

3.5 BIOLOGICAL RESOURCES

This section discusses common and sensitive biological resources, including vegetation, wildlife, and fisheries resources that occur or have the potential to occur in the Yolo Bypass Wildlife Area.

The following text was developed through a review of scientific literature, existing data sources, and Yolo Bypass Wildlife Area staff information. These sources provided information on documented occurrences, regional distributions, and habitat associations of key plant, wildlife, and fish species.

HABITAT MANAGEMENT BACKGROUND

Protection and active management of wetland and upland communities, and agricultural lands at the Yolo Bypass Wildlife Area provides vital, high-quality habitat for hundreds of wetland dependent wildlife species. California has lost approximately 95 percent of these types of habitats due to reclamation efforts, reservoir construction, levee and channelization projects, livestock grazing, timber harvest, water pollution, introduction of nonnative invasive plant species, gravel and gold mining, and clearing for agricultural, residential, and industrial uses over the past 150 years (Riparian Habitat Joint Venture 2000). The restoration of wetland and, to the extent allowable, riparian woodland communities at the Yolo Bypass Wildlife Area is providing important habitat for numerous species. Two-hundred-eighty terrestrial vertebrate species are known to use the Yolo Bypass Wildlife Area at some point during their annual life cycles (Appendix G), over 95 of which are known to breed in the Yolo Bypass Wildlife Area. The Yolo Bypass Wildlife Area also provides suitable habitat for 23 additional species that may occur on site but have not yet been observed there. The Yolo Bypass Wildlife Area is also known to support 38 special-status wildlife species (Table 3.5-3), and many more are locally rare or have specialized habitat requirements that the Wildlife Area provides. The Wildlife Area also provides seasonal or permanent aquatic habitat for 44 species of fish, 8 of which are special-status species (Table 3.5-5). Hundreds of invertebrate species also inhabit the Wildlife Area, including five special-status invertebrates (Table 3.5-3). Under the ecosystem management approach, management of the Yolo Bypass Wildlife Area is intended to maximize benefits for the full suite of these species as opposed to management at the single-species level.

During the winter and early spring of some years, flooding of the Yolo Bypass brings dramatic changes to the Wildlife Area. The floods provide vast expanses of aquatic habitat, as well as fish and invertebrate prey that attract thousands of waterbirds annually. The National Audubon Society has classified the Yolo Bypass Wildlife Area as a Globally Important Bird Area because it supports globally significant numbers of waterfowl, continentally significant numbers of least sandpiper (*Calidris minutilla*) and northern pintail (*Anas acuta*), and nationally significant numbers of American white pelican (*Pelecanus erythrorhynchos*), canvasback (*Aythya valisineria*) and dunlin (*Calidris alpina*) (Yolo Audubon Society Checklist Committee 2004).

The timing, area, volume, and duration of flooding have lasting effects on the Yolo Bypass Wildlife Area after the waters have receded. Winter (i.e., December through February) floods, which occur approximately 60 percent of years, have the most ecological value to waterbirds. Spring floods (i.e., March through May), which occur only in the wettest years, occur after many waterbirds have migrated away from the site. Initially, many wading birds are attracted to the floodwaters each year, to prey upon large populations of mammals and reptiles seeking refuge from the high waters. In the long term, spring floods are known to decrease small mammal and associated predator populations due to drowning and relocation, and it is assumed that resident reptiles experience similar declines. Spring floods also destroy early-season bird nests at the Yolo Bypass Wildlife Area. Upland habitat quality is also decreased by spring flooding, which causes many nutritious legumes to be replaced by less nutritious cocklebur and dock, and can preclude the planting of wildlife forage and agricultural crops such as safflower, milo, millet, sunflower, and rice. These habitat changes are also known to delay and ultimately reduce pheasant reproduction in years with spring floods, and affect many other species of wildlife as well.

An additional important feature of the Wildlife Area is its breeding colony of over 100,000 Mexican free-tailed bats (*Tadarida brasiliensis*). These bats nest each summer under the Yolo Causeway and prey on insects

throughout Yolo and Sacramento counties. The location of this colony in a protected Wildlife Area will help to ensure its long-term success.

3.5.1 VEGETATION RESOURCES

VEGETATION COMMUNITIES

Common vegetation communities found within the Yolo Bypass Wildlife Area are discussed below. Wildlife habitat characteristics are included in this discussion with additional description of wildlife guilds provided under Section 3.5.2, “Wildlife Resources.” A crosswalk among community types and other common vegetation community classifications is provided in Table 3.5-1.

Table 3.5-1 Crosswalk Among Yolo Bypass Wildlife Area Community Types and Other Vegetation Classifications			
Yolo Bypass Wildlife Area Community Types	CALFED MSCS NCCP Habitat Type ¹	DFG Holland Habitat Types ²	Related Sawyer/Keeler-Wolfe Habitat Series ³
Managed Seasonal and Permanent Wetland	Managed seasonal wetland, Seasonally flooded agricultural land	None	None
Natural Seasonal Wetland	Natural seasonal wetland	Vernal marsh (52500), Coastal and valley freshwater marsh (52410), Cismontane alkali marsh (52310)	Bulrush-cattail series, Saltgrass series, Sedge series, Spikerush series
Natural Perennial Wetland	Non-tidal freshwater permanent emergent	Coastal and valley freshwater marsh (52410)	Bulrush series
Riparian Woodland	Valley/foothill riparian	Great Valley willow scrub (63410), Great Valley cottonwood riparian forest (61410), Great Valley mixed riparian forest (61420), Great Valley valley oak riparian forest (61430), Elderberry savanna (63430)	Mixed willow series, Black willow series, Fremont cottonwood series, Mexican elderberry series, Narrowleaf willow series, Sandbar willow series, Valley oak series
Vernal Pool and Swale	Natural seasonal wetland	Northern claypan vernal pool (44120)	Northern claypan vernal pool series
Ditch	Seasonally flooded agricultural land	None	Mosquito fern series
Annual Grassland	Grassland	Non-native grassland (42200), Valley needlegrass grassland (42110), Valley wildrye grassland (42140)	California annual grassland series, Purple needlegrass series, Creeping ryegrass series

¹ CALFED Multi-Species Conservation Strategy - Natural Community Conservation Plan (CALFED Bay-Delta Program 2000b)
² Holland 1986
³ Sawyer and Keeler-Wolfe 1995

Seasonal and Permanent Wetlands

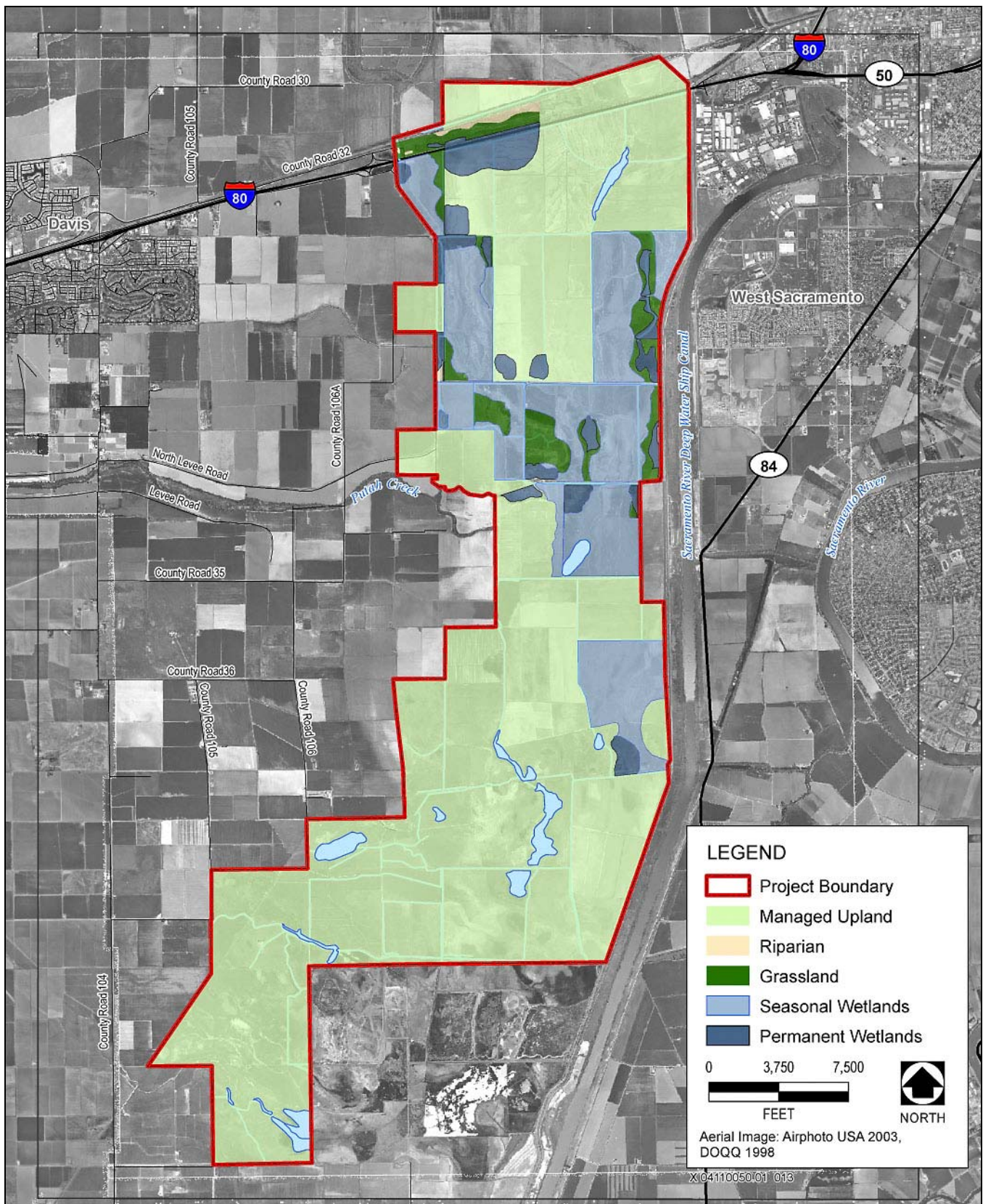
Wetlands have evolved as dynamic ecosystems, constantly changing due to the physical and chemical processes associated with floods, drought, and fire. Today, the Yolo Bypass is an engineered floodway; managed wetlands in the Yolo Bypass Wildlife Area are now enclosed by levees and berms, and flooded with water from irrigation conveyance systems. Whereas natural wetland hydrology was very dynamic, flooding cycles now used for wetlands can be predictable through strategic and innovative management. It is the task of the Yolo Bypass Wildlife Area management to emulate natural hydrology and re-create a dynamic, productive wetland system. With only an estimated 5 percent of the Central Valley's original wetlands remaining, it is also imperative that the remaining wetlands are managed such that they support the maximum abundance and diversity of wildlife (California Department of Fish and Game 1995). The Yolo Bypass Wildlife Area, geographically positioned in the heart of the Pacific Flyway where the Sacramento Valley meets the Delta, supports an extremely large concentration of wintering waterfowl, thus management has an enormous responsibility to provide optimum habitat. Furthermore, wetland management at the Wildlife Area can be conducted in such a manner that shorebirds, wading birds, breeding waterfowl, and other wetland-dependent wildlife also realize maximum benefits (California Department of Fish and Game 1995).

Wetland management techniques in the Yolo Bypass Wildlife Area are built upon the cursory prescriptions as described in "A Guide to Wetland Habitat Management in the Central Valley" (California Department of Fish and Game 1995) and have been adapted to specific environmental conditions within the Yolo Bypass and the need to remain compatible with the flood control function of the Yolo Bypass. The management of productive wetland habitat requires dynamic water management, as well as periodic soil and vegetation disturbances. Adequate water conveyance systems are essential for meeting water management objectives, thus pumps, delivery ditches, water control structures, and drainage systems must be maintained in functional condition. Discing and mowing are used to interrupt the natural evolution of wetland habitat and to set back plant succession from climax to early successional stages, stabilizing the marsh vegetation at a point which is the most productive of those elements required by waterfowl and other wetland-dependent species (California Department of Fish and Game 1995). It has also been demonstrated that manipulation of vegetation in seasonal wetlands can change the invertebrate community by increasing the proportion of midges while decreasing the number of mosquitoes. This result has the dual benefit of providing an important protein source to birds and fish while decreasing the chances of exasperating a potential public health issue by increasing mosquito production. Exhibit 3.5-1 depicts a map of managed seasonal and permanent wetlands in the Yolo Bypass Wildlife Area.

Habitat management activities are evaluated annually by the DFG Wildlife Area Habitat Committee (WAHC). The WAHC was established in 1991 to develop acreage and quality guidelines for wetland and upland habitats occurring on DFG's 14 major wetland wildlife areas. A habitat management plan is prepared each year and assessed by the WAHC. A site visit occurs during the summer months to monitor habitat conditions, develop recommendations for future efforts, and evaluate the success of planned field work.

Managed Seasonal Wetlands

Managed seasonal wetlands at the Yolo Bypass Wildlife Area occur primarily throughout the original Wildlife Area units (i.e., North, Northwest, West, Central, Northeast, and South) and are generally flooded in the fall beginning on September 1, with standing water maintained continuously throughout the winter until drawdown occurs in the following spring on April 1. A variety of annual plants germinate on the exposed mudflats of seasonal wetlands during the spring draw down. These plants are then managed through the timing, duration or absence of summer irrigations. These plants are collectively known as "moist-soil plants." These plants produce seeds that are important foods for waterfowl and other wetland-dependent wildlife. The target species for managed seasonal wetlands at the Yolo Bypass Wildlife Area is swamp timothy (*Crypsis vaginaflora*) because it provides tremendous numbers of nutritious seeds for consumption by migratory waterfowl, its branch structure is an excellent substrate for invertebrate production, and its low stature presents very little resistance to flood waters moving through the Yolo Bypass. Interestingly, this plant is considered undesirable in the vernal pool areas of the



Source: Department of Fish and Game, City of Davis 2005, CaSIL 1993

Yolo Bypass Wildlife Area Managed Permanent and Seasonal Wetlands

Exhibit 3.5-1

Tule Ranch, where a native forb community predominates. A combination of moist-soil plants and robust emergent vegetation (e.g., cattails [*Typha*] and/or tules [*Scirpus*]) results from management practices employed in Yolo Bypass Wildlife Area seasonal wetlands. A primary objective of “moist-soil management” (i.e., seasonal wetland management) is to provide an abundance and diversity of seeds, aquatic invertebrates, and other moist-soil foods for wintering waterfowl and other wildlife. Although agricultural grains produced in the Wildlife Area (e.g., rice and corn) supplement the diets of waterfowl in winter, these foods lack many of the vitamins, minerals, and proteins essential for survival and subsequent reproductive success (Euliss and Harris 1987; Chabreck et al. 1989; Combs and Fredrickson 1996). The seeds of moist-soil plants provide waterfowl with the essential nutritional balance lacking in grains. Invertebrates are protein-rich by-products of moist-soil management that serve as an important food source for waterfowl and shorebirds during autumn, winter, and spring. (California Department of Fish and Game 1995).

Wildlife Values of Managed Seasonal Wetland Plant Communities

Diets of wintering waterfowl are diverse and include aquatic invertebrates, moist-soil plant seeds, and agricultural grains (Euliss and Harris 1987; Chabreck et al. 1989; Combs and Fredrickson 1996). Research in waterfowl nutrition has recognized variability in value among foods, whereas studies of waterfowl food habits (Combs and Fredrickson 1996) and foraging ecology (Euliss and Harris 1987; Euliss et al. 1991) have focused primarily on differences in abundance among foods. Winter diet restriction in waterfowl can affect timing of molt, body mass, mortality and pair formation (Demarest et al. 1997), and nest initiation date (Dubovsky and Kaminski 1994). Studies also have shown that food quality can affect egg production and timing of molt (Richardson and Kaminski 1992). Canvasbacks (*Athya valisineria*) have been documented to quickly regain lost body mass when fed a nutritionally balanced diet following short-term food deprivation, but continue to lose mass when fed unbalanced diets (California Department of Fish and Game 1995). Thus, diet quality is important not only in maintaining condition of wintering birds, but also in mitigating physiological effects of short-term food deprivation, such as periods immediately after long distance migrations. Given the maintenance and anabolic costs of migrating and wintering birds, wetland management prescriptions at the Yolo Bypass Wildlife Area that promote the production of nutritionally balanced foods is a primary objective.

The wildlife value of a moist-soil plant species is generally based on its seed production capability, the nutritional quality of its seeds, and the invertebrate habitat the plant community provides. Management practices at the Yolo Bypass Wildlife Area promote a diversity of highly valuable moist-soil plants, many of which are non native species. Swamp timothy, watergrass (*Echinochloa crus-galli*), and smartweed (*Polygonum amphibium*) are the most important moist-soil plants in the Central Valley, although smartweed is not commonly grown on the Wildlife Area. Seeds of these three plants, in aggregate and combined with agricultural and wildlife forage crops, provide waterfowl and other seed-eating wildlife with a nutritionally balanced diet. Additionally, a variety of other wetland plants are also needed to provide additional nutrition, cover, and thermal protection including sweet clover (*Melilotus alba* and *Melilotus indica*), and the emergent cattails and bulrushes. Some moist-soil plants are not good seed producers or produce seeds with modest nutritional value, but have a complex leaf structure and harbor rich invertebrate communities, thus are also valuable to wildlife at the Area (California Department of Fish and Game 1995).

Other species that may be found in managed seasonal wetlands that are less desirable for wildlife include nonnative plants such as dock (*Rumex* spp.); native plants like gumweed (*Grindelia camporum* var. *camporum*), joint grass (*Paspalus distichum*) and cocklebur (*Xanthium strumarium*), and nonnative invasive plants like perennial pepperweed (*Lepidium latifolium*).

Seasonal wetlands are important production areas for invertebrates that provide a food source for birds both during their aquatic stages and as adults. Larger predatory invertebrate larvae such as dragonfly nymphs help control undesirable invertebrate species such as mosquitoes. They are large enough to be eaten by herons and egrets. Midge (chironomidae) larvae are a critical component of the invertebrate community. Indeed, midge larvae

provide much of the protein needed by waterfowl in the spring, by fish foraging on the flood plain in late winter, and by shorebirds throughout the year.

Habitat Values of Managed Seasonal Wetland Plant Communities

The vast majority of wetlands managed on the Yolo Bypass Wildlife Area are seasonal wetlands. Seasonal wetlands are the most productive type of wetland and they can be managed in a way that is compatible with flood protection. The target vegetation species in seasonal wetlands at the Yolo Bypass Wildlife Area is swamp timothy, making the seasonal wetlands very open and allowing efficient floodwater conveyance. When shallowly flooded, this is the preferred habitat of the northern pintail, which is important given the Pacific Flyway is the preferred wintering ground for sixty percent of the pintail on the continent. Over 100,000 waterfowl winter on the Yolo Bypass Wildlife Area on a routine basis, and many of these birds are pintail. The diminutive green-winged teal is also very numerous, preferring the same shallowly flooded seasonal wetlands. Mallard, gadwall, American widgeon round out the “big five” waterfowl species in the Central Valley.

On the shallow fringes, large numbers of shorebirds feed on invertebrates produced in the organic soup of the seasonal wetlands. Ground disturbances such as discing and mowing favor the production of midges, whose larvae provide a critical food source for shorebirds and waterfowl.

Low islands are discing prior to fall flood up to provide roosting areas for the large numbers of waterfowl crowding for a space on the dirt mounds. The “furniture” is well used throughout the winter and only the arrival of a peregrine falcon will clear the islands of waterfowl.

The deeper swales that cut through the seasonal wetlands not only help disperse water during flood up and draw down periods, they also provide deeper water habitat in the winter for diving ducks and white pelicans. In the spring, the swales can be maintained in a flooded state to present foraging areas for nesting shorebirds.

Mudflats are present on the upper edge of managed seasonal wetlands and in the Wildlife Area’s rice rotation that is specifically managed to support shorebirds. Shorebirds forage exclusively in mudflats and shallow open water habitats, which have declined substantially in California’s Central Valley due to the historical conversion of wetlands to agriculture. The on-site mudflats support abundant invertebrate populations, and thus provide important foraging habitat for large numbers of migrating and wintering shorebirds along the Pacific Flyway, including least sandpiper, western sandpiper, long-billed dowitcher, and dunlin. Shorebirds known to breed in the Wildlife Area’s upland communities also depend on mudflats to meet their foraging requirements. These species include American avocets, black-necked stilts, spotted sandpiper, and killdeer. Some dabbling ducks such as cinnamon teal also forage by skimming the mudflats’ surface. Terrestrial predators such as coyotes, raccoons, and skunks prey upon the nesting shorebirds, their young, and eggs in this habitat.

Water Drawdown and Soil Disturbance

Important moist-soil waterfowl food plants such as swamp timothy, smartweed, and watergrass are propagated on seasonal wetlands in the Yolo Bypass Wildlife Area. The primary factors that affect the type and abundance of moist-soil plants that are found in seasonal wetlands are the timing and duration of flooding and the disturbance of the soil. The seeds of these target plant species germinate best at a specific soil temperature under specific successional conditions. Therefore, as plants compete for dominance, prescribed wetland management favor specific plants (or groups of plants) by timing drawdowns to coincide with optimum germination conditions (primarily soil temperature), and discing periodically to maintain the successional stage required by the target vegetation (California Department of Fish and Game 1995). Therefore, seasonal wetlands are usually drawn down on April 1 to favor the germination of swamp timothy. Watergrass appears with later drawn down dates or with summer irrigations.

