Appendix E. General Conservation Information for Giant Garter Snakes

Reasons for Decline and Current Threats

The current distribution and abundance of the giant garter snake is much reduced from former times primarily due to habitat loss and fragmentation (USFWS 1999). Land development, particularly the reclamation of wetlands for agriculture, eliminated much of the giant garter snake's original habitat in the Central Valley (G. Hansen and Brode 1980). Agricultural and flood control activities have extirpated the giant garter snake from the southern one-third of its range in former wetlands that were associated with the historic Buena Vista, Tulare, and Kern lakebeds (G. Hansen and Brode1980, Brode and G. Hansen 1992, USFWS 1999).

The primary threats to the giant garter snake continue to be habitat loss and degradation (USFWS 2006). Because most of the giant garter snake's current habitat exists as agricultural canals and ditches, urbanization is one of the greatest threats to the giant garter snake throughout much of its extant range (USFWS 2006). The American Farmland Trust (1995) projected a loss of nearly one million acres of Central Valley farmland by 2040 due to low-density urban sprawl. Much of the remaining giant garter snake habitat is subject to flood control and canal maintenance activities, which can result in direct mortality or injury to snakes as well as degrade habitat by destroying cover and overwintering sites and reducing prey availability (USFWS 2006). Because of the giant garter snake's dependence on agricultural lands, especially rice, changes in agricultural management also threaten the species: giant garter snakes found in rice fields or agricultural canals are threatened by conversion of rice crops to non-agricultural land uses or other crops such as vineyards, orchards, or annual row-crops (CDFG 2005, USFWS 2006). Another potential threat to the giant garter snake is the export of water by rice growers to other areas of the state because fallowing of rice fields following such sales immediately eliminates the rice field as habitat for the garter snake (CDFG 2005, USFWS 2006).

Other threats to giant garter snakes include wetland management for waterfowl, which reduces summer habitat; agricultural practices such as tilling, grading, harvesting, and mowing; predation by introduced game fish such as largemouth bass (*Micropterus salmoides*) and catfish (*Ictalurus* spp.), adult bullfrogs (*Rana catesbeiana*), domestic cats (*Felis silvestris catus*), and native species such as river otters (*Lutra canadensis*), raccoons (*Procyon lotor*), and skunks (*Mephitis mephitis*); ground water pumping that reduces surface flows and water tables in wetlands; flooding of overwintering sites; poor water quality and contaminants; mosquito abatement practices that discourage shallow water in the summer; road mortalities; entrapment in netting or erosion control products; and habitat fragmentation that leaves the remaining isolated populations susceptible to extirpation from stochastic events (USFWS 1999, 2006; CDFG 2005).

Factors Limiting Recovery of the Species in the Action Area

The proposed project is located within the Sacramento Valley Recovery Unit, where recovery appears feasible. Giant garter snake habitat is currently protected on several State Wildlife Areas and National Wildlife Refuges within the recovery unit. In addition, Wildlands, Inc. purchased 565 acres of giant garter snake habitat at Gilsizer Slough in November 2005 to be preserved in perpetuity as part of a conservation bank (J. Maddox pers. comm. 2007). The three populations within the Sacramento Valley Recovery Unit were the only ones determined to not be threatened with imminent extirpation at the time of federal listing (USFWS 1993, 2006), and recent surveys suggest these populations are still extant. Giant garter snakes have been captured in all three populations within the Sacramento Recovery Unit over the past two years. Within the Butte Basin, three giant garter snakes were found in the vicinity of the City of Chico, expanding the northern extant range of the species by 9.5 miles (USFWS 2006). Within the Colusa Basin, giant garter snakes have been captured at the Colusa, Sacramento, and Delevan National Wildlife Refuges (Wylie et al. 2005). Within the Sutter Basin, giant garter snakes were captured on the Sutter National Wildlife Refuge outside the Sutter Bypass (Wylie et al. 2005) and at Gilsizer Slough Preserve (J. Maddox pers. comm. 2007).

The Sacramento Valley Recovery Unit is dominated by agriculture, and the predominant crop grown in Butte, Colusa, and Sutter Counties is rice (CRC 2007); therefore, the primary threats posed to the giant garter snake in this area are associated with ongoing and changing agricultural practices. Rapidly expanding urbanization in Chico, Marysville, and Yuba City threaten to remove valuable farmland habitat (USFWS 2006). As much as 20 percent of rice crops within each county could be fallowed in a given year under the terms of the Environmental Water Account (USFWS 2003). Canal maintenance activities including de-silting, excavation and re-sloping of ditches and channels, deposition of spoil material on adjacent property, placement of fill within the canal, and control of vegetation in and around canals, ditches, and drains by mowing and other measures can kill, injure, and displace giant garter snakes in addition to degrading their habitat (USFWS 2006).

