RAPID BIOLOGICAL RESOURCE ASSESSMENT FOR THE

SALINAS RIVER, MONTEREY COUNTY, CALIFORNIA

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INTRODUCTION

Located in central coastal California, the Salinas River is an ecological system that presents important opportunities for regional biodiversity preservation. During conservation planning within the Central Coast Ecoregion, The Nature Conservancy determined that several reaches on the mainstem of the Salinas River, as well the lowland reaches of its major tributaries, support native riparian communities and wetland and aquatic habitats of high conservation importance within the region (TNC 2006). The river supports populations of several special status aquatic species, including narrowly endemic species such as the Pinnacles riffle beetle and Monterey roach, and other declining species for which central coast streams are important for long term persistence such as California red-legged frog, foothill yellow-legged frog, and southwestern pond turtle. Neotropical migratory birds in statewide decline utilize the intact riparian vegetation lining the river and its tributaries. In addition, riparian and adjoining upland habitats provide corridors for regional wildlife movement. As such, the Salinas River system provides significant dispersal opportunities for wide-ranging wildlife and overall regional connectivity that may be essential to abate the impacts of climate change in the future.

This report assesses the approximately 110 mile reach of the Salinas River from the confluence of the Nacimiento River near the San Luis Obispo-Monterey County border to the Monterey Bay, and the lower reaches of the major tributaries. The western boundary of the approximately 250,000 acre project area is formed by the eastern slope of the Santa Lucia Mountains and the Sierra De Salinas. The eastern portion of the project area is defined by the foothills of the Gabilan and Diablo Ranges (Figure 1).

Within the project area, the mainstem Salinas River flows north through the long, fertile Salinas Valley, which ranges in width from less than a quarter of a mile near San Ardo, to more than eight miles near the confluence of Arroyo Seco and King City. Stream gradients are relatively steep in the southern headwater region, and the valley floor is deeply dissected by the streams. As the valley becomes less steep from near San Ardo to Monterey Bay, stream gradients lessen also and the tributary drainage area becomes smaller. In many places, nearly-level terraces approximately 50-150 feet in elevation separate the immediate river floodplain from the steep mountains and hillslopes.

The project area includes the lowland portions of several key tributaries to the Salinas River (Box 1). Located south of the project area, the Upper Salinas River includes other important tributaries, including Atascadero Creek, Paso Robles Creek, Huerhuero Creek and the Estrella River, which includes Cholame and San Juan Creeks. This portion of the Salinas River is described in the *Upper Salinas Watershed Action Plan* (US-LT RCD 2004).

Figure 1: Salinas River Project Area within the Salinas River Watershed in central coastal California. Map Prepared by Jodi M. McGraw.

Box 1: Major Tributaries to the Salinas River located within the Project Area (Figure 1).		
San Antonio River Nacimiento River Arroyo Seco Toro Creek San Lorenzo Creek Pancho Rico Creek Monroe Creek Limekiln Creek	Chalone Creek Hames Creek Big Sandy Creek San Carlos Canyon Thompson Canyon Pine Canyon Pine Creek	Branstetter Canyon Wildhorse Canyon Feliz Canyon Espinosa Canyon Garrissere Canyon Sargent Canyon Sarah Canyon

This report is intended to provide an initial assessment of ecological conditions to inform future studies and to help determine appropriate conservation goals for the Salinas River. It is based on a synthesis of available information regarding ecological conditions. Unfortunately, a high percentage of the river system runs through private lands, limiting availability of information about the resources in the area. The specific objectives of the report were to:

1. Assess the overall condition of the river habitat, including both its quality and the integrity of important natural processes that maintain habitat conditions;
2. Evaluate the presence of special status species and assess aspects of their populations or habitat condition that might influence their persistence;
3. Examine land uses that could influence the ecology of the riverine and riparian habitat;
4. Identify critical threats to the river and the viability of associated special status or keystone species;
5. Evaluate the potential for the river to connect upland habitats and provide corridors for wildlife movement; and
6. Determine the major gaps in information needed to plan and implement conservation efforts in the region

The report provides an overview of the physical conditions of the project area that influence the biology and conservation of the system (Section 1), with an emphasis on hydrology and land use, then describes the species and natural communities that have been identified as high priority for conservation in the region (Section 2). The report then assesses the role of the Salinas River and its tributaries in providing landscape linkages for plant and wildlife movement (Section 3), and then assesses the key threats to the high priority species, communities, and corridors (Section 4). The report concludes with a brief assessment of the opportunities and constraints for conservation in the Salinas River.