The rate of water drawdown affects moist-soil plant composition, seed production, and the duration of food availability to waterbird species. Slow drawdowns over 2 to 3 weeks cause invertebrates to become concentrated

in the shallow water and allow waterfowl and shorebirds optimum foraging conditions for a prolonged period. This presents an ideal foraging opportunity for these birds who are about to embark on their annual journey to their northerly breeding grounds. These draw downs may also concentrate fish that were captured during the winter floods, presenting a productive feeding opportunity for resident wading birds. Slow drawdowns also may enhance seed production. Rapid drawdowns (i.e., 2 to 3 days) may produce extensive stands of waterfowl food plants if timed correctly, but lose the extended shallow water habitat associated with slow drawdowns. Rapid drawdowns late in the growing season are preferably followed by a summer irrigation to ensure a good seed crop. Although slow drawdowns are generally better for wildlife, there is no “right” or “wrong” way to drain a seasonal wetland. The rate of drawdown at the Wildlife Area is based on site-specific circumstances and may vary year to year. For example during a warm spring, it may be preferable to draw down faster in order to avoid the production of large numbers of mosquitoes.

Irrigation

Spring and summer irrigations are very important to seasonal wetland management throughout the continent. Most waterfowl food plants will not attain maximum seed production without at least one irrigation. Swamp timothy is a waterfowl food plant that may be grown successfully without irrigation; however, irrigations greatly enhance seed production if timed correctly and may stimulate an over story of watergrass. Summer irrigation of swamp timothy also tends to concentrate grasshoppers and rodents to the edge of the waterline, where they are quickly consumed by Swainson’s hawks, white-faced ibis, egrets and herons. Large concentrations of Swainson’s hawks foraging in irrigated seasonal wetlands are an annual spectacular phenomenon at the Wildlife Area. Irrigation schedules at the Yolo Bypass Wildlife Area for smartweed and watergrass may vary depending on annual weather patterns (California Department of Fish and Game 1995).

Summer Water

Southbound migratory shorebirds start arriving in the Central Valley during the last week of June, peaking in mid July to early August. They have already nested in their northerly breeding grounds and are already moving south. Some of these birds may be stopping over on their way to the San Joaquin Valley or more southerly wintering grounds, and some are here for the duration of the winter. At any rate, these birds are in need of nutrition in the form of invertebrates and require a habitat that provides varying shallow water depths and a sparseness of vegetation. Additionally, they require resting areas that provide some protection from predators. These habitat characteristics are provided in the fallowed rice fields managed for migratory shorebirds. The fields are prepared identically to rice fields but are not planted and are flooded from July 1 through August 31st. At this time, significant amount of vegetation has become established. The fields are then drained, the weeds disced and the field readied for rice production the following year. This management strategy has proven to have benefits for a variety of species including waterfowl, terns, gulls, wading birds and predators such as peregrine falcon.

Fall Flooding

The timing of fall flooding is based on many factors. Early fall flooding (i.e., August and September) is particularly important for shorebirds, mallards and early migrant pintails and is generally preferred if feasible. During the planning phases of the original Yolo Bypass Wildlife Area, September 1 was determined to be the optimal fall flood up date for seasonal wetlands. With the arrival of West Nile Virus in California, the Department has abided by the requests of the Sacramento Yolo Mosquito and Vector Control District and delayed the fall flood up until October 1st on a year by year basis. The shorebird management areas have been able to provide the necessary early flood water through the month of August for the arriving pintail and mallards, but there currently remains a deficit during September.

Water Depth

Water depth is an extremely important component in Wildlife Area seasonal wetland management. Dabbling ducks (e.g., mallards, pintails, green-winged teal) cannot effectively feed on the seeds and invertebrates found on

pond-bottoms if the water is deeper than 12 inches. Water depths of 4–10 inches are preferred for feeding. Therefore, in order to provide feeding habitat for dabbling ducks, shallow water must be maintained. Shallow water habitat management is valuable to many other wildlife species as well. Shorebirds are particularly dependent on shallow water and seldom use habitats in which the water is deeper than 6 inches (California Department of Fish and Game 1995). Water depths of one inch or less are valuable for smaller shorebirds such as least and western sandpipers and even recently dried mudflats are important for certain species such as snowy plover. The complete absence of water in a plowed field has habitat value as well, attracting such birds as horned larks, mountain plover and various species of longspurs.

Managed Semi-permanent/Permanent Wetlands

Many of the Yolo Bypass Wildlife Area’s resident wildlife species are highly dependent on semi-permanent and permanent wetlands during the late spring and summer when seasonal wetlands are dry. Generally, the two primary habitat requirements of wetland wildlife during this time period are sufficient cover and protection from predators, and an abundant food supply of aquatic invertebrates. Such invertebrates are the primary source of dietary protein for ducks and other wetland-dependent birds during the breeding season. For example, breeding ducks and shorebirds eat invertebrates almost exclusively, but herons eat other direct consumers of invertebrates such as fish and amphibians.

Managed Semi-permanent wetlands, commonly referred to as “brood ponds,” are flooded during the spring and summer, but may experience a 2–6 month dry period each year. Semi-permanent wetlands in the Yolo Bypass Wildlife Area provide breeding ducks, ducklings, and other wetland wildlife with protection from predators and abundant invertebrate food supplies. Water depths of 6–12 inches are necessary to allow wildlife access to invertebrate forage; however, permanent deeper and larger areas (e.g., Green’s Lake and ponds) are also important in that they provide open water.

Both managed semi-permanent and permanent wetlands provide ample protection from predators; however, semi-permanent wetlands can supply a much greater abundance of invertebrates. Invertebrate populations decline with prolonged flooding, thus a dry period of approximately 2 months each year is essential for maintaining abundant populations of invertebrates (California Department of Fish and Game 1995). During this dry period, excessive vegetation is cut or burned and worked back into the soil, in order to remain in compliance with flood control agreements, while adding large amounts of organic matter to fuel the production of invertebrates in successive years. Vegetation removal is often necessary in order to remain within the percent cover limits imposed by agreements with the Reclamation Board.

Permanent wetlands remain flooded throughout the year. Due to year-round flooding, permanent wetlands support a diverse, but usually not abundant, population of invertebrates. However, submerged aquatic vegetation such as pondweed (*Potamogeton* spp.) and arrowhead (*Sagittaria* sp.) may occur if adequate water clarity exists. The leaves and/or nutlets of these aquatic plants are commonly consumed by waterfowl, particularly gadwalls and canvasbacks. Other aquatic plants including water primrose (*Ludwigia peploides*) and parrot’s feather (*Myriophyllum aquaticum*) are potentially invasive and can lead to choking the water column. Permanent wetlands are ultimately dominated by emergent plants such as cattail (*Typha* sp.) and bulrush (*Scirpus* sp.) which must periodically be thinned out in managed wetlands.

Habitat Values of Permanent Wetlands

Managed wetlands as wildlife habitat lie at the core of the Wildlife Area’s focus. Permanent wetlands provide important deep water habitat for diving ducks such as ruddy ducks, scaup, goldeneye, as well as other aquatic species including pied-billed grebes, coots, and moorhens. The dense emergent cover commonly found on the edges of permanent wetlands are often the preferred breeding grounds for marsh wrens, red-winged blackbirds, and roosting areas for black-crowned night herons, white-faced ibis and egrets. Islands created in the permanent wetlands are the preferred nesting areas for many waterfowl and shorebirds. Muskrats, and beaver utilize the tules

as building material for their domed homes. Otters swim effortlessly through the reeds, carving deep slides into the permanent ponds from adjacent ditches. Fish trapped in the permanent ponds following the winter floods live throughout the year in these ponds, with another chance for dispersal the following wet season.

Permanent Wetlands provide important brood habitat for resident waterfowl including mallard, cinnamon teal and gadwall. Waterfowl will nest within one mile of water, so with this in mind, permanent wetlands are situated less than one mile apart from each other. During the late spring and early summer months, dozens of young ducklings may be seen in the permanent wetlands. The hens often form large nursery groups consisting of ducklings from several broods.

Permanent marshes are important to resident waterfowl in mid- to late summer when local ducks are molting their flight feathers; the deep water and dense cover provide protection from predators (California Department of Fish and Game 1995).

Young willows and cottonwoods growing on the shoreline of permanent wetlands are controlled by DFG staff as maintenance to ensure that the flood carrying capacity of the Bypass is not diminished and are therefore always of low stature. This appears to be important habitat for yellowthroats, song sparrows and northern orioles.

Unmanaged Open Water Habitat (Floodwater Inundation)

Although not a managed habitat type and with a diminished influence of vegetation type, open water habitats provide similar habitat values to permanent wetlands. Winter floodwaters in the Yolo Bypass support thousands of migratory waterbirds each year, and are thus important to breeding populations throughout California and beyond. A wide variety of waterbirds forage in the open water habitat provided by seasonal flooding. These birds are distributed according to water depth and include American white pelican, double-crested cormorant (*Phalacrocorax auritus*), and diving ducks such as canvasback and scaup. If the flooding is not substantial, water levels day light out on the western edge, providing thousands of acres of shallow water habitat, albeit unmanaged. This edge is extremely valuable for wintering dabbling ducks, shorebirds, and wading birds. The abundant waterfowl and shorebirds onsite in turn attract many raptors, including American peregrine falcon.

After floodwaters recede, smaller areas of open water habitat remain in the Yolo Bypass Wildlife Area's perennial wetlands and ponds. These areas support foraging waterbirds and raptors throughout the year, including species which breed in the uplands and marshes, such as pied-billed grebe (*Podilymbus podiceps*), mallard, gadwall, American avocet, and black-necked stilt. The perennial ponds also support reptiles such as northwestern pond turtle (*Actinemys marmorata marmorata*) and an introduced turtle species, the red-eared slider (*Trachemys scripta*), which forage in the open water, bask on floating logs and breed in adjacent uplands. A discussion on fish species that utilize Yolo Bypass open water habitats is provided in Section 3.5.3 below.

Seasonal and Permanent Wetland Habitat Diversity

Wetland habitat diversity including variations in topography, water depths, and vegetation patterns are valuable in supporting a wide variety of wildlife species and can also more effectively resist the potentially adverse effects of plant diseases, mosquito production, and bird depredation. Diversified habitats also provide a variety of foraging opportunities throughout the fall and winter for a variety of target species. Even though some moist-soil plants are poor seed producers, when flooded they may support excellent assemblages of invertebrates. Waterfowl also utilize other plants (e.g., cattails and tules) for cover. An ideal seasonal wetland is dominated by waterfowl food plants, contains other moist-soil plants, and provides waterfowl, shorebirds, and wading birds with substantial cover.

Yolo Bypass Wildlife Area habitat improvements that were initiated in 2003 were designed to provide such habitat diversity. These enhancements were federally funded by the North American Wetland Conservation Act (NAWCA) monies matched by the acquisition dollars expended by the Wildlife Conservation Board for the expansion of the Wildlife Area. NAWCA funded improvements were carried out throughout several units on the

Wildlife Area and included adding much needed topographic variation, increasing connectivity of drainage swales, and constructing independent flooding and drainage capabilities. Through the expertise of DFG staff, Ducks Unlimited, and the California Waterfowl Association, a wetland enhancement project was constructed that improved manageability of the wetlands, allowing DFG to more effectively meet obligations to manage wetlands that are compatible with flood protection and mosquito abatement considerations. The end result are individually managed seasonal wetlands with meandering channels, deep pockets, sculptured islands, and shallow benches growing stands of lush watergrass. This complex diversity in topography and associated vegetation communities functions to provide a wide spectrum of microhabitat to meet the specific seasonal and life-stage requirements of a wide assortment of wildlife species.

Vegetation Control

As discussed above, wetland management techniques in the Yolo Bypass Wildlife Area are built upon the prescriptions as described in “*A Guide to Wetland Habitat Management in the Central Valley*” (California Department of Fish and Game 1995) and have been adapted to specific environmental conditions within the Yolo Bypass and the need to remain compatible with the flood control function of the Yolo Bypass. The need to ensure compatibility of managed wetlands with floodwater conveyance includes management of emergent vegetation to make certain that these communities will not conflict with necessary flow conveyance requirements of the Yolo Bypass. Specific criteria for managing emergent vegetation have been developed for the managed wetlands in the Yolo Bypass Wildlife Area, and are described in the U.S. Army Corps of Engineers Operating Manual for the Wildlife Area (U.S. Army Corps of Engineers 2003); these criteria include:

- ▶ no more than 5% emergent vegetation in seasonal wetlands;
- ▶ no more than 50% emergent vegetation in permanent wetlands (which make up approximately 5% of the total Wildlife Area acreage); and
- ▶ riparian vegetation allowed only in specifically designated areas as determined by hydraulic modeling.

For purposes of the operating manual, emergent vegetation includes cattails and bulrush. Acceptable seasonal wetland plants include swamp timothy, watergrass, and smartweed.

In addition to maintaining necessary flow conveyance functions, some plants can also reduce the value of a wetland to waterfowl if they become overly abundant. Tules and/or cattails can eventually “fill-in” a pond, eliminate open water, and exceed emergent vegetation criteria provided above. Any coverage greater than 50% in a permanent wetland is undesirable for waterfowl management. Of course, other species benefit from increased emergent cover such as white-faced ibis, marsh wren, and black-crowned night herons. The primary tools for tule/cattail control at the Yolo Bypass Wildlife Area are discing and mowing. Mowing can be most effective when followed by discing and 2–3 months of exposure to the sun, which is necessary in order to dry out and kill the tubers and rhizomes. Discing tules and cattails also disturbs the soil and provides favorable conditions for invasion by valuable moist-soil waterfowl food plants (California Department of Fish and Game 1995). Ideally, discing of emergent vegetation is preceded by burning, grazing, mowing and or an application of a broad spectrum herbicide to increase the effectiveness of the discing operation.

Discing is typically accomplished with either a “stubble disc” or a “finish disc.” The depth of discing varies with soil structure, soil moisture, implement weight, tractor size, and tractor speed. Most stubble discs have blades that range from 26–36 inches in diameter; these make cuts that are 7 to 14 inches deep. Stubble discs are necessary for most types of pond-bottom discing, however, a finish disc and ring-roller can be used afterward to break up dirt clods to create a better seed bed and make walking easier under subsequent flooded conditions (California Department of Fish and Game 1995).

Finish discs, which typically have blades that range from 18–24 inches in diameter, usually make cuts that are 4–6 inches deep. Finish discs often suffice for discing low-growing vegetation such as pricklegrass and swamp

timothy, but are less effective for controlling cattails, tules, and other robust wetland plants (California Department of Fish and Game 1995).

Wetland Management and Mosquito Control

With the arrival of the West Nile virus, public health concerns about mosquito production in wetlands, rice fields, or other rural sources have elevated substantially. The control of mosquitoes in the managed wetlands within the Yolo Bypass Wildlife Area is a primary concern, due to the close proximity of large urban populations in West Sacramento, Sacramento, and Davis. Seasonal and permanent wetlands at the Yolo Bypass Wildlife Area are managed in coordination with the Sacramento-Yolo Mosquito Vector Control District (SYMVCD) and with best management practices (BMPs) included in the CVHJV's Technical Guide to Best Management Practices for Mosquito Control in Managed Wetlands (Kwasney et al. 2004) and the operation manual (U.S. Army Corps of Engineers 2003) to minimize the production of mosquitoes. The term, "BMPs" is used to describe habitat management strategies that are generally defined as a practice or combination of practices determined to be an effective and practical means for reducing mosquito populations, production rates, or the timing of hatch. BMPs can be effectively classified into the following five categories:

- ▶ Water Management Practices,
- ▶ Vegetation Management Practices,
- ▶ Wetland Infrastructure Maintenance,
- ▶ Wetland Restoration and Enhancement Features, and
- ▶ Biological Controls.

A full discussion on BMPs that are used to reduce mosquito production in managed wetlands at the Yolo Bypass Wildlife Area can be found online at: <http://www.centralvalleyjointventure.org/images/CVJV_Mosquito_BMP_rev.pdf> (Kwasney et al. 2004). Wildlife Area staff in partnership with the SYMVCD was able to fund an mosquito BMP implementation project with funds made available through Senate Bill 1982. This project focused on the control of joint grass (*Paspalum dicitum*), through discing and herbicide application. Joint grass has been implicated as a plant which facilitates the production of large numbers of mosquitoes while providing little wildlife habitat value. First year monitoring has yielded promising results, with a significantly reduced number of mosquito larvae collected in the treated areas.

In response to elevated concern about West Nile Virus and Encephalitis, DFG agreed to temporarily delay the initial flood of seasonal wetlands. Continuous communication and coordination between Wildlife Area and SYMVCD staff regarding water level management, spraying operations, public use scheduling, research projects and planning and design of future wetlands are vital components of management at the Yolo Bypass Wildlife Area. The goals of both wetland managers and mosquito vector interests are not that different. Both seek effective management of water in wetlands that do not result in significantly increased mosquito numbers.

Annual Grassland

Grasslands are found across the majority of the 9,000-acre Tule Ranch unit and in scattered locations within other management units. The majority of annual grassland in California is dominated by a variety of naturalized, nonnative grasses and forbs. Species composition in this community varies widely in response to a variety of micro-scale factors such as soil moisture, soil fertility, disturbance (e.g., gopher mounds), grazing pressure and soil depth. Most grasslands in the Yolo Bypass are dominated by Italian (annual) rye grass (*Lolium multiflorum* Lam.). Common, and occasionally dominant, species include a variety of naturalized nonnative grasses and forbs such as medusahead (*Taeniatherum caput-medusae*), soft chess (*Bromus hordeaceus*), filaree (*Erodium botrys*), Mediterranean barley (*Hordeum marinum* ssp. *gussoneum*), slender wild oats (*Avena barbata*), ripgut brome (*Bromus diandrus*), and rose clover (*Trifolium hirtum*). Native geophytes (bulbs) are also common in these habitats and include a variety of species in the genus *Brodiaea* as well as *Tritelia hyacynthina*, *Tritelia laxa*, and *Calochortus*.

Community composition in wetter sites is similar to vernal pools (discussed below). On shallower soils, grasses generally become less dominant and native forbs such as smooth goldfields (*Lasthenia glabrata* ssp. *glabrata*), owl's clover (*Triphysaria eriantha*), Fitch's tarweed (*Hemizonia fitchii*), blow wives (*Achyrachaena mollis*), California plantain (*Plantago erecta*), and others are more common. Annual grasslands may occasionally contain small areas of remnant perennial native grasses where purple needlegrass (*Nassella pulchra*) and, in more moist areas, creeping wildrye (*Leymus triticoides*) are important components of the grassland community. Purple needlegrass rarely occurs in pure stands; rather it is more commonly encountered as single individuals or scattered groups of several individuals surrounded by and interspersed with nonnative annuals. On saline or alkaline soils, saltgrass (*Distichlis spicata*) becomes a common or dominant component of the grassland. The Tule Ranch grasslands are grazed with cattle as a primary management strategy. This strategy has been proven to be a successful technique for the management of native forbs, resulting in spectacular wildflower blooms in recent years.

The grassland community in the Yolo Bypass Wildlife Area's Tule Ranch Unit provides high-quality breeding and foraging habitat that is relatively scarce in the region, due to habitat conversion to agriculture and the widespread habitat degradation by nonnative invasive plants. Managed (i.e., grazed) grasslands such as those found in the Tule Ranch Unit are especially important given the grassland-obligate wildlife that they support, such as grasshopper sparrow (*Ammodramus savannarum*), and the many grassland-associated wildlife that they support, such as the ground-nesting northern harrier, California horned lark (*Eremophila alpestris actia*), Western burrowing owl (*Speotyto cunicularia*) and western meadowlark (*Sturnella neglecta*). Historically, pronghorn antelope and tule elk grazed the grassland plants. However, today, grazing cattle provide this function and serve to control mostly nonnative competing grasses while providing income, which funds management of the Yolo Bypass Wildlife Area. Grasslands also provide important breeding and foraging habitat for upland game birds such as mourning dove and ring-necked pheasant, as well as nesting habitat for resident waterfowl such as mallard, cinnamon teal, and gadwall. In addition to their ecological value, these upland game bird and waterfowl species also provide income for Wildlife Area management in the form of hunting licenses. Grasslands also support abundant small mammals such as California ground squirrel (*Spermophilus beecheyi*), which in turn attract many avian, mammalian, and reptilian predators such as Swainson's hawk, burrowing owl (*Athene cunicularia*), coyote (*Canis latrans*), racers (*Coluber constrictor*), and gopher snake (*Pituophis melanoleucus*). Large flocks of snow geese and white fronted geese are also attracted to winter grasslands on the Tule Ranch.

Natural Seasonal Wetland

Natural seasonal wetlands are found throughout the Tule Ranch Unit in the Yolo Bypass Wildlife Area. Depending on the duration of inundation, local soil factors, site history, and other characteristics, seasonal wetlands typically are dominated by species characteristic of one of three common natural wetland communities: freshwater marshes, alkali marshes, or freshwater seasonal (often disturbed) wetlands. Because these three communities are characterized by different dominant species and provide different wildlife habitat values, each is discussed separately below.

Freshwater Marsh

Freshwater marshes at Yolo Bypass Wildlife Area are usually dominated by robust native herbaceous species in two genera, *Typha* (cattails) and *Scirpus* (bulrush or tule), which frequently co-occur in large stands interspersed with areas of largely unvegetated open water that, during the dry summer months, may be dominated by nonnative swamp timothy and swamp grass (*Crypsis schoenoides*). Many of the native forbs characteristic of vernal pools in the region, such as coyote thistle (*Eryngium* spp.), gum plant (*Grindelia* sp.), Baker's Navarettia (*Navarettia bakeri*), and goldfields (*Lasthenia* spp.), may also be found in these natural wetland areas. These communities are typically found in areas subjected to prolonged flooding during the winter months and frequently do not dry down until early summer. Freshwater marsh occurs in small areas throughout the Tule Ranch primarily in the low elevation areas adjacent to East Toe Drain at the south end of the Wildlife Area. During wet springs the acreage of natural freshwater marsh increases significantly. A small area in the southeast corner of the Wildlife

Area is of such low elevation that it is subject to tidal fluctuations through a breach in the berm along the toe drain.

