Appendix D—
Description of Habitat Types

Habitats within the Baylands

Open Water

Open water areas include all areas that are below the line of mean lower low water (MLLW) and thus not exposed during daily tides: deep bay, shallow bay, deep major channel, and shallow major channel habitats. These habitats are tremendously valuable for wintering waterfowl, especially diving and sea ducks, and provide migratory corridors through which anadromous fish, such as salmon, reach freshwater spawning grounds.

During the last century, the open waters of the Bay have not been reduced to as great an extent as other habitats, but they have been greatly modified. Hydraulic gold mining sent millions of cubic yards of silt washing down from the mountains of the Sierras. Much of this sediment load settled out in the Bay, greatly reducing water depths. For example, 45,000 acres in the North Bay were once more than 60 percent deep waters; they are now almost 70 percent shallow waters.

The effect of this modification on waterfowl and other wildlife is not clear, but the capability of the watershed to deliver significant amounts of pollutants to the Bay estuary is obvious. Restoration of open water in the Bay will be difficult because it would require excavation of wetlands and uplands. Open waters could be enhanced, however, by the planting of eelgrass or by other strategies.

Mudflats

Mudflats include those lands above MLLW but below the mean tide level (MTL), where marsh vegetation begins to grow. These habitats are often described as tidal flats, due to the great variety of types of flats; sand and shell flats are not uncommon in the Bay, and the substrate character can be very important for different wildlife. Tidal flats are extremely important for wintering waterfowl and shorebirds.

Tidal flats have been greatly reduced in extent since the early part of the last century. The reduction is primarily due to the sediment loads deposited by hydraulic mining, which also shifted the flats inward toward the center of the Bay. Essentially, the upper edges of the old flats became marsh while the outer edges of the open water became flats. As with the changes in open water depth, the impacts of these shifts on wildlife use are difficult to assess, and restoration would require significant excavation of uplands and wetlands. Enhancement could be of value, though. For example, flats are being colonized by an exotic cordgrass *(Spartina alterniflora)* that increases sedimentation among these plants and a gradual conversion of the flat to marsh; removal of this invasive species could reduce or reverse mudflat losses.

Tidal Marshes

Tidal marshes are found along the Bay edge between MTL and just above mean higher high water (MHHW). They consist primarily of areas completely open to tidal influence but also include areas of muted tidal marsh, that is, areas where culverts or other obstructions reduce the range of tides but still allow frequent inundation and exposure. They may be dominated by cordgrass *(Spartina foliosa)* and pickleweed *(Salicornia virginica)* in saline areas, and several species of bulrush (*Scirpus* spp) in fresher zones. The values of tidal marshes are numerous. The Concept Plan for Waterfowl Habitat Protection (hereafter, "Concept Plan") states that these areas provide "significant habitat for both migratory birds

and resident wildlife." Aside from providing important waterfowl and shorebird habitat, these areas support the entire Estuary through production of organic nutrients, which form the basis for the open water and mudflat food chains. They also reduce shoreline erosion by damping wave action, and act as nursery and refuge areas for many fish species.

The extent of tidal marshes in the Bay region has declined by almost 80 percent. As with mudflats, marshes were shifted bayward by sediment loading in the late 1800s. Marshes are also threatened by pollutants carried by runoff (wetlands tend to be deposition areas at the ends of stormwater pipes), and by the spread of exotic species. The Bay region has a relatively lengthy history of tidal marsh restoration; a number of restoration projects have converted filled or diked lands to tidal marsh since the mid-1970s, and a variety of newer projects are underway or planned.

Diked Marshes

Diked marshes are areas within the Baylands now cut off from tidal action but dominated almost entirely by marsh. These areas consist primarily of managed marsh (often managed by duck clubs in the North Bay), and diked marsh, typically former tidal marsh that was diked and possibly converted to other uses, but now reverting to marsh. These areas are often very valuable for waterfowl, especially dabbling ducks and shorebirds, and may be used by listed species, such as the salt marsh harvest mouse, as a substitute for more natural habitats.

Diked marshes are an artifact of the diking of the Baylands. Their current habitat values are generally due to the effect of shallow ponded water on the marsh plain. Where water levels are not managed, however, highly variable conditions and wildlife values may occur. Much of the tidal marsh restoration that has occurred in the region has taken place in diked marshes, although there is significantly more debate now than in the past on the wisdom of this conversion.

Agricultural Baylands

Agricultural baylands are those former tidal wetlands that were converted to, and have remained in, some form of farming activity. These include grazed baylands, farmed baylands, and "ruderal" (weed-dominated) baylands. The extent of wetlands in these areas is open to question. Typically, the area of any particular field defined as wetlands for regulatory purposes ranges from five to 30 percent. However, these lands may pond over larger areas during wet periods and, coupled with the extent of low-lying flat ground, be good habitat for waterfowl and shorebirds. These areas, as implied by the name, can also provide important farm and other benefits (employment, silage for dairy herds, and open space, for example).

Agricultural baylands are also an artifact of the diking of Bay wetlands. As open space, they are often subject to competing pressures from other uses, from development to tidal wetland restoration. The future uses of these lands, especially those in the North Bay subregion, are subject to a great deal of scrutiny from a number of agencies, environmental organizations, and agricultural interests. Assuming that 25 percent of these lands is wetland, the remaining 75 percent, 22,250 acres in the entire region, is potentially restorable to some form of wetland.