SECTION 1: THE PHYSICAL ENVIRONMENT

Named for the salt beds located near Monterey Bay, the Salinas River was originally referred to by early explorers and soldiers “Rio Santa Delfina”, or River of the Dolphin Saint. It was later named by Portola “Rio Monterey” (US-LT RCD 2004). Approximately 170 mile long, the Salinas River begins in the southern Santa Lucia Mountains and southern Diablo Range Mountains in central San Luis Obispo County and flows north to Monterey Bay in northern Monterey County. Located in the Central Coast Ecoregion of California, the approximately 4,200 square mile Salinas watershed extends from the Salinas Valley of the Santa Lucia Mountains eastward to the western slope of the Gabilan Range and Southern Diablo Range, which are part of the Outer Coast Range Mountains (Figure 1).

1.1 Climate

The Salinas River project area experiences a Mediterranean climate moderated by maritime influences. Winters are wet and cool while summers are warm and dry. Summer fog is common in the Salinas Valley and surrounding lower elevation foothills. Precipitation occurs almost entirely as rain. Average annual rainfall ranges from about 12 to 40 inches within the basin and depends mainly upon elevation. Within the valley, rainfall ranges from about 12 inches near the center to about 16 inches in the foothills. Annually, an average of 87 percent of the total precipitation falls between November and April (USGS 2008).

1.2 Hydrology

The mainstem Salinas River is a large, low-gradient, sand-bed stream within a wide, flat alluvial plain (Watson et al. 2003). The active floodplain meanders across the broad Salinas Valley. The Salinas River has been described as one of the largest submerged rivers in the United States because of its significant subsurface flow (California State Lands Commission 1993). Flows from the mountain streams that reach the valley floor readily percolate into the highly permeable alluvial substrate, such that aboveground flows declined dramatically during the dry season, and ceased in certain reaches during periods of drought. The unconfined groundwater historically came to or near the surface, particularly near the stream bed, creating wetland conditions (Ca. Division of Water Resources 1946; Section 2.1).

The hydrology of the river has been altered as a result of various anthropogenic factors. This section summarizes known aspects of the historical hydrological conditions, alterations to the stream and its hydrology, and the current conditions that are most relevant to the biology and conservation of the system.

1.2.1 Historical Hydrological Conditions

In 1913, the Salinas River was characterized as follows:

> “The Salinas itself is an erratic and torrential stream. During the dry season its feeble current shifts here and there over broad stretches of wind blown sand, entirely disappearing at times and again rising to the surface. After the advent of the winter rains,

however, it presents a broad expanse of seething water which often threatens everything before it." (page 50, Snyder 1913)

A reconstruction of Salinas River mean flow between 1409 and 2003 based on blue oak dendrochronology revealed dramatic inter-annual to decadal variability, including periods of drought (Griffin 2006, Griffin, unpublished data). Examination of pre-dam construction stream flow within the mainstem Salinas River at Bradley, Soledad, Chualar, and Spreckles, reveals frequent periods of low flow (<5 cubic feet per second) with aboveground flow ceasing during the summer in some years (USGS, unpublished data).

Hydrology of the tributaries to the Salinas naturally varies greatly depending on the size of the area they drain, the substrate, and the topography, among other factors. Most importantly, tributaries within the western mountains (Santa Lucia) receive greater rainfall than those on the eastern mountains (Gabilan and Diablo), due to the orographic precipitation (rain shadow effect). As a result, the tributaries that drain the western mountains have greater flow than streams draining the eastern mountain slopes.

1.2.2 Hydrological Alterations

Beginning in the early part of the last century, the hydrology of the Salinas River began to be altered by five main factors that interact in complex ways:

- Dams
- Levees
- Groundwater pumping
- Channel alterations
- Estuary and lagoon alterations

The alterations in hydrology affect the aquatic and riparian species and communities through a variety of direct and indirect mechanisms (Section 2).

1.2.2.1 Dams

The Salinas River features three major dams:

1. Salinas Dam built in 1942 on the mainstem near Santa Margarita;
2. Nacimiento Dam, built in 1956 on the Nacimiento River approximately 12 river miles upstream of its confluence with the Salinas River; and
3. San Antonio Dam, built in 1965 on the San Antonio River approximately eight river miles upstream of its confluence with the Salinas River (Figure 1).

While the Salinas Dam was built primarily to supply water to Camp San Luis and the City of San Luis Obispo, the Nacimiento and San Antonio Dams were constructed to reduce flood risk and provide water for agriculture in the Salinas Valley. Dam operation toward these objectives includes storing winter run-off and releasing it during the growing season (April-October), when the potential for groundwater recharge is greatest (NOAA 2007).