Alkali Marsh

Alkali marshes are commonly found in and around the Sacramento Delta at the fringes of freshwater marsh communities. They are the areas of seasonal inundation where rainfall ponds during the winter and evaporates in the late spring leaving behind layers of accumulated mineral salts leached from surrounding upland soils (many of which are slightly to moderately saline and alkaline, e.g., Pescadero clay soils). Typically, these areas are either unvegetated salt scalds or they contain a unique assemblage of low-growing plants adapted to periodic winter inundation, summer drought, and alkaline/saline soils. Dominant native plants in this community are saltgrass (*Distichlis spicata*) and alkali heath (*Frankenia salina*). Common native associates, depending on the degree of seasonal inundation and soil alkalinity include sea blite (*Suaeda* spp.), California coyote-thistle (*Eryngium aristulatum*), clustered field sedge (*Carex praegracilis*), Baltic rush (*Juncus balticus*), and pale spikerush (*Eleocharis macrostachya*). Species commonly associated with vernal pools may also be found in this community. Small alkali marsh communities can be found in the south and southwest portions of the Tule Ranch. The nonnative invasive plant tamarisk (*Tamarix* spp.) may be invasive in alkali marshes.

Portions of alkali marsh containing alkali-adapted plants (e.g., *Distichlis spicata*) are structurally similar to seasonal disturbed wetlands. Both plant communities provide lower quality habitat for wildlife than other wetland communities such as freshwater marsh or vernal pool, as they lack the hydrology and vegetation structure necessary to support most wetland-dependent wildlife species. The vegetated alkali marsh and seasonal disturbed wetlands on site do support more generalist wildlife, however, that are capable of breeding and foraging in both upland and wetland communities. These species include common garter snake (*Thamnophis sirtalis*), savannah sparrow (*Passerculus sandwichensis*), Northern Harrier (*Circus cyaneus*), Mallard (*Anas platyrhynchos*) and California vole (*Microtus californicus*).

Seasonal (Disturbed) Wetland

Seasonal wetlands are plant communities typically characterized by any number of seasonal wetland generalist plants, many of which are nonnative and adapted to frequent disturbance, and may be found throughout the Yolo Bypass Wildlife Area. Common species include mainly nonnative species such as rabbit's foot grass (*Polypogon monspeliensis*), Italian ryegrass, curly dock (*Rumex crispus*), and hyssop loosestrife (*Lythrum hyssopifolia*), and invasive species, such as perennial pepperweed (*Lepidium latifolium*) and dallisgrass (*Paspalum dilatatum*). Some native species also occur, such as nutsedge (*Cyperus eragrostis*). Seasonal wetlands are often isolated wetlands that may have previously functioned more like vernal pools but, due to past disturbances and altered hydrology, now support species that are adapted to longer inundation periods or are more tolerant of repeated disturbance. Seasonal wetlands may also be inadvertently created in areas of claypan or hardpan soils where a lack of water infiltration results in seasonal ponding within areas of excavation or other ground disturbances.

Vernal Pool and Swale

Vernal pools and swales within the Yolo Bypass Wildlife Area are primarily found within the southwest portion of the Tule Ranch Unit. A recent survey of this area (Witham 2003) documented approximately 1,600 acres of vernal pool/grassland habitat as well as the presence of a distinct vernal pool subtype, playa pools. Playa pools are generally larger and deeper than other vernal pool types (several hectares in size and 1–2 meters deep) and defined by cut banks from repeated wave action during the winter and spring. Vernal pools typically support a suite of mostly endemic and sometimes rare plants in several genera including goldfields (*Lasthenia* spp.), popcorn flower (*Plagiobothrys* spp.), *Navarretia*, woolly-marbles (*Psilocarphus* spp.), *Downingia*, and *Limnanthes*. The nonnative Italian ryegrass is also widely distributed in vernal pools. The margins of playa pools support many of the same species as smaller vernal pools. Additionally, several rare grasses, including Colusa grass (*Neostapfia colusana*) and Crampton's tuctoria (*Tuctoria mucronata*), although not confirmed to be present

in Yolo Bypass Wildlife Area, have the potential to occur on the pool bottoms, which are otherwise typically sparsely vegetated. Vernal swales, because they hold water for relatively short periods of time, typically contain a mix of species found in both vernal pools and annual grasslands. Developing a refined grazing plan for the vernal pool areas throughout the Tule Ranch is a high priority for future management and will most certainly focus on the management of the nonnative Italian ryegrass.

Vernal pools are a unique, rare, and rapidly declining community in California. Because of the limited distribution of this community in the state and its continued decline due to land conversion for development and other uses, many vernal pool-associated wildlife species receive state or federal protection or are considered species of concern. The vernal pools at the Wildlife Area provide high-quality habitat for these species, due to the diversity in pool size, long inundation periods, and active vegetation management through grazing. Vernal pool and swale-obligate species known to breed in the Wildlife Area include vernal pool tadpole shrimp (*Lepidurus packardii*), vernal pool fairy shrimp (*Branchinecta lynchi*), conservancy fairy shrimp (*Branchinecta conservatio*), midvalley fairy shrimp (*Branchinecta mesovallensis*), and California linderiella (*Linderiella occidentalis*). Vernal pool tadpole shrimp, vernal pool fairy shrimp, and California linderiella may also inhabit vernal swales, provided that water remains ponded in the swales long enough for the shrimp to mature and reproduce (a minimum of 18 days for vernal pool fairy shrimp, 31 days for California linderiella, and 41 days for vernal pool tadpole shrimp). The vernal pools at the Wildlife Area also may provide suitable habitat for California tiger salamander (*Ambystoma californiense*) and possibly western spadefoot toad (*Spea hammondi*), although these species have not been documented on site. In addition to these species which are restricted to vernal pools and swales, a variety of more generalist wildlife forage and breed in these habitats as well, such as Pacific chorus frog, wetland-associated insects, shorebirds, and waterfowl.

Riparian Woodland

Riparian woodland was probably a dominant habitat type in the primal Yolo Basin, but are currently kept in check in order to maintain the flood conveyance capacity of the Yolo Bypass. Riparian woodland and associated riparian scrub habitats are primarily found adjacent to Green's Lake, Putah Creek, and along the East Toe Drain within the Yolo Bypass Wildlife Area. Riparian scrub is a shrub-dominated community found typically found along stream margins and within the streambed on gravel bars and similar formations. This community is typically dominated by phreatophytes (i.e., water-loving plants) representative of early to mid successional stage vegetation communities within riparian areas in California's Central Valley. Typical species include native plants such as creek dogwood (*Cornus sericea*), California rose (*Rosa californica*), Sandbar willow (*Salix exigua*), buttonbush (*Cephalanthus occidentalis* var. *californicus*), and arroyo willow (*Salix lasiolepis*), along with nonnative invasive species such as Himalayan blackberry (*Rubus discolor*), and potentially arundo (*Arundo donax*), and tamarisk (*Tamarix parviflora*). Native trees such cottonwood (*Populus fremontii*), alder (*Alnus rhombifolia*), and Oregon ash (*Fraxinus latifolia*) are occasionally found overtopping the shrub layer. Riparian woodland is a tree-dominated community found adjacent to riparian scrub on older river terraces where flooding frequency and duration is less. Common native overstory species in riparian communities include cottonwood, alder, valley oak (*Quercus lobata*), Oregon ash, black willow (*Salix gooddingii*), California sycamore (*Plantanus racemosa*), box elder (*Acer negundo*), and northern California black walnut (*Juglans californica* var. *hindsii*) hybrids (northern California black walnut readily hybridizes with cultivated English walnut [*J. regia*]). The understory is typically sparse in this community; although, native species such as California rose, California grape (*Vitis californica*), Santa Barbara sedge (*Carex barbarae*), mulefat (*Baccharis salicifolia*), California barley (*Hordeum brachyantherum* ssp. *californicum*), creeping wildrye and potentially blue elderberry (*Sambucus mexicana*), occur in tree canopy openings.

Although relatively small areas of riparian woodland and scrub communities are present on site, these areas provide very important habitat to a number of wildlife species, many of which are restricted to riparian communities. Riparian communities in California currently cover only a small fraction of their historic range, due to the widespread conversion of river floodplain to agriculture. As such, the riparian communities at the Wildlife Area provide important foraging habitat for many migrating and wintering birds in the Pacific Flyway, as well as

breeding individuals from a variety of taxa. Cavity nesting species such as tree swallow, wood duck, and several woodpecker species benefit from the presence of riparian habitat. Mature stands of cottonwood/sycamore in the Central Valley are of primary importance to breeding red bats (*Lasiurus blossevillii*). Wildlife species known to forage in the on-site riparian communities include Cooper's hawk (*Accipiter cooperii*), sharp-shinned hawk (*Accipiter striatus*), red-shouldered hawk, kingfisher, yellow warbler, willow flycatcher (*Empidonax traillii*), western grey squirrel (*Sciurus griseus*), and western aquatic garter snake. Recently, tricolored blackbird breeding colonies have also occurred in an on-site patch of buttonwillow trees.

Ditch

Ditches are found throughout most management units within the Yolo Bypass Wildlife Area. They typically contain a mixture of weedy herbaceous wetland and upland generalist plants. If frequently cleared, ditch banks may be largely unvegetated and contain only scattered upland weeds or, if unmaintained, they may be densely vegetated. A native species commonly found within ditches at the Yolo Bypass Wildlife Area is water primrose, a species that can eventually form dense stands that slow down the flow of water. Control measures are implemented at this point, which include application of herbicides or mechanical control. Additionally, ditches that are unmaintained and hold water for long period during the growing season may contain a mix of species more commonly found in perennial wetlands or freshwater marshes described above. Ditches serve as corridors, hydrologically connecting land management units.

Wildlife use of the ditches on site varies according to each ditch's pattern of water conveyance. Ditches that remain inundated throughout the summer months and are connected to rice fields or permanent wetlands provide very important habitat at the site, as these ditches and their associated infrastructure provide habitat for the state and federally-listed, threatened, giant garter snake. This aquatic species commonly travels through irrigation ditches, forages for amphibians and small fish, which may be present, and uses the dry associated banks for basking and thermoregulation. Ditches with suitable hydrology also support the foraging of other aquatic wildlife such as western aquatic garter snake, Pacific chorus frog, the nonnative bullfrog, and dabbling ducks such as mallard. Ditches are considered lower quality habitat for these species than perennial ponds, however.

Ditches that remain dry through most of the year and contain abundant vegetation may support foraging upland wildlife such as song sparrow (*Melospiza melodia*), white-crowned sparrow (*Zonotrichia leucophrys*), and American goldfinch (*Carduelis tristis*).

Agricultural Crops

Agricultural fields are found across the northern and central portions of the Yolo Bypass Wildlife Area (e.g., Causeway Ranch and 1,000 Acre units). These fields are generally planted in various annual row crops in the spring and summer months. The primary crop is rice but a variety of other crops are produced including corn, milo, tomatoes, sunflower and safflower. The rice, corn and milo fields are typically managed as flooded open water habitat in the winter months. During the winter months few, if any, plants are likely encountered in any of these fields, except for residual stubble and other by-products remaining after crop harvesting. A warm autumn may sprout a crop of such wildlife beneficial weeds as water grass.

Agricultural lands at the Wildlife Area are actively managed to benefit wildlife. This management results in the use of safflower fields by foraging mourning doves and ring-necked pheasants, which feed on the unharvested seeds; use of corn, milo, and millet fields by foraging sandhill cranes and waterfowl, which feed on the waste grains after the fields are flooded; use of grain fields by foraging waterfowl, which feed on the green shoots during the early growing season; and use of grain fields by some grassland bird species, which nest in the wheat and feed on associated insects and grains. In addition, the on-site rice fields support foraging white-faced ibis, which feed on the abundant invertebrates in the flooded fields; and tomato fields also support foraging Swainson's hawks and other raptors, which prey on the small mammals made more accessible by grading and

harvesting activities. Post harvest flooding of rice fields attracts thousands of waterfowl and shorebirds on an annual basis.

SPECIAL-STATUS SPECIES

Based on queries of the California Natural Diversity Database (CNDDDB 2006) and the California Native Plant Society (CNPS) Inventory of Rare and Endangered Plants of California (CNPS 2007: <<http://cnps.web.aplus.net/cgi-bin/inv/inventory.cgi/BrowseAZ?name=LIST>>), there are 24 special-status plant species known from the vicinity of the Yolo Bypass Wildlife Area (Table 3.5-2). Special-status plants are those plants listed as threatened or endangered under either the Federal or California Endangered Species Acts (ESA/CESA). The CNPS also maintains a list of rare and endangered plants. Although these plants carry no formal regulatory status, except for those plants also listed as threatened or endangered by the federal government or State of California, potential impacts to these species are generally analyzed under the California Environmental Quality Act (CEQA).

A discussion on the habitat requirements for each of these species and their potential for occurrence within the Yolo Bypass Wildlife Area is provided below.

Species	Status 1			Habitat and Blooming Period	Potential for Occurrence
	USFWS	DFG	CNPS		
Suisun Marsh aster <i>Aster lentus</i>	FSC	--	1B	Endemic to San Joaquin Delta, generally occurs in marshes and swamps, often along sloughs, from 0 to 3 meters in elevation. Blooms May–November	CNDDDB documents occurrences south of the Yolo Bypass Wildlife Area at Lindsey Slough/Calhoun Cut.
Ferris’ milkvetch <i>Astragalus tener</i> var. <i>ferrisiae</i>	FSC	--	1B	Meadows, valley and foothill grassland, subalkaline flats on overflow land in the Central Valley; usually seen on dry, adobe soil, 5 to 75 meters in elevation. Blooms April–May	Witham survey of Tule Ranch (2003) documented this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area.
Alkali milkvetch <i>Astragalus tener</i> var. <i>tener</i>	FSC	--	1B	Playas and vernal pools in valley and foothill grassland, alkali flats and flooded lands, from 0 to 60 meters in elevation. Blooms March–June	Witham survey of Tule Ranch (2003) documented this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area. CNDDDB documents 27 other occurrences close by, including Calhoun Cut, Yolo County Grasslands park, Jepson Prairie, Woodland, and Davis area alkaline flats. The locality “0.5 miles W of R.R. tracks, Yolo Bypass area” is most likely within the Yolo Bypass Wildlife Area and may correspond with Tule Ranch.

**Table 3.5-2
Special-status Plants Known to Occur or with Potential to Occur at Yolo Bypass Wildlife Area**

Species	Status 1			Habitat and Blooming Period	Potential for Occurrence
	USFWS	DFG	CNPS		
Heartscale <i>Atriplex cordulata</i>	FSC	--	1B	Alkaline flats and scalds in the Central Valley, sandy soils in Chenopod scrub, valley and foothill grassland, meadows, from 1 to 375 (600) meters in elevation. Blooms April–October	Witham survey of Tule Ranch (2003) documented suitable habitat for this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area, however the species was not encountered during her survey. CNDDDB documents occurrences at Gridley Ranch, Jepson Prairie, alkaline flats between Davis and Woodland, and Calhoun Cut.
Brittlescale <i>Atriplex depressa</i>	FSC	--	1B	Alkali scalds or alkaline clay and playas, in chenopod scrub, meadows, and valley and foothill grassland, rarely associated with riparian, marshes, or vernal pools, from 1 to 320 meters in elevation. Blooms May–October	CNDDDB documents occurrences of this species on alkaline flats between Woodland and Davis, just north of Davis, and at Dozier Station (Jepson Prairie).
San Joaquin spearscale <i>Atriplex joaquiniana</i>	FSC	--	1B	Alkali meadow, chenopod scrub, seeps in valley and foothill grassland, often in seasonal alkali wetlands or alkali sink scrub, from 1 to 835 meters in elevation. Blooms April–October	Witham survey of Tule Ranch (2003) documented suitable habitat for this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area; however, the species was not encountered during her survey. CNDDDB documents occurrences at Liberty Island, alkaline flats between Davis and Woodland, just north of Davis, and Yolo County Grasslands Park.
Lesser saltscale <i>Atriplex persistens</i>	FSC	--	1B	Alkaline vernal pools, from 10 to 115 meters in elevation. Blooms June–October	Witham survey of Tule Ranch (2003) documented suitable habitat for this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area, however the species was not encountered during the survey. CNDDDB documents occurrences at Jepson Prairie.
Bristly sedge <i>Carex comosa</i>	--	--	2	Coastal prairie, marshes and swamps, valley and foothill grassland, on lake margins and wet places, from 0 to 625 meters in elevation. Blooms May–September	CNPS documents this species within the 12 quad search performed, however no location information was provided. This species is known to occur in the Delta along sloughs and in marshes.

**Table 3.5-2
Special-status Plants Known to Occur or with Potential to Occur at Yolo Bypass Wildlife Area**

Species	Status 1			Habitat and Blooming Period	Potential for Occurrence
	USFWS	DFG	CNPS		
Palmate-bracted bird's beak <i>Cordylanthus palmatus</i>	E	E	1B	Chenopod scrub, alkaline areas in valley and foothill grassland, usually on Pescadero silty clay, which is alkaline, from 5 to 155 meters in elevation. Blooms May–October	CNDDDB documents an occurrence of this species at the City of Woodland reserve and Yolo County Park along County Road 102.
Dwarf downingia <i>Downingia pusilla</i>	--	--	2	Margin of vernal lakes and pools (mesic sites) in valley and foothill grassland, from 1 to 485 meters in elevation Blooms March–May	Witham survey of Tule Ranch (2003) documented suitable habitat for this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area; however, the species was not encountered during the survey. CNDDDB documents occurrences at Barker Slough, Calhoun Cut, Dozier area, Jepson Prairie, the Rio Linda area, and Elk Grove.
Fragrant fritillary <i>Fritillaria liliacea</i>	FSC	--	1B	Coastal scrub, coastal prairie, valley and foothill grasslands, often on serpentine (often clay in grasslands), from 3 to 410 meters in elevation Blooms February–May	Witham survey of Tule Ranch (2003) documented suitable habitat for this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area; however the species was not encountered during surveys. CNDDDB documents occurrences at Jepson Prairie.
Bogg's Lake hedge hyssop <i>Gratiola heterosepala</i>	--	E	1B	Freshwater marshes and swamps, vernal pools, lake margins, usually on clay soils, from 5 to 2,400 meters in elevation Blooms April–August	Witham survey of Tule Ranch (2003) documented suitable habitat for this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area; however the species was not encountered during surveys. CNDDDB documents occurrences at Jepson Prairie, the Rio Linda area, and Mather County Park.
Rose-mallow <i>Hibiscus lasiocarpus</i>	--	--	2	Freshwater marshes and swamps, generally found on wetted river banks and low peat islands in sloughs, known from the Sacramento-San Joaquin Delta watershed, from 0 to 120 meters in elevation Blooms June–September	CNDDDB documents occurrences of this species in Snodgrass and Lost Sloughs, as well as near I-80 at the W. El Camino Avenue on ramp.

**Table 3.5-2
Special-status Plants Known to Occur or with Potential to Occur at Yolo Bypass Wildlife Area**

Species	Status 1			Habitat and Blooming Period	Potential for Occurrence
	USFWS	DFG	CNPS		
Carquinez goldenbush <i>Isocoma arguta</i>	FSC	--	1B	Alkaline soils, flats, near drainages, on low benches, on tops and sides of mounds in swale habitat, lower hills, in valley and foothill grassland, from 1 to 20 meters in elevation. Blooms August–December	Witham survey of Tule Ranch (2003) documented suitable habitat for this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area, however the species was not encountered during surveys. CNDDDB documents occurrences near Dozier along Hwy 113 and at Jepson Prairie.
Northern California black walnut <i>Juglans hindsii</i>	FSC	--	1B	Riparian forest/woodland on deep alluvial soil, from 0 to 400 meters in elevation. Blooms April–May	CNDDDB documents occurrences along the Sacramento River between Rio Vista and Freeport.
Delta tulle pea <i>Lathyrus jepsonii</i> var. <i>jepsonii</i>	FSC	--	1B	Freshwater and brackish marshes, usually on marsh/slough edges, generally restricted to the Sacramento-San Joaquin Delta, from 0 to 4 meters in elevation. Blooms May–September	CNDDDB documents occurrences at Snodgrass, Barker, Lindsey, Hass, and Cache Sloughs, Delta Meadows Park, and Calhoun Cut.
Legenere <i>Legenere limosa</i>	FSC	--	1B	Vernal pool bottoms, from 1 to 880 meters in elevation. Blooms April–June	Witham survey of Tule Ranch (2003) documented suitable habitat for this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area; however, the species was not encountered during surveys. CNDDDB documents occurrences near Calhoun Cut, Jepson Prairie, Elk Grove, Gibson Ranch (Rio Linda), and Robla.
Heckard's peppergrass <i>Lepidium latipes</i> var. <i>heckardii</i>	FSC	--	1B	Grasslands, alkaline soils, edges of vernal pools, in valley and foothill grassland, from 3 to 200 meters in elevation. Blooms March–May	Witham survey of Tule Ranch (2003) documented this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area. According to CNDDDB, this species also occurs north of Davis, at Jepson Prairie, and in Haas Slough (Dozier).
Mason's lilaepsis <i>Lilaeopsis masonii</i>	FSC	R	1B	Freshwater and brackish marsh, riparian scrub, generally found in tidal zones on muddy or silty soils formed through river deposition or bank erosion, from 0 to 10 meters in elevation. Blooms April–November	CNDDDB documents occurrences of this species in Barker, Lindsey, Cache, and Snodgrass Sloughs as well as in Calhoun Cut.