Flooding likely poses a significant threat to giant garter snakes within the Sacramento Valley Recovery Unit. Vast expanses of otherwise suitable giant garter snake habitat occur in flood-prone areas, which may reduce or eliminate their use by the species. No giant garter snakes were captured by USGS crews at Llano Seco NWR in the 1990s or in 2005, which could be attributed to the fact that the site is located in the historic floodplain of the Sacramento River, which may have precluded the area from colonization by the species (Wylie et al. 2005). In addition, although a healthy population of giant garter snakes occurs just east of the Sutter Bypass in the vicinity of Gilsizer Slough, no giant garter snakes were captured during surveys of the Sutter NWR within the Sutter Bypass, which may be due to extensive and frequent flooding (Wylie et al. 2005). In 1997, the west Sutter Bypass levee broke approximately 6 miles north of the Tisdale Bypass, inundating the entire western Sutter Basin from Butte Creek in the north to the Sacramento River in the east to the Tisdale Bypass in the south (USACE 1999). This event likely drowned or displaced the majority of giant garter snakes occupying the area because the only high ground existed along the Sutter Bypass, Tisdale Bypass, and Sacramento River levees, which are subject to intensive levee maintenance practices that virtually eliminate upland

overwintering refugia.

As mentioned above, maintenance of flood control facilities also pose a threat to the giant garter snake. The Army Corps of Engineers mandates maintenance of flood systems, which include weed and rodent eradication to facilitate inspection of levees (USACE 1955). These are achieved through mowing, burning, disking, dragging, applying herbicides, and grouting, which destroy surface cover and eliminate the occurrence of burrows and cracks. Giant garter snakes rely on terrestrial vegetation for cover from predators (G. Hansen 1988) and depend upon rodent burrows and cracks to thermoregulate, to provide cover during ecdysis (shedding of skin), and for overwintering (USFWS 2006).

The draft recovery criteria require multiple, stable populations within each of the four recovery units with subpopulations well-connected by corridors of suitable habitat (USFWS 1999). Although the populations within the Sacramento Valley Recovery Unit appear stable and habitat is protected on public and private lands, habitat corridors connecting populations and subpopulations are not present and/or protected (USFWS 2006). The Sacramento River and flood bypasses in the area may represent barriers to dispersal, precluding exchange of individuals from the different populations, leaving them vulnerable to extirpation from catastrophic events like flooding. Exchange may occur within subpopulations via agricultural canals, ditches, and flooded fields; however, the future availability of this habitat is uncertain and unpredictable because these areas are subject to market- and water transfer-driven crop choices and agricultural practices (CDFG 2005, USFWS 2006).

Local Empirical Information

The area of Sutter Basin located east of the Sacramento River and west of the Sutter Bypass has not been surveyed for giant garter snakes recently, so locality records are at least 20 years old from this area. George Hansen (1988) conducted surveys in this area in the mid-80s and found giant garter snakes at three locations along irrigation canals in the vicinity of Robbins. More recent survey efforts in the Sutter Basin have been concentrated in areas within and

east of the Sutter Bypass.

In 1995 and 1996, U.S. Geological Survey (USGS) biologists studied giant garter snakes at Gilsizer Slough, immediately east of the Sutter Bypass, where they found a healthy population (Wylie et al. 1997, 2005). Habitat use by radio-tagged snakes during the summer of 1996 was documented as followed: irrigation canals (49.9%), freshwater marsh (22.9%), rice fields (20.3%), and sloughs (6.7%) (Wylie et al. 1997), although how habitat use relates to availability of habitat is unknown. Twelve of the 22 radio-tagged snakes were observed using rice fields in 1996, including a rice field that had been a tomato field the year before, which demonstrated the species' ability to exploit newly created habitat connected to existing habitat (Wylie et al. 1997). Wintering locations of radio-tagged snakes tended to be in the vicinity of where they were originally caught in the spring: irrigation canals were used 61.4% of the time, freshwater marsh 38.1%, and slough 0.5% (Wylie et al. 1997). The authors noted that giant garter snakes from the Gilsizer Slough population overwintered in wetland habitats, even though the Sutter Bypass levee adjacent to the site is much higher. Only one radio-tagged snake crossed the levee into the interior of the Sutter Bypass (Wylie et al. 2005).