Salt Ponds

Salt ponds are baylands that have been diked and converted to salt production uses. These ponds are tremendously important for shorebirds and for several species of waterfowl, especially canvasback and scaup. The highly saline conditions of the ponds can produce significant populations of invertebrates that become prey for flocks of shorebirds and waterfowl. Birds are also attracted by the variety of depths and the lack of vegetation that elsewhere provides cover for predators.

These areas are almost all former tidal wetlands, mudflats, or open water. Salt ponds are extensive in the South Bay and their varying colors are among the most noticeable artifacts of the Bay edge. Salt production has been an economically viable concern, and only a few of these ponds have been restored to tidal wetlands.

Ponds and Lagoons

Ponds and lagoons are areas of confined open water, sometimes influenced by tides. These include natural ponds; ponds built for habitat purposes, such as Pacheco Pond in Marin County; artificial lagoons, such as those found in Bel Marin Keys or Foster City; and constructed storage or treatment basins. The

values of these areas are highly variable. Some ponds are used by large numbers of waterfowl, especially diving and sea ducks, while others are seldom used. The Concept Plan notes that these areas provide important "habitat for a variety of species including waterfowl" (p. 14), but also notes that further research and consensus-building are needed for a better definition of these values.

These habitats are generally artifacts of development; less than 100 acres of ponds occurred around the Bay prior to the historic period. Most of these areas could be enhanced, however, and because of the general shortage of freshwater marshes near the Bay, could provide improved wildlife habitat.

Beaches

The Bay region once had extensive beaches along its edges. Assuming a 50-foot width, 200 acres of beach would be 33 miles long. These were probably significant as shorebird roosting and nesting sites, haul-outs for seals and other marine mammals, and refuges for other wildlife.

The loss and modification of beaches has been significant. It is not surprising that the snowy plover and least tern—two wildlife species dependent on beaches—should be endangered. There is little work on the restorability of the current beaches. Given their recreational use and the modifications that have so drastically changed shoreline hydrology and sediment transport, restoring or even enhancing existing beaches may be difficult.

Uplands

Prior to the 1800s, there were almost 5,000 acres of uplands within the Baylands, primarily islands. Today, uplands within the Bayland zone include the remnants of those islands, undeveloped fill, and developed fill and islands. Uplands near or adjacent to wetlands can be tremendously valuable as refuges during high water events, foraging habitat, and as buffers to treat runoff. Many dabbling ducks and shorebirds prefer upland areas adjacent to wetlands for nesting.

The uplands within the Bayland zone may have been modified more during the past centuries than any other habitat type. Most uplands in the Baylands were dominated by native grasses or, more rarely, by woodlands. Today, little undeveloped native upland remains and very few stands of native grasses survive. Most were replaced by the non-native annual grasses and forbs brought in during the Mission period.

There is little information on the extent of native uplands needed as buffer or refuge for wetlands, and little experience in restoring native uplands. Although the current extent of uplands within the Baylands is significant, most uplands are developed. About 6,500 acres of uplands are presently undeveloped, and could be restored to a mix of wetlands and uplands.

Habitats outside the Baylands

Riparian

Riparian wetlands include both woodlands and forb-dominated swales on sites that do not support trees. These areas can be very important for certain species of waterfowl, such as wood ducks, and significant in pollution-reduction, buffering, nutrient production, and habitat for other wildlife. The Concept Plan notes that this community often supports the greatest variety and density of resident and migratory wildlife.

Riparian habitats have been greatly reduced in the Bay region. Aside from the loss in acreage, if we assume that the average riparian corridor is 100 feet wide, over 400 miles of creeks and streams have been eliminated.

Riparian restoration work has been significant in the Bay region, but it is generally very costly. Most creeks now carry large flows from adjacent neighborhoods or other developed areas, and more pollutants. Newly planted woodlands must be able to withstand these impacts. Many urban creeks have been culverted underground and, although there has been some success in bringing several streams back to the surface, this is an expensive process.

Seasonal Wetlands

Seasonal wetlands are wetlands within a matrix of uplands. The acreage figures in the attached tables show the extent of the total landscape, including both wetlands and uplands. These habitats typically occur as basins in relatively flat areas or on gently rolling ground. The basins are typically wetlands, and may be termed vernal pools, seasonal wetlands or marshes, or wet meadows. They typically consist of seeps,

wet soils, and vernal pools. The values of these habitats are often significant. They may host large numbers of waterfowl and shorebirds during the winter and spring migratory periods, and may support several rare or endangered plants and invertebrates.

The loss of these areas has been great, almost 75 percent of their original level. Additionally, of the remaining areas, uplands have often been converted from native perennial grasses and wildflowers to non-native annual weeds. Restoration work has begun on these types of habitats but most projects are relatively new. However, large areas are potentially restorable.

Associated Uplands

Uplands associated with habitats outside the Baylands historically included native grasslands, shrublands, and woodlands. The value of these habitats was immense as filter zones for the wetlands, as refuge for wetland-related wildlife, nesting habitat, and other functions. Many of these lands have been converted to other uses; defining the exact extent of the acreage would be impossible. Restoration has begun on many types of associated uplands, often as buffers for wetland creation projects, and many of the issues involved have been explored and defined.