**Table 3.5-2
Special-status Plants Known to Occur or with Potential to Occur at Yolo Bypass Wildlife Area**

Species	Status 1			Habitat and Blooming Period	Potential for Occurrence
	USFWS	DFG	CNPS		
Delta mudwort <i>Limosella subulata</i>	--	--	2	Riparian scrub, freshwater and brackish marsh, generally on mud banks of the delta in marshy or scrubby riparian associations, from 0 to 3 meters in elevation. Blooms May–August	CNDDDB documents occurrences of this species in Barker Slough as well as in Calhoun Cut.
Baker’s navarretia <i>Navarretia leucocephala</i> ssp. <i>bakeri</i>	FSC	--	1B	Vernal pools, swales, meadows and seeps in cismontane woodland, lower montane coniferous forest, and valley and foothill grassland, on adobe or alkaline soils, from 5 to 1,740 meters in elevation. Blooms April–July	Witham survey of Tule Ranch (2003) documented this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area. CNDDDB documents occurrences of this species at Glide Ranch and Jepson Prairie.
Colusa grass <i>Neostapfia colusana</i>	T	E	1B	Usually in large or deep vernal playa pools (flowering on drying pool bottoms), on adobe soils, from 5 to 200 meters in elevation. Blooms May–August	Witham survey of Tule Ranch (2003) documented suitable habitat for this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area, however the species was not encountered during her survey. CNDDDB documents occurrences at Jepson Prairie and at Yolo County Grasslands Park.
Sanford’s arrowhead <i>Sagittaria sanfordii</i>	FSC	--	1B	Marshes and swamps, shallow, slow-moving, freshwater habitats, ponds, ditches, from 0 to 619 m in elevation. Blooms May–October	CNDDDB documents occurrences in Sacramento along the American River, in Morrison Creek, and northern Sacramento sites.
Crampton’s Tuctoria/Solano grass <i>Tuctoria mucronata</i>	E	E	1B	Usually in dry bottoms of large or deep vernal playa pools in valley and foothill grassland (flowering on drying pool bottoms), 5 to 10 meters in elevation. Blooms April–September	Witham survey of Tule Ranch (2003) documented suitable habitat for this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area; however, the species was not encountered during surveys. CNDDDB documents occurrences west of Jepson Prairie and at Yolo County Grasslands Park.

Legal Status Definitions
U.S. Fish and Wildlife Service (USFWS)
 E Endangered
 T Threatened
 FSC Federal Species of Concern
California Department of Fish and Game (DFG)
 E Endangered
 T Threatened
 R Rare

California Native Plant Society (CNPS) Categories
 1A Plants presumed extinct in California
 1B Plant species considered rare, threatened, or endangered in California and elsewhere
 2 Plant species considered rare, threatened, or endangered in California but more common elsewhere
 3 Plants about which we need more information – a review list
 4 Plants of limited distribution – a watch list

Aster lentus

Suisun marsh aster (*Aster lentus*) is a perennial in the sunflower (Asteraceae) family. It grows in marshes along tidal streams in the Sacramento-San Joaquin Delta, frequently at or very near the water line mixed with tules, cattails, and other emergent vegetation. It may be found in the Yolo Bypass Wildlife Area within perennial wetlands and similar habitats. Suisun marsh aster is listed as a federal species of concern and has been placed on List 1B by the CNPS.

Astragalus tener* var. *ferrisiae

Ferris' milkvetch (*Astragalus tener* var. *ferrisiae*) is a small annual in the pea (Fabaceae) family. It occurs in moist and slightly alkaline habitats such as vernal pools, vernal marshes, and grasslands in the Sacramento Valley and is known from only six sites, one of which is the Tule Ranch (Witham 2003). Ferris' milkvetch is a federal species of concern and has been placed in List 1B by the CNPS.

Astragalus tener* var. *tener

Alkali milkvetch (*Astragalus tener* var. *tener*) is closely related to Ferris' milkvetch and has similar habitat requirements; however, alkali milkvetch is more widely distributed throughout the Bay Area, Sacramento Valley, and San Joaquin Valley. Witham (2003) detected several occurrences of this plant on the Tule Ranch, including one large population containing approximately 300 plants. Alkali milkvetch is a federal species of concern and has been placed on List 1B by CNPS.

***Atriplex* spp.**

Four different special-status species in the genus *Atriplex* are known from the vicinity of the Yolo Bypass Wildlife Area. These four species are: heartscale (*Atriplex cordulata*), brittlescale (*Atriplex depressa*), San Joaquin spearscale (*Atriplex joaquiniana*), and lesser saltscale (*Atriplex persistens*). All are annuals in the amaranth (Amaranthaceae) family (formerly considered part of Chenopodiaceae) and distributed throughout the Central Valley and Bay Area in saline or alkaline habitats. *Atriplex cordulata* and *A. joaquiniana* both grow up to 40cm in height or taller and may be found in a variety of vernal mesic saline or alkaline habitats including salt scalds, grasslands, and alkali flats. *A. depressa* and *A. persistens* are both low growing, rarely exceeding 20cm in height. *A. depressa* shares similar habitat requirements with *A. cordulata* and *A. joaquiniana* and may frequently be found growing in association with these species; *A. persistens* is more commonly found growing on the drying bottoms of large, alkaline vernal pools. Although none of these species have been found in the Yolo Bypass Wildlife Area, all have the potential for occurrence. All four species are federal species of concern and have been placed on List 1B by CNPS.

Carex comosa

Bristly sedge (*Carex comosa*) is an herbaceous, grass-like perennial in the sedge (Cyperaceae) family. It is found throughout the Delta along sloughs, river channels, pond margins, and marshes. It also inhabits similar habitats in other parts of the United States with the exception of the Great Basin. Bristly sedge may be found along perennial wetlands, the Toe Drain, and ditches within the Yolo Bypass Wildlife Area. This plant has been placed on List 2 by CNPS.

Cordylanthus palmatus

Palmate-bracted birds' beak (*Cordylanthus palmatus*) is an annual in the figwort (Scrophulariaceae) family and can reach 30 cm in height. It grows in vernal mesic alkaline or saline grassland or scrub habitats in scattered localities in the Sacramento and San Joaquin Valleys and at Livermore in the Bay Area. Locally, it is frequently found growing on Pescadero saline-alkaline silty clay soils in association with saltgrass (*Distichlis spicata*), tarplant (*Hemizonia* spp.), pickleweed (*Salicornia subterminalis*), and alkali-heath (*Frankenia salina*) near

Woodland, California. *Cordylantus palmatus* is a hemiparasite, forming connections with the roots of a host plant. Although *Cordylanthus* has photosynthetic capability, it also receives nutrients from its host plant. Although not found during surveys by Witham (2003), suitable habitat is found on the Fireman's Club in the Tule Ranch unit of the Wildlife Area. Palmate-bracted birds' beak is listed by the State and U.S. Fish and Wildlife Service as an endangered species. It is placed on List 1B by CNPS.

Downingia pusilla

Dwarf downingia (*Downingia pusilla*) is a diminutive annual in the bellflower (Campanulaceae) family. It is widely distributed in vernal pools and wet grasslands throughout the Central Valley and north Bay areas as well as Central Chile. This species occurs in sparsely vegetated micro-habitats. Witham (2003) did not locate this species during her surveys; however, the species is difficult to locate if surveys are not timed specifically to detect it. Suitable habitat is found on the Tule Ranch unit. Dwarf downingia has been placed on List 2 by CNPS.

Fritillaria liliacea

Fragrant fritillary (*Fritillaria liliacea*) is an herbaceous perennial in the lily family (Liliaceae). It may be found in grassland or scrub habitats, often on clay soils. Locally, this species is usually found growing on the tops of mima-mounds or other upland areas within vernal pool grasslands. Although this species has not been located on the Tule Ranch unit (Witham 2003) suitable grassland habitat exists in the Tule Ranch unit and in other management units in the wildlife area. *Fritillaria liliacea* is found at the Jepson Prairie. Fragrant fritillary has been placed on list 1B by CNPS and is a federal species of concern.

Gratiola heterosepala

Bogg's Lake hedge-hyssop is a diminutive annual in the figwort (Scrophulariaceae) family. It grows on the margins and bottoms of deeper vernal pools as well as lake margins, marshes, ponds, and similar habitats at scattered locations in the Central Valley, northern Coast Ranges, central Sierra Foothills, and Modoc Plateau. Although this species has not been located in the Project area, suitable habitat for this species is found in the Tule Ranch unit. Bogg's Lake hedge-hyssop is listed by the State of California as endangered and has been placed on List 1B by CNPS.

Hibiscus lasiocarpus

California hibiscus (*Hibiscus lasiocarpus*) is a robust, shrub-like perennial in the mallow (Malvaceae) family. It grows alongside creeks, streams, rivers, and marshes in California's Central valley from Butte County south to San Joaquin County (as well as similar habitats in the central, southern, and southeastern United States). This species may be found along the Toe Drain and within perennial wetlands in the Yolo Bypass Wildlife Area. California hibiscus has been placed on List 2 by CNPS.

Isocoma arguta

Carquinez golden-bush (*Isocoma arguta*) is a perennial sub-shrub in the sunflower (Asteraceae) family. It typically grows on alkaline soils in open grasslands, on the tops and sides of mima-mounds in vernal pool grasslands, or near drainages in the Delta. This species has not been located in the Yolo Bypass Wildlife Area; although, suitable habitat does exist on the Tule Ranch and in similar grassland habitats. Carquinez golden-bush has been placed on List 1B by CNPS and is a federal species of concern.

Juglans californica* var. *hindsii

Northern California black walnut (*Juglans californica* var. *hindsii*) is a large tree in the walnut (Juglandaceae) family. It was formerly found throughout riparian areas in northern California and has served as rootstock for cultivated English walnuts. Northern California black walnut readily hybridizes with other walnuts, including

other rootstock and English walnut, and this propensity has reduced the genetic purity of extant native walnut stands and contributed to the increasing rarity of genetically pure individuals. Northern California black walnut may be found along riparian areas of Putah Creek and the Toe Drain. This species is a federal species of concern and has been placed on List 1B by CNPS.

Lathyrus jepsonii* var. *jepsonii

Delta tulle pea (*Lathyrus jepsonii* var. *jepsonii*) is an herbaceous, perennial vine in the pea (Fabaceae) family. It is found only in the Sacramento-San Joaquin Delta where it grows within and above the upper tidal zone, frequently mixed among shrubby vegetation, such as California rose, Himalayan blackberry, or sandbar willow. Within the Yolo Bypass Wildlife Area, it is possible that this plant may be found along the edges of perennial or seasonal wetlands and the Toe Drain. Delta tulle pea is listed as a federal species of concern and has been placed on List 1B by CNPS.

Legenere limosa

Green's legenera (*Legenere limosa*) is a diminutive annual in the bellflower (Campanulaceae) family. It grows in the bottoms of larger vernal pools, frequently with species such as pale spikerush (*Eleocharis macrostachya*) and rayless goldfields (*Lasthenia glaberrima*). It may also be found with the related dwarf downingia. This species has not been located on the Yolo Bypass Wildlife Area although it may grow in suitable habitats within the Tule Ranch and similar vernal pool or seasonal wetland habitats. Green's legenera is a federal species of concern and has been placed on List 1B by CNPS.

Lepidium latipes* var. *heckardii

Heckard's peppergrass is a small annual in the mustard (Brassicaceae) family. It is known from eight locations across California, one of which is the Tule Ranch, and tends to be found in vernal wet alkali grasslands where it co-occurs with plants such as annual rye grass, dwarf pepperweed (*Lepidium latipes* var. *latipes*), smooth goldfields (*Lasthenia glabrata* ssp. *glabrata*), annual hairgrass (*Deschampsia danthonioides*), and others. Recent vegetation surveys (Witham 2003) documented this species in several locations throughout Tule Ranch. Heckard's peppergrass has been placed on List 1B by CNPS and is a federal species of concern.

Lilaeopsis masonii

Mason's lilaeopsis (*Lilaeopsis masonii*) is a tiny perennial in the carrot (Apiaceae) family. It is found primarily on mudflats and similar habitats within the tidal zone of marshes and rivers within the Sacramento-San Joaquin Delta. This species may occur along the Toe Drain. Mason's lilaeopsis is listed as a federal species of concern and has been placed on List 1B by CNPS.

Limosella subulata

Delta mudwort (*Limosella subulata*) is a diminutive perennial in the figwort (Scrophulariaceae) family found in the Sacramento-San Joaquin delta and on the east coast of the United States. Similar to Mason's lilaeopsis, it is frequently found in microhabitats where bank sloughing and other similar disturbances have created localized areas of saturated fine sediment (clay and silty clay) deposition below the average high tide level. This species may occur along the Toe Drain. Delta mudwort has been placed on List 2 by CNPS.

Navarretia leucocephala* ssp. *bakeri

Baker's navarretia (*Navarretia leucocephala* ssp. *bakeri*) is a diminutive annual in the phlox (Polemoniaceae) family. As with other *Navarretia leucocephala* subspecies, it grows throughout vernal pools as well as seasonally wet grasslands. In contrast to the more widely distributed, and occasionally sympatric, *N. leucocephala* spp. *leucocephala*, the corolla tube is smaller, the corolla lobes are more linear, and the corolla tube is included within

the calyx tube. Witham (2003) found that most habitats within the Tule Ranch are suitable for this species. Somewhat notably, it was not only the sole *Navarretia* species found during her surveys but also the only member of the phlox family found on the Tule Ranch. CNPS has placed Baker's navarretia on List 1B, and it is listed as a federal species of concern.

Neostapfia colusana* and *Tuctoria mucronata

Colusa grass (*Neostapfia colusana*) and Crampton's tuctoria (*Tuctoria mucronata*) are small, annual plants in the grass (Poaceae) family. They are part of a larger group of related vernal pool grasses, most of which were formerly placed in the genus *Orcuttia*. These species tend to be found in larger, deeper vernal pools where they grow on the drying pool bottoms, frequently later into the summer than many other vernal pool plants. They are widely distributed throughout suitable habitats within the Central Valley; although, they are uncommon wherever they are found. Both species are known from the vicinity of the Yolo Bypass Wildlife Area and, although not detected during recent surveys (Witham 2003), they could occur in suitable habitat within the Tule Ranch unit. Both species are listed by the State of California as endangered, and CNPS has placed both species on list 1B. Colusa grass is federally listed as threatened and Crampton's tuctoria is federally listed as endangered.

Sagittaria sanfordii

Sanford's arrowhead (*Sagittaria sanfordii*) is an aquatic perennial in the water plantain (Alismataceae) family. It grows in shallow, slow-moving streams, drainage canals, ditches, and pond or lake margins throughout the Central Valley as well as scattered localities on the north and central California coast where it can form large, mono-specific clumps of plants or be interspersed with a variety of other similar vegetation such as common water plantain (*Alisma plantago-aquatica*). It may be found in suitable habitats throughout most management units within the Yolo Bypass Wildlife Area. Sanford's arrowhead is a federal species of concern and has been placed on List 1B by CNPS.

3.5.2 WILDLIFE RESOURCES

The Yolo Bypass Wildlife Area supports a diverse assemblage of communities that provide valuable wildlife habitat for a variety of species guilds. The communities are described in Section 3.5.1, "Vegetation Resources." Two additional features, open water and mudflat, are not vegetation communities but provide important foraging habitat for many wildlife species and are key components of the Yolo Bypass Wildlife Area's ecological value. Primary species guilds and key wildlife species that utilize each of the communities are discussed below.

SPECIES GUILDS

The Yolo Bypass Wildlife Area lies within a central portion of the Pacific Flyway, the major pathway for migratory bird species on the West Coast. Many of the species that inhabit the Wildlife Area are there during the fall and winter months, when the Central Valley becomes home to an abundance of birds. The most conspicuous groups of wintering birds include waterfowl, shorebirds and wading birds, and raptors. Other groups that utilize the Wildlife Area include upland game species, cavity-nesting birds, and neotropical migratory birds.

Waterfowl

A significant feature of the Yolo Bypass Wildlife Area is the abundance and variety of wintering waterfowl that migrate down the Pacific Flyway each year. Large numbers of ducks, geese, and swans winter in the Wildlife Area after migrating from northern breeding areas. Waterfowl populations are a highly valued and diversified biological resource. They are of high interest to a variety of recreational users of the Wildlife Area, particularly hunters and bird watchers. Species that occur in high abundance include northern pintail (*Anas acuta*), northern shoveler (*Anas clypeata*), mallard (*Anas platyrhynchos*), gadwall (*Anas strepera*), American wigeon (*Anas americana*), cinnamon and green-winged teal (*Anas cyanoptera* and *A. crecca*), lesser scaup (*Aythya affinis*),

tundra swan (*Cygnus columbianus*), snow goose (*Chen caerulescens*), and white-fronted goose (*Anser albifrons*). Some species, such as mallard, gadwall, and Canada goose (*Branta canadensis*) are year-round residents and breed locally in wetlands and nearby uplands.

Natural wetland areas have declined by approximately 95% in California and as a result, waterfowl breeding and wintering populations have declined from historical levels. Therefore, the Wildlife Area is a critical link in the chain of wetlands that make up the Pacific Flyway, contributing to the preservation of wintering and breeding waterfowl populations.

A peak in the number of waterfowl in the Wildlife Area occurs in December–April, when large numbers are attracted to the seasonally flooded wetlands. During periods of water inundation in the Bypass, less abundant diving species such as canvasback (*Aythya valisineria*), scaup (*Aythya* spp.), and goldeneye (*Bucephala* spp.) can be present. These species may also be present in the deeper areas of seasonal and permanent ponds. A secondary peak in waterfowl abundance occurs in late summer and is correlated with the presence of breeding ducks, their young and early migrants. Primary nesting species at the Wildlife Area include mallard, gadwall, and cinnamon teal. Grazing, upland cover plantings, and maintenance of properly spaced brood ponds are strategies used for nesting waterfowl. Semi permanent wetlands and permanent wetlands provide brood cover for ducklings for the first few weeks of their lives.

Seasonal flooding of wetlands is the primary wetland management strategy in the Yolo Bypass Wildlife Area for migratory waterfowl. In addition, agricultural activities provide high quality foraging habitat for some waterfowl species. Pintail, tundra swans, snow geese, and white-fronted geese can often be seen foraging in large numbers in rice fields.

The periodic flooding that occurs during high flow events results in deeper water and a subsequent increase in diving ducks, such as canvasback and scaup.

Shorebirds and Wading Birds

The Yolo Bypass Wildlife Area has become one of the premier shorebird areas in the Central Valley. With managed seasonal wetlands providing shallow water, mud flats, and island mounds, hundreds of thousands of shorebirds and wading birds annually migrate through, winter, and/or breed in the Yolo Bypass Wildlife Area. These species are a significant component of the Wildlife Area and are of high interest to recreational bird watchers.

Shorebirds and wading birds that breed in or nearby the Wildlife Area include American avocet (*Recurvirostra Americana*), black-necked stilt (*Himantopus mexicanus*), killdeer (*Charadrius vociferus*), spotted sandpiper (*Actitis macularia*), Virginia rail (*Rallus limicola*), white-faced ibis (*Plegadis chihi*), black-crowned night heron (*Nycticorax nycticorax*), great blue heron (*Ardea herodias*), and snowy and great egret (*Egretta thula* and *Ardea alba*). Since the opening of the Wildlife Area, a heronry (nesting colony of herons and egrets) has become established nearby. In addition large numbers of ibis, egrets, and black-crowned night herons from nesting colonies elsewhere in the region use the Wildlife Area during summer months, feeding primarily on crayfish, fish and amphibians. A considerable number of black-crowned night herons and white-faced ibis roost on the Wildlife Area in dense cattail thickets or willows.

A high diversity of shorebirds rely on the Wildlife Area to provide habitat during migration and winter. Species regularly observed in during these periods include western and least sandpiper (*Calidris maurim* and *minutilla*), long- and short-billed dowitchers (*Limnodromus scolopaceus* and *griseus*), dunlin (*Calidris alpina*), greater and lesser yellowlegs (*Tringa melanoleuca* and *flavipes*), whimbrel (*Numenius phaeopus*), long-billed curlew (*Numenius americanus*), and Wilson's phalarope (*Phalaropus tricolor lobatus*). Species that occur more rarely in the Wildlife Area include ruff (*Philomachus pugnax*), pectoral sandpiper (*Calidris melanotos*), and red-necked phalarope (*Phalaropus lobatus*).

On a regional scale, there have been substantial losses of historic habitat used by these species, resulting in smaller, detached patches of suitable habitat for nesting and foraging. Available information suggests that their populations are declining. Riparian habitats suitable for use by colonial-nesting species, such as egrets, have been lost or fragmented on the Wildlife Area. The aforementioned heron rookery is located on property owned and managed by the Sacramento-Yolo Port District.

Managed seasonal wetlands with complex diverse topography combined with innovative rice/shorebird habitat rotations in the Wildlife Area provide critical foraging, nesting, and loafing habitat for an abundance of shorebird and wading bird species. Maintaining existing and restoring additional suitable seasonal and permanent wetland, and riparian communities, and reducing the effect of factors that can suppress breeding success in the Yolo Bypass Wildlife Area is critical to maintaining healthy shorebird and wading bird populations in the region.

Neotropical Migratory Birds

Many species of neotropical migratory birds migrate through or breed in the Yolo Bypass Wildlife Area. The neotropical migratory bird guild includes species that breed in North America and winter in Central and South America. Representative species that breed and/or migrate through the Wildlife Area include western kingbird (*Tyrannus verticalis*), western wood-pewee (*Contopus sordidulus*), tree swallow (*Tachycineta bicolor*), barn swallow (*Hirundo rustica*), Bullock's oriole (*Icterus bullockii*), Wilson's warbler (*Wilsonia pusilla*), yellow warbler (*Dendroica petechia*), and blue grosbeak (*Guiraca caerulea*).

Regionally, there have been substantial losses of historic habitat used by neotropical migratory species, and available information suggests that population levels for many of these species are declining. Continued management of existing habitat and restoration of additional suitable wetland, riparian, and grassland habitats in the Yolo Bypass Wildlife Area is important to maintaining healthy neotropical migrant bird populations. Opportunities to increase length and density of riparian vegetation along Putah Creek and the East Toe Drain will also benefit species in this guild. Protection and restoration of nesting habitat helps reduce nest parasitism and predation by creating habitat conditions that render neotropical birds less susceptible to these stressors. Management of upland habitat to provide variations in height and density of vegetation, food crops, and water has proven to be beneficial to many neotropical migratory song birds.