In 2005, USGS surveyed for giant garter snakes in the Sutter National Wildlife Refuge (NWR) inside and to the east of the Sutter Bypass (Wylie et al. 2005). No giant garter snakes were found using ditches adjacent to seasonal marsh, permanent pond, or watergrass habitats within the Sutter Bypass; however, four giant garter snakes were found east of the Sutter Bypass in ditches adjacent to watergrass and perennial ponds (Wylie et al. 2005). This eastern section of the Sutter NWR is connected to the irrigation supply and drainage system that also connects with Gilsizer Slough to the south. The authors speculated that frequent flooding may preclude giant garter snakes from using the otherwise suitable habitat located within the Sutter Bypass. If this is the case, the Sutter Bypass may represent a significant barrier to dispersal.

A similar pattern was observed in the Natomas and Middle American Basins,

where giant garter snakes on either side of the Natomas Cross Canal (NCC) did not cross over the levees (E. Hansen 2006). Despite considerable effort surveying for giant garter snakes visually and passively (trapping) within the NCC, the only observation of a giant garter snake was a male radio-tagged snake from the American Basin who entered the canal on two occasions in 2005; however, this snake was likely displaced by winter flooding (E. Hansen 2006). Only its transmitter was located the following spring on the Natomas Basin side of the NCC, and it appeared to have damage consistent with raptor predation (E. Hansen 2006). Eric Hansen (2006) speculated that the NCC may represent a barrier to dispersal between the two basins and concluded that the populations on each side be considered separate until greater evidence of movement between the two has been documented.

Inconsistent with this pattern is the recent discovery of giant garter snakes in the western toe drain inside the Yolo Bypass (E. Hansen in litt. 2006). An apparently healthy population of giant garter snakes was observed on both sides of the Yolo Bypass's western levee on the Yolo Wildlife Area with at least one male snake traveling over the levee from the inside of the Bypass to the outside (E. Hansen in litt. 2006). High quality giant garter snake habitat in the form of bulrush-dominated emergent marsh and less frequent flooding due to higher elevation on the west side of the Yolo Bypass may account for the presence of considerable numbers of the species here as opposed to the NCC, where the habitat is less suitable and flooding more frequent. Eric Hansen (2006) noted that while the NCC possesses the minimum requirements to support giant garter snakes, levee maintenance activities that damage bankside and overwintering refugia, high winter flooding, predatory game fish, lack of rigid emergent vegetation such as cattails or bulrushes, and dominance of a riparian overstory may discourage use by the snake.

Although a healthy population was captured within the Yolo Bypass during the 2005 active season, there was a significant decline in overall captures and re-captures on the waterside in 2006 (E. Hansen in litt. 2007). Eric Hansen (in litt. 2007) speculated that the lack of recaptures from snakes marked in 2005 and the

significant decrease in capture success rates are perhaps explained by the extraordinarily high waters present in the Yolo Bypass during the winter of 2006. Giant garter snakes displaced by floodwaters were reported on the levees cold and vulnerable to predation following peak flows (Dave Feliz pers. comm. 2007), and two of three snakes recaptured from 2005 had been last observed on the levee's landside and presumably survived by overwintering in areas west of the Bypass that were unaffected by floodwaters (E. Hansen in litt. 2007).

Currently, there are no known on-going monitoring efforts for giant garter snakes within the Sacramento Valley Recovery Unit, although Wildlands, Inc. conducted limited surveys on the Gilsizer Slough Preserve in 2005 and 2006 (J. Maddox pers. comm. 2007) and will likely continue to survey their property to some extent annually.

Population Trend for the Species

The abundance and distribution of giant garter snakes has not changed significantly since the time of federal listing: many populations north of Stockton remain stable, while the two known populations south of Stockton remain small, fragmented, and unstable and are probably decreasing (USFWS 2006). Populations range-wide are largely isolated from one another and from remaining suitable habitat (USFWS 2006). Without hydrologic links to suitable habitat during periods of drought, flooding, or diminished habitat quality, the snake's status will decline (USFWS 2006). The species continues to have a high degree of threat but also a high potential for recovery (USFWS 2006).