scores were slightly increased for WoUS with Class III primary adjacent land covers (Table 2-1). The open space associated with these land cover types facilitates infiltration, reducing the flashiness of the local hydrograph. Therefore, the hydrologic function scores were slightly increased

for WoUS with Class III primary adjacent land covers. Most land uses in this class are sources of sediment, nutrient, and pesticide inputs to WoUS. Water quality function scores were not increased for WoUS with Class III primary adjacent land cover. Habitat, water quality, and hydrologic function scores were not increased for WoUS with Class III secondary adjacent land cover.

Class IV consists of urban land cover. This land cover type provides little habitat value and is characterized by extensive hydrologic modification. Habitat and hydrologic function scores were not increased for WoUS with Class IV primary or secondary adjacent land cover types. However, urban areas are generally less significant sources of nutrients, sediment, and other contaminants relative to Class III agricultural areas. Therefore, water quality function scores were slightly increased for WoUS with Class IV primary adjacent land cover. Water quality function scores were slightly increased for WoUS with Class IV secondary adjacent land cover.

Scoring System

Habitat, water quality and hydrologic function scores based on the factors above were each summed separately. Total WoUS scores for each function ranged from 0 to 10 points. The three function scores were totaled to produce an overall WoUS quality score, ranging from 0 to 30 points. Scores were translated into ranks in the following manner. For each function, scores of 8-10 were assigned a rank of high, scores of 4-7 were assigned a rank of medium, and scores of 1-3 were assigned a rank of low. For overall quality, scores of 24-30 were assigned a rank of high, scores of 8-23 were assigned a rank of medium, and scores of 1-7 were assigned a rank of low. This system was used in order to be conservative about classifying WoUS as low quality.

Ranking of WoUS function and overall quality is on a relative scale within each WoUS type. In other words, an alkali PPEM wetland with low habitat function may nonetheless be a greater conservation priority than a seasonal PPEM wetland with high habitat function.

Subbasin or Site-Specific Factors

In some portions of the inventory area, known factors affect WoUS functioning that are not captured by the indices discussed above. A brief discussion of these factors and a description of their effects on the valuation follow.

Abandoned Mercury Mine

Mercury contamination from the abandoned Mt. Diablo Quicksilver Mine on Dunn Creek has contaminated areas downstream to the Marsh Creek reservoir. Instream WoUS in affected areas of Upper Marsh creek have therefore been

given a Water Quality function ranking of "low." Habitat function for these WoUS is reduced by one rank, to "low" or "medium." Hydrologic functioning of these WoUS is unaffected. Lower Marsh Creek does not appear to be significantly affected by mercury contamination. Normal mercury levels in Lower Marsh Creek are due to two factors: 1) the Marsh Creek Reservoir traps mercury-containing sediment from sources upstream, 2) mercury-contaminated sediments that were present before the construction of the reservoir have been flushed out of the system, and are now located in the Big Break and the Delta.

Abandoned coal mine

An abandoned coal mine in upper Kirker Creek subbasin has led to pH levels of 4-5 in the upper portions of the creek. The creek rapidly becomes neutral in pH downstream of the Black Diamond Mine Regional Park boundaries. WoUS within the affected area have been given a water quality and habitat function ranking of "low."

Reservoirs

There are four reservoirs of significant size in the study area. These reservoirs have smoothed out the hydrographs of creek reaches downstream greatly, reducing peak flows and increasing base flows. Hydrologic functioning of Instream WoUS downstream of Marsh Creek reservoir, Los Vaqueros Reservoir, Contra Loma Reservoir, and Antioch Reservoir have therefore been ranked as "low" for hydrologic functioning.

Potential Quality

Based on an evaluation of opportunities for restoration and enhancement, WoUS types within each subbasin were assigned a ranking of high, moderate, or low for potential quality.