Raptors

A wide variety of wintering and/or breeding raptors utilize the Yolo Bypass Wildlife Area, including red-tailed hawk (*Buteo jamaicensis*), white-tailed kite (*Elanus leucurus*), rough-legged hawk (*Buteo lagopus*), ferruginous hawk (*Buteo regalis*), prairie falcon (*Falco mexicanus*), peregrine falcon (*Falco peregrinus anatum*), kestrel (*Falco sparverius*), barn owl (*Tyto alba*), great horned owl (*Bubo virginianus*), short-eared owl (*Asio flammeus*), and northern harrier (*Circus cyaneus*). Of these, Swainson's hawk (*Buteo swainsoni*), red-tailed hawk, kestrel, northern harrier, white-tailed kite, barn owl, and great horned owl are known to nest in the Wildlife Area.

All of these raptor species can be seen foraging and hunting for prey in recently flooded wetlands and in fresh cut alfalfa fields. Management strategies for raptors include optimizing foraging opportunities by managing for a food base consisting of rodents and large insects. Rodent numbers are highly dependent on the timing, magnitude, and duration of flooding in the Yolo Bypass. Maintaining high humidity in pond/wetland bottoms helps to develop high grasshopper numbers. Discing, mowing, and summer irrigations attract large numbers of Swainson's hawks feeding on grasshoppers. Fall preparation of agricultural fields also attracts wintering raptors and often provides important foraging opportunities for Swainson's Hawks, shortly before their autumn journey to Mexico and Central America.

Cavity-nesting Birds

Cavity-nesting birds, such as kestrels, tree swallows, and wood ducks (*Aix sponsa*) can be seen throughout the Wildlife Area. Providing nesting boxes for these cavity-nesters benefits these species in the Wildlife Area, as shown by the success of a series of nest box projects.

Swallows are summer migrants, occurring in the Wildlife Area from late winter to early fall (February–October), with peak abundance generally in June and July. Large post and pre-breeding mixed flocks of swallows can occur in the spring and summer, particularly when flying insect populations associated with wetlands and agricultural fields are abundant.

Upland Game Birds

The Yolo Bypass Wildlife Area provides habitat for several upland game birds of great interest to recreational hunters. The primary upland game bird species that utilize the Wildlife Area are mourning dove (*Zenaida macroura*) and ring-neck pheasant (*Phasianus colchicus*). Tenant farmers grow fields of safflower that provide abundant foraging opportunities. Safflower is also left unharvested and mowed to provide additional foraging prospects for these species. These management strategies have resulted in improved upland game bird hunting throughout the Wildlife Area. Spring floods can significantly affect pheasant nesting and recruitment success thereby limiting populations in subsequent years.

SPECIAL-STATUS SPECIES

Special-status wildlife species are legally protected or are otherwise considered sensitive by federal, state, or local resource conservation agencies and organizations. Special-status wildlife species addressed in this section include:

- ▶ species listed as threatened or endangered under the ESA/CESA;
- ▶ species identified by USFWS or DFG as species of special concern;
- ▶ species fully protected in California under the California Fish and Game Code; and
- ▶ species identified as priorities for recovery under CALFED's MSCS.

Table 3.5-3 includes 43 special-status species that are known (38) or have potential (5) to occur regularly in the Yolo Bypass Wildlife Area. The table also provides information on each species' regulatory status, habitat requirements, and potential for occurrence, and each species is discussed further in the text that follows. Migratory birds described as "winter" visitors may occur in small numbers throughout the year, but do not breed in the area and are most common in winter. A map of special-status species occurrences in the Wildlife Area that have been documented in the CNDDDB is provided in Exhibit 3.5-2.

Invertebrates

Vernal pool crustaceans

Vernal pool crustaceans are restricted to vernal pools, swales, and other seasonal pools. Eggs of these species lie dormant during most of the year in the form of cysts, which are capable of withstanding extreme environmental conditions, such as heat, cold, and prolonged desiccation. The cysts hatch when the pools fill with rainwater, and the young rapidly develop into sexually mature adults. Not all of the cysts hatch with the first rainfall; some remain dormant to hatch during subsequent events or in later years. Eggs are dispersed from one pool to another on the feet of birds and mammals, which move between the pools. The vernal pools in the Tule Ranch Unit of the Wildlife Area are known to support five special-status vernal pool crustaceans; suitable habitat on site is restricted to this unit. Species known to occur on site include the federally endangered vernal pool tadpole shrimp (*Lepidurus packardii*), federally endangered conservancy fairy shrimp (*Branchinecta conservatio*), federally threatened vernal pool fairy shrimp (*Branchinecta lynchi*), and two federal species of concern: midvalley fairy

shrimp (*Branchinecta mesovallensis*) and California linderiella (*Linderiella occidentalis*). The first four of these species are listed as species to be maintained under CALFED's MSCS.

Table 3.5-3 Special-Status Wildlife Known or with Potential to Occur Regularly at Yolo Bypass Wildlife Area					
Species	Status ¹			Habitat	Potential for Occurrence
	USFWS	DFG	MSCS		
Invertebrates					
Vernal pool tadpole shrimp <i>Lepidurus packardii</i>	E	--	m	Inhabit vernal pools and seasonal wetlands, which range from 2 m ² to over 350,000 m ² .	Known to occur in vernal pools in the Tule Ranch Unit, which provide suitable habitat.
Vernal pool fairy shrimp <i>Branchinecta lynchi</i>	T	--	m	Typically inhabit vernal pools and seasonal wetlands less than 200 m ² and less than 5 cm deep; they may also occur in larger, deeper pools.	Known to occur in vernal pools in the Tule Ranch Unit, which provide suitable habitat.
Conservancy fairy shrimp <i>Branchinecta conservatio</i>	E	--	m	Large vernal pools and seasonal wetlands, ~ 1 acre in size.	Known to occur in vernal pools in the Tule Ranch Unit, which provide suitable habitat.
Midvalley fairy shrimp <i>Branchinecta mesovallensis</i>	SSC	--	m	Small vernal pools and seasonal wetlands less than 202 m ² in area (average area 67 m ²), with average depth of 10 cm (range 5–15 cm).	Known to occur in vernal pools in the Tule Ranch Unit, which provide suitable habitat.
California linderiella <i>Linderiella occidentalis</i>	SSC	--	--	Vernal pools and seasonal wetlands from 1 to 52,500 m ² in area (average area 1,283 m ²), with average depth of 19 cm (range 3–151 cm).	Known to occur in vernal pools in the Tule Ranch Unit, which provide suitable habitat.
Reptiles					
Giant garter snake <i>Thamnophis gigas</i>	T	T	r	Inhabits slow-moving streams, sloughs, ponds, marshes, flooded rice fields, irrigation and drainage ditches, and adjacent upland areas.	Known to occur in the northwestern portion of the Wildlife Area. Suitable habitat is present throughout the site in wetlands, rice fields, irrigation channels, riparian areas, and adjacent uplands.
Northwestern pond turtle <i>Actinemys marmorata marmorata</i>	SSC	SSC	m	Inhabits slow-moving streams, sloughs, ponds, irrigation and drainage ditches, and adjacent upland areas.	Known to occur in suitable habitats throughout the site, including: wetlands, rice fields, irrigation channels, riparian areas, and adjacent uplands.
Amphibians					
California tiger salamander <i>Ambystoma californiense</i>	T	SSC	m	In winter, breeds in vernal pools and seasonal wetlands with a minimum 10-week inundation period. In summer, aestivates in grassland habitat, primarily in rodent burrows.	Could occur. Not documented on site, but suitable habitat is present in vernal pools within the Tule Ranch Unit, and the Wildlife Area is within the species' known range.
Western spadefoot toad <i>Spea hammondi</i>	--	SSC	m	In winter, breeds in vernal pools and seasonal wetlands with a minimum 3-week inundation period. In summer, aestivates in grassland habitat, in soil crevices and rodent burrows.	Could occur. Not documented on site, but suitable habitat may be present in vernal pools within the Tule Ranch Unit, and the Wildlife Area is within the species' known range.

**Table 3.5-3
Special-Status Wildlife Known or with Potential to Occur Regularly at Yolo Bypass Wildlife Area**

Species	Status ¹			Habitat	Potential for Occurrence
	USFWS	DFG	MSCS		
Birds					
American white pelican <i>Pelecanus erythrorhynchos</i>	--	SSC	--	Forages in open water. Although individuals may be present year-round, this species does not breed in the Central Valley.	Known to forage on site throughout the year, occasionally in numbers significant to the nation-wide population.
Double-crested cormorant <i>Phalacrocorax auritus</i>	--	SSC	m	Forages in open water. Breeds colonially in rock ledges and trees.	Known to forage on site throughout the year. No breeding colonies are present on site.
Great blue heron <i>Ardea herodias</i>	--	--	m	Nests colonially in tall trees. Forages in fresh and saline marshes, shallow open water, and occasionally cropland or low, open, upland habitats.	Known to breed in trees just outside of the Wildlife Area. Known to forage in wetlands, and uplands and agricultural fields throughout the site. No breeding colonies are present on site, but suitable nesting habitat is present.
Great egret <i>Ardea alba</i>	--	--	m	Nests colonially in tall trees. Forages in fresh and saline marshes, shallow open water, and occasionally cropland or low, open, upland habitats.	Known to forage in wetlands, uplands, and agricultural fields throughout the site, which provide suitable habitat. Breeding colonies have been recently documented on site.
Snowy egret <i>Egretta thula</i>	--	--	m	Nests colonially in dense marshes and low trees. Forages in fresh and saline marshes, shallow open water, and occasionally irrigated cropland or wet upland habitats.	Known to forage in wetlands throughout the site, which provide suitable habitat. No breeding colonies are present on site, but suitable nesting habitat is present.
Black-crowned night-heron <i>Nycticorax nycticorax</i>	--	--	m	Nests colonially in dense marshes, groves of low trees, and dense shrubs. Forages in fresh and saline marshes and in shallow open water at the edge of marsh vegetation.	Known to forage in wetlands throughout the site, which provide suitable habitat. Roosts in large numbers in willow trees and cattail marsh. No breeding colonies are present on site, but suitable nesting habitat is present.
White-faced ibis <i>Plegadis chihi</i>	--	SSC	m	Forages in wetlands and irrigated or flooded croplands and pastures. Breeds colonially in dense freshwater marsh.	Known to forage in flooded croplands and wetlands throughout the site, especially in summer months. No breeding colonies are present on site but there has been a breeding colony just north of the Causeway Unit.
Osprey <i>Pandion haliaetus</i>	--	SSC	m	Forages exclusively in fish-bearing waters.	Known to forage on site during the winter floods, which provide suitable foraging habitat. Unlikely to nest because foraging habitat is marginal during the dry summer breeding season.

**Table 3.5-3
Special-Status Wildlife Known or with Potential to Occur Regularly at Yolo Bypass Wildlife Area**

Species	Status ¹			Habitat	Potential for Occurrence
	USFWS	DFG	MSCS		
White-tailed kite <i>Elanus leucurus</i>	SSC	FP	m	Nests in woodlands and isolated trees; forages in grasslands, shrublands and agricultural fields.	Known to nest and forage in open habitats throughout the site, which provide suitable habitat.
Bald eagle <i>Haliaeetus leucocephalus</i>	T PFD	E FP	m	Winter visitor to the Central Valley floor. Forages primarily in fish-bearing waters, but also in open terrestrial habitats.	Known to forage on site during the winter months.
Northern harrier <i>Circus cyaneus</i>	--	SSC	m	Nests and forages in open habitats including marshes, grasslands, shrublands and agricultural fields.	Known to nest and forage in open habitats throughout the site, which provide suitable habitat.
Sharp-shinned hawk <i>Accipiter striatus</i>	--	SSC	--	Winter visitor to the Central Valley floor. Forages primarily in riparian woodlands and other wooded habitats.	Known to forage in riparian habitat along the toe drains and Putah Creek, which provide suitable winter foraging habitat.
Cooper's hawk <i>Accipiter cooperii</i>	--	SSC	m	Nests and forages primarily in riparian woodlands and other wooded habitats.	Known to forage in riparian habitat throughout the Wildlife Area, especially along Putah Creek, which provide suitable foraging habitat. Not known to nest on site.
Swainson's hawk <i>Buteo swainsoni</i>	SSC	T	r	Nests in riparian woodlands and isolated trees; forages in grasslands, shrublands and agricultural fields.	Known to nest and forage in open habitats throughout the site, which provide suitable habitat. Several nests on site along Putah Creek and in scattered large trees throughout the Wildlife Area.
Ferruginous hawk <i>Buteo regalis</i>	--	SSC	--	Winter visitor to the Central Valley. Forages most commonly in grasslands and shrub-steppe; also forages in agricultural fields.	Known to forage in upland habitats throughout the site, which provide suitable winter habitat when not flooded.
Golden eagle <i>Aquila chrysaetos</i>	--	FP	m	Nests and forages in a variety of open habitats including grassland and cropland, but most common in foothill and shrub-steppe habitats. Rare breeder in the Central Valley foothills; breeds in cliffs, rock out crops, and large trees.	Known to forage in upland habitats throughout the site, which provide suitable habitat. The site is unsuitable for nesting.
Merlin <i>Falco columbarius</i>	--	SSC	--	Winter visitor to California. Forages in a wide variety of habitats, but in the Central Valley is most common around agricultural fields and grasslands.	Known to forage throughout the site in winter. Suitable habitat is provided by on-site wetlands, and uplands when not flooded.
American peregrine falcon <i>Falco peregrinus anatum</i>	--	E FP	m	Nonbreeding visitor to the Central Valley. Forages in a wide variety of habitats, but is most common near water, where shorebirds and waterfowl are abundant.	Known to hunt the abundant shorebirds and waterfowl present from mid-summer to late winter.
Prairie falcon <i>Falco mexicanus</i>	--	SSC	--	Currently presumed to be a non-breeding visitor to Yolo County. Forages most commonly in grasslands and shrub-steppe; also forages in agricultural fields.	Known to forage throughout the site, which provides suitable habitat when not flooded.

**Table 3.5-3
Special-Status Wildlife Known or with Potential to Occur Regularly at Yolo Bypass Wildlife Area**

Species	Status ¹			Habitat	Potential for Occurrence
	USFWS	DFG	MSCS		
Greater sandhill crane <i>Grus canadensis tabida</i>	--	T FP	r	Winter visitor to the Central Valley. Forages primarily in moist croplands with rice or corn stubble; also frequents grasslands and emergent wetlands.	Known to forage in the agricultural habitats and wetlands throughout the site, which provide suitable winter foraging habitat.
Long-billed curlew <i>Numenius americanus</i>	--	SSC	m	Forages in cropland, grassland, wetland, and mudflat habitats. Although individuals may be present throughout the year, this species does not breed on the Central Valley floor.	Known to forage in agricultural, upland, wetland, and mudflat habitats throughout the site, which provide suitable foraging habitat.
California gull <i>Larus californicus</i>	--	SSC	m	Forages in open water, wetland, and cropland habitats, as well as landfills. Although individuals may be present year-round, this species does not breed in the Central Valley.	Known to forage year-round throughout the site and especially during the winter floods, which provide suitable foraging habitat.
Black tern <i>Chlidonias niger</i>	--	SSC	m	Nests in freshwater marsh and rice habitats, forages for fish and insects in open water, rice, and marsh. This species is present in Yolo County primarily during migration.	Known to forage in the wetland and rice habitats throughout the site during migration; numbers increasing in recent years.
Burrowing owl <i>Athene cunicularia</i>	SSC	SSC	m	Nests and forages in grasslands, shrublands, deserts and agricultural fields, especially where ground squirrel burrows are present.	Known to nest and forage in upland habitats throughout the site, which provide suitable habitat, and most commonly in the Tule Ranch Unit.
Short-eared owl <i>Asio flammeus</i>	--	SSC	m	Winter visitor and rare nesting species to Yolo County. Forages in open habitats including marshes, grasslands, shrublands and agricultural fields.	Known to forage in marsh and upland habitats throughout the site, and occasionally nests.
Little willow flycatcher <i>Empidonax traillii brewsteri</i>	--	E	r	Migrates through the Central Valley during spring and fall. Forages in riparian willow scrub.	Known to forage in low numbers in riparian habitats along Putah Creek and the toe drains, which provide suitable foraging habitat during migration.
Loggerhead shrike <i>Lanius ludovicianus</i>	SSC	SSC	--	Nests and forages in grasslands, agricultural fields, open woodlands and shrublands.	Known to nest and forage in upland habitats throughout the site, which provide suitable habitat, and most commonly in the Tule Ranch Unit.
California horned lark <i>Eremophila alpestris actia</i>	--	SSC	--	Nests and forages in open habitats with sparse vegetation including grasslands and fallow agricultural fields.	Known to nest and forage in sparsely vegetated habitats throughout the site, which provide suitable habitat.
Bank swallow <i>Riparia riparia</i>	--	T	R	Forages primarily over water. Nests in vertical banks and cliffs with fine textured or sandy soils near streams, rivers, lakes, and ocean.	Known to forage in low numbers over wetland habitats in summer. Suitable nesting habitat is not present.

**Table 3.5-3
Special-Status Wildlife Known or with Potential to Occur Regularly at Yolo Bypass Wildlife Area**

Species	Status ¹			Habitat	Potential for Occurrence
	USFWS	DFG	MSCS		
California yellow warbler <i>Dendroica petechia brewsteri</i>	--	SSC	r	Nests in riparian woodland and riparian scrub habitats. Forages in a variety of wooded and shrub habitats during migration.	Known to forage in low numbers in riparian habitats along Putah Creek and the toe drains, which provide suitable foraging habitat during migration.
Grasshopper sparrow <i>Ammodramus savannarum</i>	--	--	m	Nests and forages in dense native grasslands containing diverse assemblages of grasses and forbs. This species is rare and localized in Yolo County.	Known to forage and presumed to breed in the Tule Ranch Unit, which provides suitable habitat. Territorial males have been observed singing on site.
Tricolored blackbird <i>Agelaius tricolor</i>	SSC	SSC	m	Nests colonially in tules, cattails, willows, thistles, blackberries, and other dense vegetation. Forages in grasslands and agricultural fields.	Recorded breeding once (2005) colonially in a patch of button willow trees on the Tule Ranch, while foraging in agricultural fields and uplands.

Mammals

Pallid bat <i>Antrozous pallidus</i>	--	SSC	--	Typically roosts in caves or rock crevices; however, colonies of ~12 individuals occasionally roost in buildings or tree cavities. Forages in grassland, shrub and wooded habitats.	Unlikely to breed on site due to marginal breeding habitat, but may forage on site. Old buildings may provide roosting habitat.
Townsend's big-eared bat <i>Corynorhinus townsendii</i>	--	SSC	--	Typically roosts in caves; however, colonies of <100 individuals occasionally roost in buildings. Forages in all but alpine and subalpine habitats, but prefers mesic forests.	Unlikely to breed on site due to marginal habitat, but may forage on site. Old buildings may provide roosting habitat.

¹ Legal Status Definitions

U.S. Fish and Wildlife Service (USFWS)

- E Endangered
- T Threatened
- PFD Proposed for delisting
- SSC Species of special concern

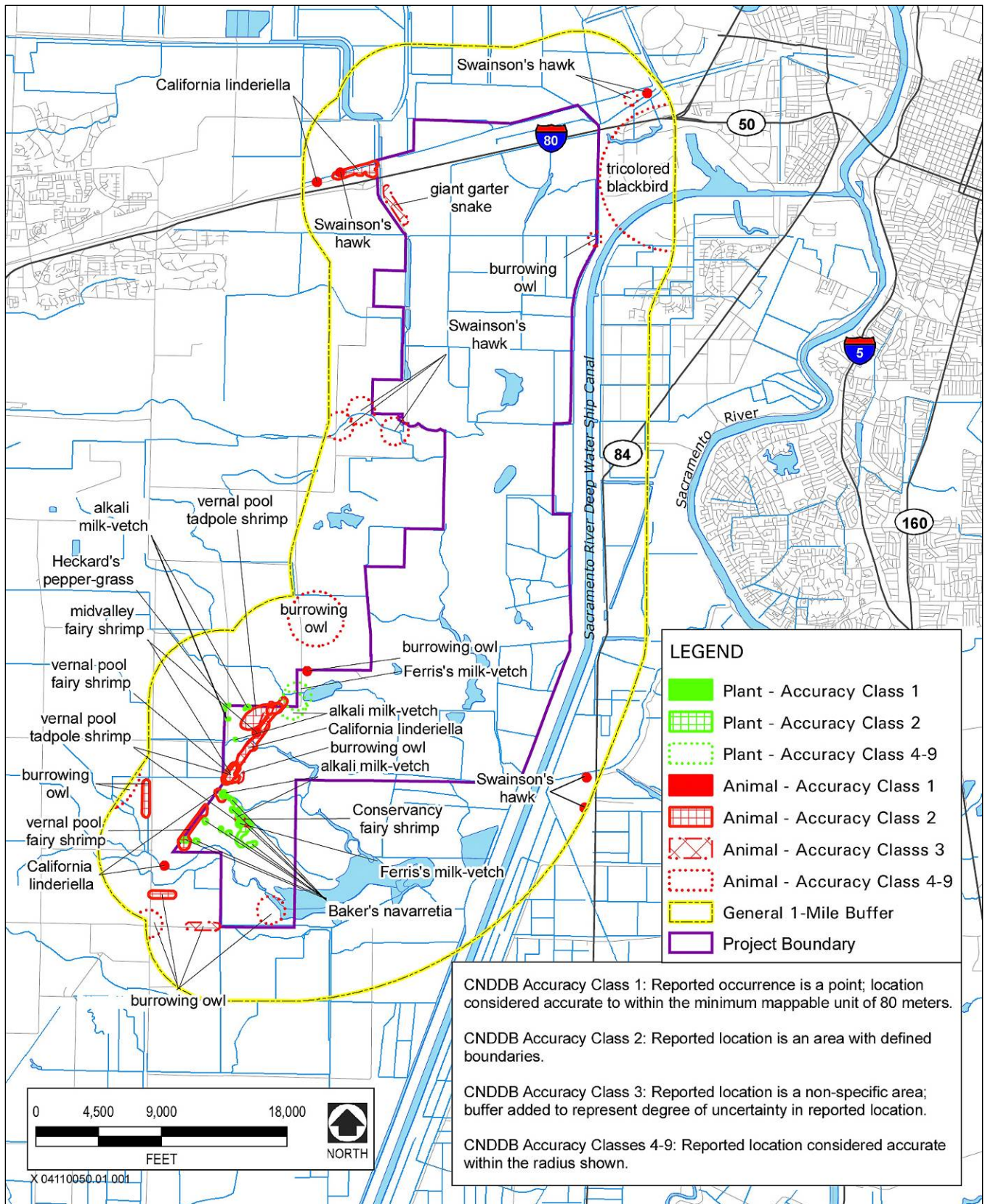
California Department of Fish and Game (DFG)

- E Endangered
- T Threatened
- FP Fully Protected
- SSC Species of special concern

CALFED Multi-Species Conservation Strategy (MSCS)

- R Recovery: CALFED is expected to undertake all actions within the ERP ecological management zones and program scope necessary to recover the species so that its long-term survival in nature is assured.
- r Contribute to recovery: CALFED will make specific contributions to the species' recovery; however, CALFED actions will have a limited effect on the species in a limited portion of its range.
- m Maintain: CALFED will take actions to maintain the species by improving habitat conditions where practicable and by avoiding, minimizing, and compensating for any adverse effects. This designation is less rigorous than "contribute to recovery," and CALFED actions are expected to have minimal effects on the species.

Source: Compiled by EDAW in 2005



Source: CNDDDB 2005, CaSIL 1998

Map of CNDDDB Recorded Special-status Species Occurrences in the Yolo Bypass Wildlife Area

Exhibit 3.5-2

Reptiles

Giant garter snake

Giant garter snake (*Thamnophis gigas*) inhabits sloughs, marshes, low-gradient streams, flooded rice fields, ponds, irrigation and drainage ditches, and adjacent upland habitats. This snake forages primarily at the interface between open water and emergent aquatic vegetation, and is most often found in habitats with slow flowing or standing water, permanent summer water, mud bottoms, earthen banks, and an abundance of prey such as small fish, frogs and tadpoles. Giant garter snakes use upland habitat with grassy or shrubby banks for basking and thermoregulation. They also use upland burrows and soil or rock crevices as nighttime refugia, daytime escape cover, and winter aestivation sites. Giant garter snakes typically emerge from winter retreats from late March to early April and can remain active through October. The timing of their annual activities is subject to varying seasonal weather conditions. Cool winter months are spent in dormancy or periods of reduced activity. While this species is strongly associated with aquatic habitats, individuals have been noted using burrows as far as 165 feet from marsh edges during the active season and retreats more than 800 feet from the edge of wetland habitats while overwintering. Giant garter snakes have been observed in the northwest portions of the Wildlife Area, and suitable habitat for this species exists in many marsh, pond, rice, ditch, and upland edge habitats on site, while the western external levee of the Bypass provides the high ground necessary to survive the winter floods. Unknown until recently, the Yolo Bypass Wildlife Area population was verified as part of a survey of Yolo County giant garter snake distribution in 2005 (Hansen, in prep. 2006). During this study, 41 giant garter snakes (20 male and 21 female) were detected within the Wildlife Area. Dispersal was detected between Wildlife Area wetlands and privately managed rice lands outside the levee of the Yolo Bypass. Using mark-recapture techniques, this population was estimated at 57 individuals with a 95% confidence interval ranging from 45 to 84. As such, this population is comparable with estimates provided for southern American Basin (i.e., Natomas Basin) populations (Hansen 2005; Hansen, in prep. 2006; Jones and Stokes 2006). The dynamics of this population and the effects of periodic inundation within the Yolo Bypass on its health and distribution are unknown. Giant garter snake is state and federally listed as threatened, and CALFED has pledged to contribute to the recovery of this species.

Northwestern pond turtle

Northwestern pond turtle (*Actinemys marmorata marmorata*) occurs in ponds, marshes, rivers, streams, and irrigation ditches supporting aquatic vegetation. Adjacent upland areas are also used for basking and thermoregulation, egg-laying, and aestivation. Features which improve habitat quality for this species include emergent and submergent aquatic vegetation for cover, as well as rocks, logs, and open mud banks for basking. This species is widely distributed throughout the Yolo Bypass Wildlife Area and is believed to breed on site. Northwestern pond turtle is a California species of special concern, and is listed as a species to be maintained under CALFED's MSCS.

Amphibians

California tiger salamander and western spadefoot toad

California tiger salamander (*Ambystoma californiense*) and western spadefoot toad (*Spea hammondi*) breed in suitable aquatic habitats (e.g., vernal pools) during wet winter conditions, and aestivate in adjacent grassland habitat after the pools have dried. Although vernal pools are the preferred habitat for these species, other aquatic habitats may be used, provided that they are free of predatory fish and hold water long enough to sustain reproduction. California tiger salamanders require pools that are large enough to retain water during the ten weeks required for larval development and metamorphosis (Jennings and Hayes 1994). Western spadefoot larvae can complete development in as little as three weeks, but may require up to twelve weeks depending on pool conditions (Jennings and Hayes 1994; Feaver 1971). The vernal pools and adjacent uplands in the Wildlife Area's Tule Ranch Unit may provide suitable habitat for both species, although cursory sampling efforts in 2001 failed to document either species. Other seasonal wetlands throughout the Wildlife Area may also be used by these species,

provided that their habitat requirements are met. Both species are California species of special concern and are listed as species to be maintained under CALFED's MSCS. California tiger salamander is also federally listed as threatened.

Birds

Non-breeding Waterbirds

The Wildlife Area provides important foraging habitat for waterbirds, including several special-status species, although no special-status waterbirds are known to nest on site. The special-status waterbirds in this section include some species that only occur in the Central valley during winter and the fall and spring migrations. Other included species are present during the late spring and summer breeding season and may nest elsewhere in the Central Valley, but do not breed on site due to lack of suitable habitat or regional location.

Non-breeding residents

Double-crested cormorant

Double-crested cormorant (*Phalacrocorax auritus*) forages for fish in open water and nests colonially in rock ledges or groves of trees. This species is abundant at the Yolo Bypass Wildlife Area throughout the year. Cormorants occasionally forage in ditches and permanent wetlands during the summer nesting season, but the more limited fish resources in summer make the site unlikely to support a breeding colony of cormorants. Double-crested cormorant is a California species of special concern and is listed as a species to be maintained under CALFED's MSCS.

Great blue heron, great egret, snowy egret, and black-crowned night-heron

These four species are common in the Wildlife Area, and forage in marshes and shallow open water habitats throughout the site. Great blue heron (*Ardea herodias*) and great egret (*Ardea alba*) also forage less frequently in the grasslands and agricultural fields on site, while snowy egret (*Egretta thula*) and black-crowned night-heron (*Nycticorax nycticorax*) are unlikely to forage in these upland habitats. Although they do not currently nest on site, suitable nesting habitat is available in the Wildlife Area for all four species. A great blue heron and egret rookery is present in a grove of tall trees just outside the Wildlife Area along the Sacramento River Deep Water Ship Channel, and these individuals forage and roost in the Wildlife Area. Large numbers of black-crowned night herons roost in willows on the Wildlife Area during the non breeding season. CALFED has pledged to maintain the colonial rookeries of these four species, under its MSCS.

White-faced ibis

White-faced ibis (*Plegadis chihi*) forage in wetlands, mudflats, and irrigated or flooded croplands and pastures. This species typically nests in dense colonies in large stands of emergent marsh. Individuals from breeding colonies in ponds north of the Causeway Unit forage in the Wildlife Area during summer, when they feed on crayfish in the site's wetlands and flooded rice fields. Smaller numbers of birds forage on site throughout the year. This species may roost in large numbers in cattail marshes during the late summer. White-faced ibis is a California species of special concern and is listed as a species to be maintained under CALFED's MSCS.

Black tern

Black tern (*Chlidonias niger*) nests semicolonially in marsh vegetation and occasionally rice fields, and forages for fish and insects in these habitats and the adjacent open water. This species inhabits inland California and the Delta during summer, and forages primarily in marine habitats in winter. This species regularly forages throughout the marsh, rice, and open water habitats of the Wildlife Area during its spring migration. It may be possible to accommodate nesting black terns within the rice production fields with small islands. Black tern is a California species of special concern, and is listed as a species to be maintained under CALFED's MSCS.

Winter visitors

American white pelican

American white pelican (*Pelecanus erythrorhynchos*) forages for fish in open water and is abundant at the Yolo Bypass Wildlife Area throughout the year. Birds forage on site throughout the year, especially in mid-summer, when birds from distant breeding colonies and non-breeding birds arrive in the Central Valley. American white pelican does not nest in the Central Valley. American white pelican is a California species of special concern.

Long-billed curlew

Long-billed curlews (*Numenius americanus*) forage in wetlands, mudflats, and irrigated or flooded croplands and pastures. This species does not breed on the floor of the Central Valley, but non-breeding individuals forage in the Wildlife Area throughout the year. This is one of the first species to migrate with some individuals arriving as early as June. The largest aggregations are often of post-breeding birds in late summer. Long-billed curlew is a California species of special concern and is listed as species to be maintained under CALFED's MSCS.

Greater sandhill crane

Greater sandhill crane (*Grus canadensis tabida*) is a winter visitor to the Central Valley that forages primarily in moist croplands with rice or corn stubble, as well as grasslands and emergent wetlands. In winter, this species is most densely concentrated in counties south of Yolo County, in agricultural regions and large preserves that support vast fields of suitable habitat. Water levels in the agricultural fields and wetlands in the northern management units of the Yolo Bypass Wildlife Area are managed to provide high-quality foraging habitat for cranes and similar species. As a result, cranes forage casually in the Wildlife Area on a regular basis.

California gull

California gull (*Larus californicus*) forages in open water, wetland, and cropland habitats, as well as landfills. Although this species does not breed in the Central Valley, individuals forage in the Wildlife Area throughout the year. California gulls are most common on site during the winter floods. California gull is a California species of special concern and is listed as a species to be maintained under CALFED's MSCS.

Breeding Raptors

The Wildlife Area provides high-quality habitat for four special-status raptors that are known to nest on site. Section 3503.5 of the California Fish and Game Code provides protection for all raptor nests, including those of the species below. Their nests are also protected by the Migratory Bird Treaty Act.

Northern harrier

Northern harrier (*Circus cyaneus*) nests and forages in a variety of open habitats including marshes, grasslands, low shrublands, and agricultural fields. This raptor nests on the ground and preys on a variety of prey, particularly small mammals (e.g., rabbits, mice, voles) and small birds. Harriers are common in the Wildlife Area and they nest and forage throughout the site. Northern harrier is a California species of special concern, and is listed as a species to be maintained under CALFED's MSCS.

Swainson's hawk and white-tailed kite

These two species nest in large and medium-sized trees such as oak and cottonwood and forage in grasslands, low shrublands, seasonal wetlands and agricultural fields. Portions of Yolo, Sacramento, and San Joaquin counties contain optimal nesting and foraging habitat conditions with their landscapes of scattered trees, riparian strips, open fields and manipulated agricultural fields that are mowed, irrigated and disced on a somewhat regular basis. These counties support the majority of Swainson's hawks (*Buteo swainsoni*) that breed in the state. Swainson's hawk and white-tailed kite (*Elanus leucurus*) nests and foraging activity have been observed throughout the Yolo

Bypass Wildlife Area. These species are particularly abundant when the discing, mowing, and summer irrigation of the site's agricultural fields and seasonal wetlands expose numerous grasshoppers and small mammals for prey. Kettles of 50–100 Swainson's hawks can be seen foraging at the edge of ponds during the fall flood up and just prior to the hawks leaving on their southern migration. A significant number of nesting pairs use the trees of the Wildlife Area and Putah Creek. Swainson's hawk is state listed as threatened and is a federal species of concern; it is estimated that the 700 to 1,000 breeding pairs in California represent less than 10% of the historical population. CALFED has pledged to contribute to the recovery of this species. White-tailed kite is a federal species of concern and a fully protected species under the California Fish and Game Code. White-tailed kite is also listed as a species to be maintained under CALFED's MSCS.

Western burrowing owl

Western burrowing owl (*Athene cunicularia*) forages in grasslands, low shrublands and agricultural fields. It nests and roosts in underground burrows, often those created by medium-sized mammals such as ground squirrels. Several burrowing owl nests have been documented in the Wildlife Area's Tule Ranch Unit; the species may also nest in other locations throughout the site. Burrowing owls are known to forage throughout the upland and agricultural habitats on site. These animals appear to be opportunistic, often appearing in unlikely places such as remote pipe crossings and piles of discarded pipe or concrete. Winter and spring flooding displaces several Burrowing owls each year, sending them to the edge of the flood waters, sometimes in impressive numbers. A series of artificial burrow structures were placed on the Tule Ranch in late 2006. A substantial number of these structures were occupied in early 2007. Western burrowing owl is a California species of special concern and a federal species of concern, and is listed as a species to be maintained under CALFED's MSCS.

Non-breeding Raptors

The Wildlife Area provides important winter foraging habitat for a variety of birds of prey. The raptors in this section include some species that only occur in the Central Valley during winter and the fall and spring migrations. Other included species are present during the late spring and summer breeding season and may nest elsewhere in the Central Valley, but do not breed on site due to lack of suitable habitat or regional location.

Non-breeding residents

Osprey

Osprey (*Pandion haliaetus*) forages exclusively for fish over open water, and is most commonly seen at the Yolo Bypass Wildlife Area during migration in August. Osprey is a California species of special concern and is listed as a species to be maintained under CALFED's MSCS.

Cooper's hawk

Cooper's hawk (*Accipiter cooperii*) is a bird of riparian woodlands and other wooded habitats, where it preys primarily on birds and to a lesser extent, small mammals. This species has been observed foraging in the Wildlife Area during fall and winter months, but is not known to nest on site. Cooper's hawk generally requires more extensive woodland for nesting than that present at the Wildlife Area. Cooper's hawk is a California species of special concern and is listed as a species to be maintained under CALFED's MSCS.

Winter visitors

Bald eagle

Bald eagle (*Haliaeetus leucocephalus*) is a winter visitor to the Central Valley floor. This species forages primarily over open water, and occasionally occurs at the Yolo Bypass Wildlife Area during the winter months. Bald eagle is federally listed as threatened, although it has been proposed for delisting. Bald eagle is also state listed as endangered, is a fully protected species under the California Fish and Game Code, is federally protected by the Bald Eagle Protection Act of 1940, and is listed as a species to be maintained under CALFED's MSCS.

Sharp-shinned hawk

Sharp-shinned hawk (*Accipiter striatus*) nests and forages primarily in riparian woodlands and other wooded habitats, where it preys primarily on small birds. This species has been observed foraging in the Wildlife Area, but is a winter visitor that does not nest on the Central Valley floor. Sharp-shinned hawk is a California species of special concern.

Ferruginous hawk

Ferruginous hawk (*Buteo regalis*) forages in upland habitats and preys primarily upon rabbits, as well as other small mammals and birds. This raptor is a winter visitor to the Central Valley, and is known to forage occasionally throughout the upland habitats of the Yolo Bypass Wildlife Area. Ferruginous hawk is a California species of special concern.

Golden eagle

Golden eagle (*Aquila chrysaetos*) nests and forages in a variety of open habitats including grassland and cropland. This species is most common, however, in foothill and shrub-steppe habitats, where it preys upon jackrabbits, other mid-sized mammals, and upland game birds. Golden eagle is a rare breeder in the foothill fringes of the Central Valley. This species is known to forage occasionally in upland habitats throughout the Wildlife Area in winter. Golden eagle is a fully protected species under the California Fish and Game Code, is federally protected by similarity of appearance under the Bald Eagle Protection Act of 1940, and is listed as a species to be maintained under CALFED's MSCS.

Merlin, American peregrine falcon, and prairie falcon

These three falcons are primarily winter visitors to the Central Valley, and are known to forage in the Yolo Bypass Wildlife Area. Merlin (*Falco columbarius*) forages in a variety of habitats and feeds primarily on small shorebirds and passerines. American peregrine falcon (*Falco peregrinus anatum*) forages primarily in mudflats and open water, where it preys upon waterfowl and shorebirds, and hence also occurs on-site from mid summer through spring, a time period corresponding with the presence of migratory shorebirds.

Peregrine Falcons have become more common on the Wildlife Area since the initiation of shorebird management activities in 2002. Prairie falcon (*Falco mexicanus*) forages in upland habitats, where it preys upon small mammals and less frequently birds. Merlin and prairie falcon are California species of special concern. American peregrine falcon is state listed as endangered and is a fully protected species under the California Fish and Game Code. American peregrine falcon is also listed as a species to be maintained under CALFED's MSCS.

Short-eared owl

Short-eared owls (*Asio flammeus*) forage in a variety of open habitats including marshes, grasslands, low shrublands, and agricultural fields, and are known to forage throughout the Wildlife Area during the non-breeding seasons of late summer through early spring. Short-eared owls have been sighted during the spring and summer months in some years and are presumed to occasionally nest on the Wildlife Area. Short-eared owls are irruptive and will nest in more southerly locations when their prey are numerous. At the Yolo Wildlife Area, the prey is primarily California voles, whose numbers fluctuate according to the severity of the previous winter floods. Short-eared owl is a California species of special concern, and is listed as species to be maintained under CALFED's MSCS.

Breeding Songbirds

In addition to protections afforded to special-status species, the nests of these neotropical migrants are also protected by the Migratory Bird Treaty Act.

Loggerhead shrike

Loggerhead shrike (*Lanius ludovicianus*) nests and forages in grassland, shrub-steppe, open woodland/savannah, riparian, and agricultural habitats with scattered shrubs and trees. This species nests and forages throughout the Wildlife Area, with the Tule Ranch Unit providing the highest quality habitat. Loggerhead shrike is a California species of special concern and a federal species of concern.

California horned lark

California horned lark (*Eremophila alpestris actia*) inhabits flat plains with short vegetation (often less than 10 centimeters high) or bare ground, and is found in both grassland and fallow agricultural areas. California horned lark is a year-round resident of the Yolo Bypass Wildlife Area, and is known to breed in sparsely vegetated patches throughout the site. California horned lark is a California species of special concern.

Grasshopper sparrow

Grasshopper sparrow (*Ammodramus savannarum*) nests and forages in dense native grasslands containing diverse assemblages of tall grasses and forbs. They have been seen in seasonal wetlands during the summer months for several years but their stronghold on the Wildlife Area appears to be the Tule Ranch. The Tule Ranch Unit of the Yolo Bypass Wildlife Area provides diverse, high-quality habitat for this species with vegetation heights close to two feet. Grasshopper sparrows have become a significant feature of this unit in recent years. They have regularly been observed foraging and are presumed to breed, as territorial males have regularly been observed singing on site. This rare remnant of diverse native grassland is one of only a handful of breeding sites in Yolo County for this rare and localized species; the few other sites are in the western foothills. Grasshopper sparrow is listed as a species to be maintained under CALFED's MSCS.

Tricolored blackbird

Tricolored blackbird (*Agelaius tricolor*) nests in dense colonies in a variety of habitats, including freshwater marsh, riparian scrub, and other vegetation that provides dense cover for protection from predators. Tricolored blackbird colonies range in size from fewer than 25 individuals to more than 100,000, and colony locations often change from year to year. This species forages in grasslands, pastures and agricultural fields. Tricolored blackbirds were observed breeding on the Wildlife Area for the first time in 2005. Their colony was located among the branches of buttonwillow trees on the Tule Ranch. Tricolored blackbird flocks also forage in the Wildlife Area's upland communities and agricultural areas. Tricolored blackbird is both state and federally listed as a species of special concern, and is listed as a species to be maintained under CALFED's MSCS.

Non-breeding Songbirds

The Wildlife Area provides important foraging habitat for many songbird species that do not nest on site. The songbirds in this section include two species that only occur in the Central Valley during migration and one summer resident that nests elsewhere in the Central Valley but does not breed on site due to lack of suitable habitat.

Non-breeding resident

Bank swallow

Bank swallow (*Riparia riparia*) is a neotropical migrant that nests in vertical banks and cliffs near water, and forages for insects over water. The Wildlife Area does not contain vertical banks for bank swallow nesting, and the nearest nesting colonies are along Cache Creek in Yolo County, and along the Sacramento River at the border of Yolo and Sutter Counties. A few individuals from these colonies are known to forage over the Wildlife Area's wetlands after cessation of breeding in late summer. Bank swallow is state listed as threatened and CALFED has

pledged to undertake all actions within the ERP ecological management zones and program scope necessary to recover this species.

Migration visitors

Little willow flycatcher

Little willow flycatcher (*Empidonax traillii brewsteri*) nests in montane riparian willows and migrates through the Central Valley in spring and fall. During migration, this species is known to forage in the Wildlife Area's riparian communities along Putah Creek and the toe drains of the Sacramento River levees. Little willow flycatcher is state listed as endangered and CALFED has pledged to contribute to the recovery of this species.

California yellow warbler

California yellow warbler (*Dendroica petechia brewsteri*) nests and forages in riparian woodland and riparian scrub habitats, where it gleans insects from the riparian foliage. This species is currently present in Yolo County only during migration. Yellow warbler has declined dramatically in California's Central Valley with the loss of riparian habitat, and the species has not been known to breed in Yolo County since 1974 (Gaines 1974). California yellow warbler is a California species of special concern and CALFED has pledged to contribute to the recovery of this species.

Mammals

Pallid bat, Red Bat, and Townsend's big-eared bat

These three species forage over a wide variety of grassland, wetland, shrub, and wooded habitats, although Pallid bat (*Antrozous pallidus*) is most common in grassland and other arid habitats and Townsend's big-eared bat (*Corynorhinus townsendii*) is most common in mesic forests. These two species typically have maternity roost in small colonies of 12–200 individuals in caves and rock crevices, while the red bat (*Lasiurus blossevillii*) is usually solitary. Bridges, buildings, and tree cavities are also occasionally used for roosting. Townsend's big eared bats are unlikely to breed at the Wildlife Area due to the marginal maternity roosting habitat present for this species. Pallid bats have the potential to breed on site although unlikely. Red bats may utilize trees on the Wildlife Area for both roosting and breeding. All of these species may forage and night-roost in the Wildlife Area. Pallid bats, red bats and Townsend's big-eared bats are California species of special concern.

Mexican Free-tailed Bat

Although not a species of special concern, the large colony of Mexican Free-tailed Bats (*Tadarida basiliensis*) that roosts and breeds under the Yolo Causeway is of significant conservation value. Over 100,000 of these individuals can be seen leaving their daytime roost during summer months.

3.5.3 FISHERIES RESOURCES

This section summarizes the current conditions for fisheries resources in Yolo Bypass Wildlife Area. It discusses native and nonnative fish use of the Yolo Bypass Wildlife Area, aquatic habitats, and special-status fish species. The primary sources of information for this section were published reports on the fish, fisheries, ecology, and natural history of the Yolo Bypass and associated habitats.

The Yolo Bypass provides vital fish spawning, rearing, and/or migratory habitat for a diverse assemblage of native and nonnative fish species (Table 3.5-4) (Moyle 2002a; Sommer et al. 2001). Native and nonnative species can be separated into anadromous (i.e., species that spawn in fresh water after migrating as adults from marine habitat) and resident species.

Native anadromous species that occur or have the potential to occur in the Yolo Bypass Wildlife Area include four runs of Chinook salmon (*Oncorhynchus tshawytscha*), steelhead trout (*O. mykiss*), green and white sturgeon (*Acipenser medirostris* and *A. transmontanus*), and Pacific lamprey (*Lampetra tridentata*). Native resident species include delta smelt (*Hypomesus transpacificus*), Sacramento pikeminnow (*Ptychocheilus grandis*), Sacramento splittail (*Pogonichthys macrolepidotus*), Sacramento sucker (*Catostomus occidentalis*), Sacramento perch (*Archoplites interruptus*), hardhead (*Mylopharodon conocephalus*), and rainbow trout (*O. mykiss*). Nonnative anadromous species include striped bass (*Morone saxatilis*) and American shad (*Alosa sapidissima*). Nonnative resident species include largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), white and black crappie (*Pomoxis annularis* and *P. nigromaculatus*), channel catfish (*Ictalurus punctatus*), white catfish (*Ameiurus catus*), brown bullhead (*Ictalurus nebulosus*), bluegill (*Lepomis macrochirus*), green sunfish (*Lepomis cyanellus*), and golden shiner (*Notemigonus crysoleucas*). Several of the resident species (i.e., Sacramento splittail and delta smelt) can show a strong migratory life history pattern.

**Table 3.5-4
Fish Species in the Yolo Bypass Wildlife Area**

Common Name	Scientific Name	Common Name	Scientific Name
American Shad	<i>Alosa sapidissima</i>	Redear Sunfish	<i>Lepomis microlophus</i>
Bigscale Logperch	<i>Percina macrolepida</i>	River Lamprey	<i>Lampetra ayersii</i>
Black Bullhead	<i>Ameiurus melas</i>	California Roach	<i>Hesperoleucus symmetricus</i>
Black Crappie	<i>Pomoxis nigromaculatus</i>	Sacramento Blackfish	<i>Orthodon microlepidotus</i>
Bluegill	<i>Lepomis macrochirus</i>	Sacramento Pikeminnow	<i>Ptychocheilus grandis</i>
Brown Bullhead	<i>Ameiurus nebulosus</i>	Sacramento Sucker	<i>Catostomus occidentalis</i>
Channel Catfish	<i>Ictalurus punctatus</i>	Shimofuri Goby	<i>Tridentiger bifasciatus</i>
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>	Smallmouth Bass	<i>Micropterus salmoides</i>
Common Carp	<i>Cyprinus carpio</i>	Splittail	<i>Pogonichthys macrolepidotus</i>
Delta Smelt	<i>Hypomesus transpacificus</i>	Spotted Bass	<i>Micropterus punctulatus</i>
Fathead Minnow		Steelhead Trout	<i>Oncorhynchus mykiss</i>
Golden Shiner	<i>Notemigonus crysoleucas</i>	Striped Bass	<i>Morone saxatilis</i>
Goldfish	<i>Carassius auratus</i>	Threadfin Shad	<i>Dorosoma petenense</i>
Green Sunfish	<i>Lepomis cyanellus</i>	Threespine Stickleback	<i>Gasterosteus aculeatus</i>
Hardhead	<i>Mylopharodon conocephalus</i>	Tule Perch	<i>Hysteroecarpus traski</i>
Hitch	<i>Lavinia exilicauda</i>	Wakasagi	<i>Hypomesus nipponensis</i>
Inland Silverside	<i>Menidia beryllina</i>	Warmouth	<i>Chaenobryttus gulosus</i>
Largemouth Bass	<i>Micropterus salmoides</i>	Western Mosquitofish	<i>Gambusia affinis</i>
Pacific Lamprey	<i>Lampetra tridentata</i>	White Catfish	<i>Ameiurus catus</i>
Pacific Staghorn Sculpin	<i>Leptocottus armatus</i>	White Crappie	<i>Pomoxis annularis</i>
Prickly Sculpin	<i>Cottus asper</i>	White Sturgeon	<i>Acipenser transmontanus</i>
Red Shiner	<i>Cyprinella lutrensis</i>	Yellowfin Goby	<i>Acanthogobius flavimanus</i>

Source: Moyle 2002a; Sommer et al. 2001

Throughout the Yolo Bypass, the use of different aquatic habitats by various fish species is influenced by variations in permanent habitat conditions, seasonal inundation of the floodplain (i.e., Yolo Bypass), and by the habitat requirements, life history, daily and seasonal movements, and behavior of each species. Altered flow regimes, flood control, and floodwater conveyance activities along much of the Yolo Bypass have affected available habitat and ecological processes (see Section 3.4, “Geomorphology, Hydrology, and Water Quality,” for additional information on physical processes). Historically, seasonal flooding covered various lands adjacent to the Sacramento River and tributaries and provided important spawning and rearing habitat for many fish species, including Sacramento splittail and juvenile Chinook salmon and steelhead. Levee and flood control facility (i.e., Fremont Weir and Sacramento Weir) construction has caused a reduction in the overall amount of seasonal flooding and shallow-water habitat in the Sacramento River system. In winter and spring, however, agricultural fields and wetland habitats throughout the Yolo Bypass often flood during high flows and are used by Sacramento splittail for spawning and rearing, and by Chinook salmon and steelhead for rearing (Sommer et al. 2001, 2003).

AQUATIC HABITATS

Primary aquatic habitats throughout the Yolo Bypass Wildlife Area include the Yolo Bypass floodplain during seasonal flooding events, Putah Creek, East Toe Drain, and permanent wetlands. General characteristics of each of these aquatic habitats are provided below.

Yolo Bypass Floodplain

Similar to other Sacramento-San Joaquin Delta habitats, there are more introduced species than native species in the Yolo Bypass floodplain (Table 3.5-4) (Sommer et al. 2003). Introduced species are one of the major environmental issues in the Delta, where they frequently dominate the fauna on a year-round basis (Bennett and Moyle 1996) and in fact make up approximately 90 percent of the biomass in the Delta. However, unlike other Sacramento-San Joaquin Delta habitats, the floodplain is seasonally dewatered during late spring through autumn. This prevents introduced fish species from establishing year-round dominance except in perennial water sources (Sommer et al. 2003). Moreover, many of the native fish are adapted to spawn and rear in winter and early spring (Moyle 2002a) during the winter flood pulse. Introduced fish typically spawn during late spring through summer when the majority of the floodplain is not available to them.

Recent surveys demonstrate that the Yolo Bypass provides habitat for a wide variety of fish species (Table 3.5-4). Sampling to date has shown that the floodplain is used by at least 42 fish species including seasonal fish and fish that are year-round residents in perennial water sources. Examples include federal and state-listed species (steelhead trout, delta smelt, spring-run (state-listed only) and winter-run Chinook salmon) and sport fish (striped bass and white sturgeon) (Sommer et al. 2003).

The native minnow Sacramento splittail is perhaps the most floodplain-dependent species in the Sacramento-San Joaquin Delta (Sommer et al. 1997). For much of the year, splittail reside in the San Francisco Estuary (Estuary); however, in autumn and winter they seasonally migrate upstream to spawn in the Sacramento-San Joaquin Delta and its tributaries.

Studies by Sommer et al. (1997) demonstrated that the Yolo Bypass provides some of the most important habitat for this species. Their sampling data indicated that adults move onto the floodplain in winter and early spring to forage and spawn among flooded vegetation. DWR has conducted both a pilot study and a more expanded investigation of splittail spawning behavior, first using the small ¼ acre wetland at the DFG demonstration wetlands on Chiles Road, and again in a 10-acre pond in the North Unit within the Yolo Bypass Wildlife Area.

Splittail rear in the Yolo Bypass and emigrate to the river channels and estuary as floodwaters recede. As one indication of the importance of the floodplain habitat to splittail, Sommer et al. (1997) showed that larval

production of splittail for two floodplain habitats (Yolo and Sutter bypasses) was substantially higher than in surrounding river channels.

Juvenile Chinook salmon represent another good example of the value of the floodplain habitat to native fish. There are four races of Chinook salmon in the Sacramento Valley: winter, spring, late-fall and fall-run (Yoshiyama et al. 2000). Historical data indicate that all races have declined in abundance since the 1950s, however, the spring, winter and late-fall runs have shown the largest declines. There are multiple causes for these long-term reductions, including habitat loss, habitat degradation, water diversions and oceanic conditions. These declines led to the federal listing of winter-run Chinook as “endangered” in 1991 and spring-run as “threatened” in 1999.

Although there are multiple races, most young Chinook salmon emigrate from upstream riverine spawning habitats during winter and spring, then enter the Sacramento-San Joaquin Delta (Fisher 1994). In low flow periods, downstream migrants are confined to the Sacramento River and similar Delta channels. During flood pulses the Yolo Bypass floodplain provides an alternative migration corridor.

The results of Sommer et al. (2001) indicated that this seasonal floodplain habitat potentially provides better rearing conditions than the adjacent Sacramento River channel. They noted two major advantages of floodplain: 1) increased area of suitable habitat and 2) increased food resources.

Young Chinook salmon typically prefer habitat that is shallow and has low velocity (Everest and Chapman 1972). Sommer et al. (2001) estimated that complete inundation of the Yolo Bypass floodplain creates a wetted area approximately ten times larger than the comparable reach of the Sacramento River.

Moreover, they observed that the river channel lacked the broad, low velocity shoal (areas with mean depth typically < 2 meters) areas preferred by young salmon because flows are confined to deep, narrow rip-rapped channels. By contrast, Sommer et al. (2001) noted that the Yolo Bypass has extensive shoals and substantial habitat complexity.

Another important attribute of floodplain habitat is an enhanced food web. Sommer et al. (2001) found that drift insects (primarily chironomids) were 10 to 100 times more abundant in the floodplain than the adjacent Sacramento River channel during 1998 and 1999 flood events. Sommer et al. (2001) also observed that the higher drift insect abundance was reflected in the diets of juvenile salmon; Yolo Bypass salmon had significantly more prey in their stomach than salmon collected in the Sacramento River. However, they noted that the increased feeding success may have been partly offset by significantly higher water temperatures on the floodplain habitat, resulting in increased metabolic costs for young fish. The higher water temperatures were a consequence of the broad shallow shoals, which warm faster than deep river channels. Through bioenergetic modeling, Sommer et al. (2001) concluded that floodplain salmon had substantially better feeding success than fish in the Sacramento River, even when the prey data were corrected for increased metabolic costs of warmer floodplain habitat.

In his study, Sommer et al. (2001) found that improved rearing conditions potentially allowed juvenile salmon to grow substantially faster in the Yolo Bypass floodplain than the adjacent Sacramento River. They showed that the mean salmon size increased significantly faster in the seasonally-inundated Yolo Bypass floodplain than the Sacramento River, suggesting better growth rates.

Although these results suggest that several habitat measures may be better for young salmon in the Yolo Bypass, floodplain habitat carries stranding risks. The relative importance of stranding mortality is difficult to evaluate because there is currently no reliable estimate of the total number of salmon which migrate through the Sacramento River and its tributaries. However, the Yolo Bypass floodplain has been graded for agriculture using laser leveling technology, resulting in an exceptionally well drained topography. Observations indicate that highly efficient drainage may promote successful emigration of young salmon (Sommer et al. 2003). Sommer et al. (2001) examined this issue by doing paired releases of juvenile coded-wire-tagged salmon in the Yolo Bypass and Sacramento River to obtain comparative survival data for fish migrating through each habitat type. They found

that the Yolo Bypass floodplain release groups had somewhat higher survival indices than Sacramento River fish in both 1998 and 1999; however, the sample size (n=2) was too low to demonstrate statistical significance.

Although preliminary results suggest that growth of juvenile salmon in the Bypass may be accelerated, because of the low sample size, these results should be considered with caution. It is unknown exactly how significantly the Bypass contributes to overall Central Valley escapement.

Recent analysis of juvenile salmon utilizing the Bypass indicates higher methylmercury levels in these fish when compared to juvenile salmon that used the Sacramento River to get to the Delta. Further study is needed as well as analysis of methylmercury levels in splittail using the Yolo Bypass. Splittail spend their entire lives within the Bay-Delta ecosystem and therefore may have a higher propensity to contribute towards the bioaccumulation of methylmercury up the food chain.

Other Benefits of Floodplain to Aquatic Communities

Floodplain inundation may also provide benefits to organisms downstream in the brackish portion of the Delta (i.e., estuary). At the base of the estuarine food web, phytoplankton are responsible for most of the primary production in the estuary (Jassby et al. 1996). However, to the detriment of the organisms dependent on phytoplankton, there has been a major long-term decline in phytoplankton biomass in the estuary as a result of multiple factors including introduction of new benthic grazers (i.e., Asian clam) (Alpine and Cloern 1992), water exports and low outflow (Jassby et al. 1995), and climate change (Lehman 2000). Modeling studies by Jassby and Cloern (2000) suggest that phytoplankton produced in the Yolo Bypass may be an important source of organic carbon to the Estuary, at least during flood events. Moreover, Yolo Bypass is probably also a major pathway for detrital material, an important additional source of organic carbon to the food web of the phytoplankton-deficient Estuary. This conclusion is supported by Schemel et al. (1996), who found that the Yolo Bypass is the major pathway for organic matter to the Estuary in wet years.

Putah Creek

The reach of Putah Creek within the Yolo Bypass Wildlife Area (i.e., Putah Creek Cross Channel) consists of a historic channel that is seasonally dammed by the Los Rios Check Dam. The creek channel in this reach is approximately 40 feet wide on average. The riparian corridor above the dam is less than 5 trees wide although many of these trees are substantial in height. Below the Los Rios Check Dam, the channel has very few trees and steep banks. There is also an approximately one mile stretch of Putah Creek that is lined with a narrow band of tall riparian trees. This stretch is currently cut off from perennial flow. The Los Rios Check Dam is a 12-foot-high, 30-foot-long concrete box culvert with hardware to hold large flashboards that serves as a seasonal check dam in the Yolo Bypass to create a head of water for irrigation pumping for neighboring agricultural lands and to flood the seasonal wetlands in the Yolo Bypass Wildlife Area. The Los Rios Check Dam is also managed to facilitate the migration of fall-run Chinook salmon into lower Putah Creek by removing boards in fall/winter in conjunction with pulse flow releases from the Putah Diversion Dam (PDD). The boards are typically removed in the fall/winter as soon as the irrigation season ends and upon the arrival of Chinook salmon in the East Toe Drain (based on DWR fike trap sampling) and replaced in April of the following year (for agricultural and wildlife habitat uses). Replacement of the check dam in April could impede emigration of late hatching young fall-run Chinook salmon.

Habitat and fisheries conditions in this reach of lower Putah Creek have been affected and shaped by several factors, including historic agricultural activities in the Yolo Bypass Wildlife Area, upstream flood control grading and vegetation removal, construction and operation of the Solano Project and, in May 2000, settlement and implementation of the historic Putah Creek Settlement Agreement (aka Water Accord) (Sacramento County Superior Court 2000). Due to hydrologic connectivity to the reach of Putah Creek in the Yolo Bypass Wildlife Area, the following discussion from the Lower Putah Creek Watershed Management Action Plan (Lower Putah

Creek Coordinating Committee 2005) provides a description on the segment of Putah Creek from the East Toe Drain in the Yolo Bypass Wildlife Area, upstream to the PDD.

Stream Conditions Prior to Water Accord (1960s to 2000)

Construction and operation of the Solano Project had major effects on flows and sediment conditions downstream of the PDD. In general, the Solano Project substantially decreased total annual discharges through lower Putah Creek compared with pre-project conditions (Jones & Stokes 1992). Following operation of the project, the minimum normal and dry year annual releases required (by a 1970 State Water Resource Control Board decision) were about 22,000 acre-feet and 19,000 acre-feet, or 6 percent and 5 percent of the estimated pre-project discharges, respectively. The Solano Project also modified summer hydrological conditions, extending streamflow throughout summer, such that median flows in August through October were higher than during pre-project conditions, and flows were generally present from the PDD to the Yolo Bypass in most years. However, significant periods of reduced flows in the lowest reaches of Putah Creek occurred at various times since the Solano Project became operational. The 1987–1992 drought years were the driest 6-year period on record for the Putah Creek drainage. At the same time, surface water diversions and increased groundwater pumping were further reducing Putah Creek flows due to a shortage of surface water supplies. The reduced releases during drought years, coupled with reduced recharge from the adjacent groundwater table, resulted in the complete dewatering of long stretches of the creek, major fish die-offs, and raised concern for fish habitat and other beneficial functions of Putah Creek.

The impoundment of gravel upstream of the dams has resulted in a lack of gravel substrate in Putah Creek downstream of the PDD. In addition to the reduction in sediment movement downstream following completion of the Solano Project, gravel mining occurred along Putah Creek during the 1960s and 1970s (USFWS 1993). Channel surveys in 1972 indicated that mining had left a wide, relatively flat channel with a few artificial berms and levees (Jones & Stokes 1992).

Vegetation clearing activities in the creek channel by state and federal agencies continued through the 1960s and early 1970s. After 1975, when vegetation clearing policies were changed (USFWS 1993), the creek bed stabilized, riparian woodland cover increased, and a seemingly more natural stream channel was created (Moyle 1991).

Fisheries Prior to Water Accord (1960s to 2000)

About 40 species of fish have been reported from lower Putah Creek below the PDD, including 17 permanent residents (LPCCC 2003, Moyle 1991, Marchetti and Moyle 2001). The fish species could be divided into four categories: anadromous fish, resident native fish, introduced resident game fish, and introduced resident non-game fish. Sightings of anadromous fish, including spawning activity by small numbers of Chinook salmon, occurred when there were adequate late fall and winter flows in Putah Creek, the Yolo Bypass, and the Sacramento River (Lower Putah Creek Coordinating Committee 2003).

Native resident fishes in the creek included mainly Sacramento blackfish, hitch, prickly sculpin, riffle sculpin, Sacramento pikeminnow, Sacramento sucker, three-spine stickleback, and tule perch (USFWS 1993). Introduced game species in the creek provided many opportunities for angling. These included species such as brown trout, largemouth bass, smallmouth bass, bluegill, green sunfish, warmouth, white and black crappie, white catfish, channel catfish, black bullhead, and common carp (USFWS 1993, Moyle 1991). Other nonnative species included Western mosquitofish, inland silverside, goldfish, bigscale log perch, fathead minnow, golden shiner, and red shiner (USFWS 1993).

Putah Creek Water Accord

From 1987 to 1992 the worst 6-year drought on record hit the region. Lake Berryessa was drawing down at a rate of about 200,000 net acre-feet per year. In summer 1989, long stretches in the downstream reaches of lower Putah

Creek began drying up and major fish die-offs of fish began occurring (Moyle et al. 1998). Attempts to negotiate a permanent solution to the problem resulted in several legal actions over a period of approximately 10 years.

On May 23, 2000, a settlement (the Accord) was reached. It created a new permanent release schedule intended to balance the competing uses for water between supply, demand, and maintenance of aquatic and riparian resource functions. The purpose of the Accord is to create as natural a flow regime as feasible and to maintain a living stream for the benefit of fish, wildlife, and plants from the PDD to the connection at the East Toe Drain in the Yolo Bypass. The Accord focuses on the protection and enhancement of native resident and anadromous fish populations. It includes six primary elements, including four functional flow requirements. The four flow requirements pertain to rearing flows, spawning flows for native resident fishes, supplemental flows for anadromous fishes, and drought-year flows. The six Accord elements are as follows (a discussion on release schedules is provided below):

1. Flows for resident native fish, which include important spawning and rearing components and guarantee a continuous flow to I-80;
2. Flows that will attract and support salmon and steelhead;
3. A drought schedule that provides enough water to maintain Putah Creek as living stream but provides water users relief from other flow requirements;
4. Creation of the Lower Putah Creek Coordinating Committee (LPCCC) and the streamkeeper position;
5. Habitat restoration and monitoring funds for the creek; and
6. A term requiring Solano County Water Agency (SCWA) to notify riparian water users of the amount of riparian water available in any given year and to prevent illegal water diversions in excess of the amount of riparian water available.

Rearing Flows

This is a baseline flow regime designed to maintain a year-round living stream from the PDD to the East Toe Drain. It is intended to provide cool-water habitat for native fishes for at least several miles below the PDD, even under the worst drought conditions. It also provides enough water to support introduced fishes (e.g., largemouth bass, catfishes, and bluegill) in the lower reaches. These flows overcome past limitations in which the stream dried up during summer in extreme drought years, except for a few large pools and a short section below the PDD (Moyle 2002b).

Spring Pulse Flows

Spring pulse flows consist of a short pulse in February–March, lasting three consecutive days, followed by a month-long release of higher than baseline flows. The purpose of these flows is to promote emigration of juvenile salmon and to provide spawning opportunities for native fishes in winter and spring if there was insufficient rain to provide for them naturally. Native fishes, such as Sacramento sucker, are stimulated to spawn by hydrological changes that deepen spawning riffles and flood shoreline habitat for rearing. The pulse would bring the fish upstream and the increased flows would allow them to spawn and rear. Dr. Moyle predicted that these flows, in combination with baseline rearing flows, would greatly increase the abundance and distribution of native fishes in the creek (Moyle 2002b).

Supplemental (Pulse) Flows

Supplemental flows are designed to primarily benefit the migration of fall-run Chinook salmon. The Accord includes a requirement for a minimum flow beginning in November and a 5-day pulse flow to occur at an optimal

time (based on monitoring) in November or December to attract and enable adult fall-run Chinook salmon to migrate up Putah Creek from the East Toe Drain. The Accord also specifies a minimum flow that follows the pulse flow and continues through the end of May. The springtime minimum flows are designed to benefit juvenile salmon for rearing and to enable them to return back to the East Toe Drain and sea (Moyle 2002b).

When salmon are detected in the East Toe Drain during the fall, and DFG personnel as well as local farmers are through utilizing the pool of water trapped behind the Los Rios Check Dam, a well orchestrated sequence of events takes place. Los Rios Farms schedules the removal of the boards. SCWA coordinates with Yolo Bypass Wildlife Area regarding release of the fall attraction flows which is timed to coincide with the removal of the boards from the Los Rios Check Dam. Removing the check boards in coordination with the fall attraction flows helps to attract and enable salmon to migrate up into Putah Creek from the East Toe Drain.

The supplemental flow regime, although designed primarily to benefit salmon, seems to benefit lampreys and may be adequate for rearing juvenile steelhead as well. Adult steelhead may make it up the stream under high winter flows (Moyle 2002b).

Drought Year Flows

These flows are to be implemented during severe droughts, when all flows but the minimum flows can be eliminated for 2 years. During droughts, normal flow regimes outlined in the subsections above are not in effect every year. Droughts are defined as periods in which the total storage in Lake Berryessa is less than 750,000 cfs on April 1 of any given year. Severe droughts are defined as periods in which Lake Berryessa holds less than 400,000 acre-feet of water on April 1. Under the drought year flow regime, normal flows are implemented in every third year of an extended drought unless the drought is severe. During extended (e.g., 3 or more years) severe droughts, normal flows are not implemented until the first year immediately after Lake Berryessa storage exceeds 400,000 acre-feet.

The drought year flow regime seeks to strike a reasonable balance between human water demands and the minimum needs of fishes during droughts. While the stream and its fish will not receive more than minimum flows during most drought years, periodically they regain priority for water if the drought continues. The drought regime also recognizes that during drought conditions, native fish can persist under minimal flow conditions without reproducing. Native fishes can persist if competition and predation from introduced fishes is limited or if suitable habitat refuges exist for the native fishes (Marchetti and Moyle 2001). Even before the settlement, small numbers of native fishes managed to persist through extreme drought conditions that dried up most of the creek. The minimum flows provided under the new schedule are expected to enable native fishes to have a higher level of persistence than prior to the Accord.

The drought schedule requires that a continuous flow be maintained in the reach from PDD to I-80 (a 15-mile stretch) at all times. Thus, the reaches of Putah Creek closer to the Diversion Dam, which are the reaches dominated by resident native fishes, will not go dry, protecting native fish from lengthy droughts. The nonnative species, which tend to dominate in the reaches nearer to and below I-80, will not receive as much protection from the drought year flow schedule. However, introduced fish may repopulate those reaches from upstream populations following the end of drought cycles (Moyle 2002b).

Fisheries after Water Accord (2000 to Present)

Fisheries response to the Accord flow releases is still currently being evaluated; however, based on initial data, several improvements have been noted. The most noteworthy result of the new flow releases is that fall-run Chinook salmon are migrating up Putah Creek to spawn. An estimated 70 adult fall-run Chinook salmon migrated up lower Putah Creek in fall 2003, resulting in the largest salmon run in the past 40 or more years (Putah Creek Council 2003).

East Toe Drain

The tidally influenced East Toe Drain provides perennial aquatic habitat for several fish species. The East Toe Drain is characterized by a wide (50 to 150 feet) and fairly deep (more than 5 feet) channel with no canopy and little bank or overhead vegetation. Portions of the Toe Drain bank in this Yolo Bypass Wildlife Area are riprapped. The channel is homogeneous with little habitat complexity and generally low fish habitat value. The Lisbon Weir is located in the East Toe Drain adjacent to the Tule Ranch Unit. The Lisbon Weir is a rock weir used to capture water at high tide to maintain a higher elevation pool for irrigation source water.

Fish studies in the East Toe Drain show that this aquatic feature likely functions as year-round habitat for resident species, as a migration corridor (e.g., fish movement into Putah Creek and onto the seasonally inundated floodplain), and potentially as spawning habitat for striped bass and American shad (Harrel and Sommer 2003). Resident species are primarily nonnative and include common carp, channel catfish, white catfish, striped bass, threadfin shad, black crappie, white crappie, Sacramento blackfish, and Sacramento sucker (Harrel and Sommer 2003).

Permanent Wetlands

Permanent wetlands in the Yolo Bypass Wildlife Area provide perennial aquatic habitat for a diverse assemblage of fish species (dominated by nonnative species). Three of the permanent wetland ponds in the Yolo Bypass Wildlife Area were surveyed in 2001 to examine the functional role of perennial floodplain ponds for fishes in a regulated and highly invaded temperate river-floodplain system (Feyrer et al. 2004). Fish sampling resulted in the collection of 18 different species, all of which were nonnative with the exception of one native fish species, Sacramento blackfish (Feyer et al. 2004). The most abundant species sampled included threadfin shad, common carp, inland silverside, and white and black crappie.

Fish assemblages in these aquatic habitats likely change over time between floodplain inundation events. Immediately following inundation events, the species composition is likely shuffled with native and nonnative species becoming more balanced. As the permanent wetlands become isolated and more stable, interactions between the native and nonnative species likely play an important role. Negative interactions between native and nonnative species, such as predation (Turner and Kelley 1966; Bennett and Moyle 1996) and/or competition (Marchetti 1999) are likely to be major factors affecting native fish use of the perennial floodplain ponds between inundation events. Predation is an important factor structuring fish assemblages in similar habitats (Rodriguez and Lewis 1994; Tejerina-Garro et al. 1998) and considered to be a primary mechanism. Additionally, predation is generally enhanced where the visual environment (i.e., reduced turbidity in the stabilized environment) is optimal.

SPECIAL-STATUS SPECIES

Special-status fish species are legally protected or are otherwise considered sensitive by federal, state, or local resource conservation agencies and organizations. Special-status fish species addressed in this section include:

- ▶ species listed as threatened or endangered under the state or federal Endangered Species Acts;
- ▶ species identified by USFWS, NMFS, or DFG as species of special concern;
- ▶ species fully protected in California under the California Fish and Game Code; and
- ▶ species identified as priorities for recovery under CALFED's MSCS.

A total of nine special-status fish species occur or have the potential to occur in the Yolo Bypass and/or lower Putah Creek and are described below (see also Table 3.5-5). Of the nine species, Central Valley steelhead Evolutionarily Significant Unit (ESU), Central Valley spring-run Chinook salmon ESU, Sacramento River winter-run ESU, green sturgeon, and delta smelt are listed as a federally threatened or endangered species. The USFWS de-listed Sacramento splittail from its federally threatened status on September 22, 2003. NMFS determined that listing is not warranted for Central Valley fall-/late fall-run Chinook salmon. However, it is still

designated as a Species of Concern because of concerns over specific risk factors. The two remaining species (hardhead and Sacramento perch) are considered Species of Special Concern by DFG and/or federal Species of Concern by USFWS. Brief descriptions follow for the special-status species with potential to occur in the Yolo Bypass and/or lower Putah Creek.

**Table 3.5-5
Special-status Fish Species Potentially Occurring in the Yolo Bypass Wildlife Area**

Species	Status ¹			Habitat	Potential to Occur in the Yolo Bypass Wildlife Area
	USFWS/ NMFS	DFG	MSCS Goals		
Central Valley steelhead <i>Oncorhynchus mykiss</i>	T	--	R	Requires cold, freshwater streams with suitable gravel for spawning; rears seasonally inundated floodplains, rivers, tributaries, and Delta.	Occurs in the Sacramento River and tributaries. Occurs seasonally in the Yolo Bypass Wildlife Area.
Sacramento winter-run Chinook salmon <i>Oncorhynchus tshawytscha</i>	E	E	R	Requires cold, freshwater streams with suitable gravel for spawning; rears seasonally inundated floodplains, rivers, tributaries, and Delta.	Occurs in the Sacramento River and tributaries. Occurs seasonally in the Yolo Bypass Wildlife Area.
Central Valley spring-run Chinook salmon <i>Oncorhynchus tshawytscha</i>	T	T	R	Requires cold, freshwater streams with suitable gravel for spawning; rears seasonally inundated floodplains, rivers, tributaries, and Delta.	Occurs in the Sacramento River and tributaries. Juveniles occasionally occur seasonally in the Yolo Bypass Wildlife Area.
Central Valley fall/late fall-run Chinook salmon <i>Oncorhynchus tshawytscha</i>	--	SSC	R	Requires cold, freshwater streams with suitable gravel for spawning; rears seasonally inundated floodplains, rivers, tributaries, and Delta.	Occurs in the Sacramento River and tributaries. Occurs seasonally in the Yolo Bypass Wildlife Area.
Green sturgeon <i>Acipenser medirostris</i>	T	--	R	Requires cold, freshwater streams with suitable gravel for spawning; rears seasonally inundated floodplains, rivers, tributaries, and Delta.	Occurs in the Sacramento River and tributaries. Has potential to occur in the Yolo Bypass Wildlife Area.
Delta smelt <i>Hypomesus transpacificus</i>	T	T	R	Spawns in tidally influenced freshwater wetlands and seasonally submerged uplands; rears seasonally inundated floodplains, tidal marsh, and Delta.	Occurs in the Sacramento River downstream of its confluence with the American River. Has potential to occur seasonally in the Yolo Bypass Wildlife Area.
Sacramento splittail <i>Pogonichthys macrolepidotus</i>	DT	SSC	R	Spawning and juvenile rearing from winter to early summer in shallow weedy areas inundated during seasonal flooding in the lower reaches and flood bypasses of the Sacramento River including the Yolo Bypass.	Occurs in the Sacramento–San Joaquin River Delta and Sacramento River and tributaries. Occurs seasonally in the Yolo Bypass Wildlife Area and breeds successfully.

**Table 3.5-5
Special-status Fish Species Potentially Occurring in the Yolo Bypass Wildlife Area**

Species	Status ¹			Habitat	Potential to Occur in the Yolo Bypass Wildlife Area
	USFWS/ NMFS	DFG	MSCS Goals		
Hardhead <i>Mylopharodon conocephalus</i>	--	SSC	m	Spawning occurs in pools and side pools of rivers and creeks; juveniles rear in pools of rivers and creeks, and shallow to deeper water of lakes and reservoirs.	Occurs in freshwater portions of Sacramento River and tributaries. Occurs seasonally in the Yolo Bypass Wildlife Area.
Sacramento perch <i>Archoplites interruptus</i>	--	SSC	r	Spawning has been reported to extend from spring to late summer, depending on location and water temperature; among aquatic plants or congregating in shallow waters in schools among or near inshore vegetation.	Historically occurred in Sacramento and San Joaquin rivers and tributaries; depleted in native range, and now are restricted to a few locations, principally ponds and reservoirs where they are stocked. Not known to occur in the Yolo Bypass Wildlife Area.

¹ Legal Status Definitions

Federal Listing Categories (USFWS & NMFS)	State Listing Categories (DFG)
E Endangered (legally protected)	E Endangered (legally protected)
T Threatened (legally protected)	T Threatened (legally protected)
DT Recently delisted from threatened status	FP Fully Protected (legally protected, no take allowed)
SC Species of Concern	CSC California Species of Concern (no formal protection)

Multi-Species Conservation Strategy Goals

R Recovery. Recover species' populations within the MSCS focus area to levels that ensure the species' long-term survival in nature.

r Contribute to recovery. Implement some of the actions deemed necessary to recover species' populations within the MSCS focus area.

m Maintain. Ensure that any adverse effects on the species that could be associated with implementation of CALFED actions will be fully offset through implementation of actions beneficial to the species (CALFED 2000b).

Source: Data compiled by EDAW in 2006

Steelhead

The Central Valley steelhead ESU (*Oncorhynchus mykiss*) is a federally threatened species. The Central Valley steelhead includes all naturally spawned populations of steelhead in the Sacramento and San Joaquin rivers and their tributaries (McEwan and Jackson 1996). Steelhead have a complex life history, including the capability to be anadromous or resident (called rainbow trout) (Moyle 2002a). Anadromous species spend most or a portion of their adult life in the ocean and then migrate back into freshwater to reproduce. Spawning and rearing habitat for steelhead typically occurs in perennial streams with clear, cool to cold, fast-flowing water with a high dissolved oxygen content and abundant gravels and riffles (McEwan and Jackson 1996). After spending 1–4 years in the ocean, adult steelhead return to their home streams to spawn (Moyle 2002a). Migration into freshwater begins in August and peaks in September–October, after which the steelhead hold until flows are sufficiently high to enable migration into tributaries (Moyle 2002a). Spawning begins in late December and peaks in February–March (Busby et al. 1996). Steelhead eggs hatch in 3–4 weeks (at 50–59°F), and fry emerge from the gravel 2–3 weeks later (Moyle 2002a). After steelhead fry emerge from spawning gravels, they continue to grow and mature in freshwater for 1–3 years before emigrating to the ocean (Moyle 2002a). Unlike salmon, steelhead do not

necessarily die after spawning and can spawn more than one time. In central California, most spawning steelhead are 3 years old, with one year spent in the ocean (Busby et al. 1996). Steelhead have been captured in Yolo Bypass fish sampling (Sommer et al. 2001).

Chinook salmon

Threatened or endangered Chinook salmon with potential to occur in the Yolo Bypass Wildlife Area consist of three ESUs, the fall-run, winter-run, and spring-run Chinook. Chinook are relatively common within the Sacramento–San Joaquin River system. Adult and juvenile Chinook may move through the portions of the Yolo Bypass and Putah Creek on their way to and from the ocean (i.e., adult migration and juvenile rearing and emigration).

Winter-run Chinook salmon is listed as an endangered species under both CESA and ESA (59 FR 440). Designated critical habitat for winter-run Chinook includes the Sacramento River adjacent to the project study area. Winter-run Chinook return to the upper Sacramento River between December and July, but delay spawning until the spring and summer (April–August) (Moyle 2002a). Juveniles typically spend 5–9 months in the river and Sacramento–San Joaquin River Delta (Delta) before entering the ocean (Moyle 2002a).

Spring-run Chinook salmon is listed as a threatened species under CESA and ESA (50 FR 50394). Designated critical habitat was proposed for spring-run Chinook in December 2004 with a final determination September of 2005. Spring-run Chinook salmon enter the Sacramento River system between March and September and move upstream into the headwaters, where they hold in pools until they spawn between August and October (Moyle 2002a). Juveniles typically emigrate from the tributaries from mid-November through June; however, some juveniles spend a year in the streams and emigrate as yearlings the following October (Moyle 2002a).

Fall-run Chinook salmon ESU is a federal Species of Concern. Fall-run Chinook salmon is the most widely distributed and most numerous run occurring in the Sacramento and San Joaquin rivers and their tributaries (McEwan and Jackson 1996). After spawning, eggs generally hatch in 6–12 weeks, and newly emerged larvae remain in the gravel for another 2–4 weeks until the yolk is absorbed. Fall-run juveniles typically rear in fresh water for up to 5 months before migrating to sea. Fall-run Chinook salmon have historically spawned in Putah Creek and, after decades of sparse occurrences; have returned to spawn in lower Putah Creek in recent years (Lower Putah Creek Coordinating Committee 2005).

Green Sturgeon

Green sturgeon has recently has been listed as threatened by NMFS (71 FR 17757). Green sturgeon occur in the lower reaches of large rivers, including the Sacramento–San Joaquin River basin, and in the Eel, Mad, Klamath, and Smith rivers (Moyle et al. 1992). Green sturgeon adults and juveniles occur throughout the upper Sacramento River, based upon observations incidental to winter-run Chinook monitoring at the Red Bluff Diversion Dam in Tehama County (NMFS 2005). Green sturgeon spawn predominantly in the upper Sacramento River. They are thought to spawn every 3–5 years (Tracy 1990). Their spawning period is March to July, with a peak in mid-April to mid-June (Moyle et al. 1992). Juveniles inhabit the estuary until they are approximately 4–6 years old, when they migrate to the ocean (Kohlhorst et al. 1991). Green sturgeon have been recorded in the toe of the Yolo Bypass and Cache Slough downstream and there is potential for this species to occur in the Wildlife Area due to the hydrologic connectivity between these areas (and the Sacramento River) and Yolo Bypass.

Delta Smelt

Delta smelt occur in the Sacramento-San Joaquin Delta where, for most of the year, they are typically associated with the freshwater edge of the salt-water/fresh water mixing zone, in the portion of the water column that has relatively low water velocities. The species moves inland to areas of flooded terrestrial vegetation for spawning. Spawning season varies from year to year and may occur from February to July, but mainly from April through May (Moyle 2002a). The lower Yolo Bypass is a known spawning area for this species (USFWS 2004). Delta

smelt was federally listed as a threatened species in March 1993 (58 FR 12854). Critical habitat for the species was designated in December 1994 and includes the Delta and Sacramento River up to the City of Sacramento (59 FR 65256). Delta smelt are tolerant of a wide range of salinity and typically rear in shallow, fresh or slightly brackish waters of the estuary (Moyle 2002a). Delta smelt have been captured in the Yolo Bypass (Sommer et al. 2001).

Sacramento splittail

Sacramento splittail (*Pogonichthys macrolepidotus*) has been de-listed from its federal threatened status but remains a California Species of Special Concern. This large cyprinid (minnow family) is endemic to California and occurs in sloughs, lakes, and rivers of the Central Valley (Moyle 2002a). Sacramento splittail spawn and rear on terrestrial vegetation and debris on floodplains inundated by high spring flows (i.e., late February through April) (Moyle 2002a). In wet years, Sacramento splittail are commonly found in the Putah Creek Sinks, in the region where Putah Creek crosses the Yolo Bypass, and, as discussed above, the Yolo Bypass provides valuable spawning and rearing habitat for splittail (Sommer et al. 1997; 2001).

Hardhead

Hardhead (*Mylopharodon conocephalus*) is a California Species of Special Concern. It is a large minnow that resembles pikeminnow. It prefers clear, deep pools and runs with sand-gravel-boulder substrates and slow water velocities. Most of the streams in which it occurs have summer temperatures in excess of 60°F. However, hardhead tends to be absent from streams that have been severely altered by humans and where introduced species, especially sunfish, predominate (Moyle 2002a). Hardhead is widely distributed in low to mid-elevation streams in the main Sacramento-San Joaquin river drainage. Despite its widespread distribution, hardhead populations are increasingly isolated from one another, making them vulnerable to local extinctions (Moyle 2002a). As a result, hardhead is much less abundant than it once was (Moyle 2002a). Hardhead is no longer present in lower Putah Creek (Moyle et al. 1998). Hardhead have not been captured in the Yolo Bypass (Sommer et al. 2001).

Sacramento perch

Sacramento perch (*Archoplites interruptus*) is a federal Species of Concern and a California Species of Special Concern. It is the only native centrarchid (sunfish) in California. Historically, Sacramento perch was found below 300 feet in elevation throughout the Central Valley, the Pajaro and Salinas rivers, and Clear Lake (Moyle 2002a). Along with the Sacramento pikeminnow (formerly squawfish), it was the dominant piscivorous (fish-eating) fish in waters of the Central Valley. However, Sacramento perch has been extirpated from most of its former range because of the introduction of 11 species of sunfish (Moyle 2002a). Adults do not remain on nests and unguarded eggs are vulnerable to predation. Sacramento perch formerly inhabited sloughs, slow-moving rivers, and lakes; however, it is now mostly found in reservoirs and farm ponds. Sampling during the 1980s and 1990s indicated that Sacramento perch were no longer present in lower Putah Creek (Moyle et al. 1998). They were re-introduced into the creek in 1997 but failed to become established. However, a small population exists in a pond that drains into Putah Creek (Moyle et al. 2003). Sacramento perch have not been captured in the Yolo Bypass (Sommer et al. 2001).

SENSITIVE HABITATS

The East Toe Drain and Putah Creek, including the portion within the Yolo Bypass Wildlife Area, has been designated as Essential Fish Habitat (EFH) by the Pacific Fishery Management Council (PFMC) to protect and enhance habitat for coastal marine fish and macroinvertebrate species that support commercial fisheries. This is in addition to the critical habitat designations noted above. EFH is defined as waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. Under the Pacific Coast Salmon Fisheries Management Plan (Pacific Fishery Management Council 2003), the East Toe Drain and Putah Creek, including the reaches within Yolo Bypass Wildlife Area, have been designated as EFH for fall-run Chinook salmon.