Construction and operation of the dams has altered the hydrology of the Salinas River and its major tributaries in several ways including by (NOAA 2003, 2007):

- Reducing the velocity and magnitude of peak winter flows
- Reducing the amount of time the mouth is open to the ocean, thus altering lagoon/estuary habitat conditions
- Increasing flows during the dry season
- Eliminating flows, primarily to allow channel maintenance
- Facilitating channel aggradation due to lack of flows with sufficient power to scour deposited material

Releases from Nacimiento and San Antonio dams during the summer enhance flows in the mainstem Salinas River. Typically dam releases cease in the early fall to facilitate channel maintenance activities, though occasionally flows continue throughout the year (Casagrande et al. 2003).

The altered flow regimes have greatly influenced aquatic species and communities (Section 2).

1.2.2.2 Levees

The lower 24 miles of the Salinas River has an extensive levee system constructed by the US Army Corps of Engineers and private landowners (NOAA 2007). Developed to reduce the flooding in the Salinas area, the levees have confined the river, which over millennia moved throughout the flood plain, entering the Monterey Bay between its present location and Moss Landing (Gordon 1996).

Channelization of the stream, along with associated reclamation projects, eliminated the broad estuary and saltwater wetlands, and the large freshwater marsh system including shallow lakes, sloughs, and marshes, in the lower Salinas basin (Gordon 1996, NOAA 2007; Section 2.1). Channelization has additional effects on the river's hydrology, including increasing stream velocity and limiting the width of riparian vegetation (NOAA 2007). These changes have important implications for aquatic and riparian species of the Salinas River.

1.2.2.3 Groundwater Pumping

Pumping of groundwater from shallow wells, for both agricultural and urban use, has greatly depleted the aquifer, which has been lowered below mean sea level (EDAW 2001). This has allowed saltwater intrusion into the aquifer—a main factor contributing to damming of the Nacimiento and San Antonio Rivers. By lowering the water table, groundwater pumping has also reduced the amount and duration of surface flows in the stream. The resulting reduction in the length of seasonal peak flows impedes both upstream and downstream migration of steelhead trout (NOAA 2003) and other aquatic species. Groundwater pumping for irrigation also reduced the wetlands that historically lined the stream bed (Ca. Division of Water Resources 1946).

1.2.2.4 Channel Alterations

Human activities in and around the river channel including grading, vegetation clearing, all-terrain vehicle riding, sand bar removal, and gravel mining and have altered stream hydrology and habitat conditions by altering the native substrate, removing/reducing the low flow channel, and removing/reducing aquatic and riparian vegetation (NOAA 2007).

In addition, encroachment on the river by development has steepened the channel slope, ultimately causing bank erosion (NOAA 2003).

1.2.2.5 Estuary and Lagoon Alterations

At the mouth of the Salinas River, the estuary is turned into a lagoon when a sand bar forms during periods of low surface flow, such as naturally occur during the dry season and extended droughts. The lagoon is naturally breached during periods of high flow, such as occur during peak winter storms which wash away the sand bar.

The estuary and lagoon have undergone a series of alterations beginning in the 1877, when the wetlands around the lagoon began to be drained and used for agriculture. In 1909-1910, a series of heavy winter storms cause the river, which previously emptied into Monterey Bay near Moss Landing, to change to its current course. Today, the old river course, referred to as the Old Salinas River (OSR), is a drainage ditch blocked from the river by a levee with a manual slide gate, and a tide gate near Elkhorn Slough (NOAA 2007).

In 1910, the lagoon opening began to be artificially regulated first by the US Army Corp of Engineers and then by the Monterey County Water Resources Agency beginning in the mid-1960s (NOAA 2007). At present, the sand bar is mechanically breached during fall or early winter to prevent flooding as might result from winter storms that would otherwise likely result in a natural breach (Gilchrist and Associates et al. 1997).

Opening and closing the lagoon influences the biology of the estuary and larger river system through several mechanisms, including:

- Altering the concentration of salt in the water and water temperature, thus influencing aquatic habitat including whether the estuary can support freshwater, saltwater, and brackishwater species
- Determining when anadramous fish including steelhead and pacific lamprey can move between the ocean and estuary
- Influencing the height of water in the lagoon, and thus extent of adjacent saltwater marsh habitat and mudflats that provide habitat for many species including roosting water birds.

1.2.2.6 Other Hydrological Alterations

Other anthropogenic factors that have altered the hydrology of the Salinas River include:

- In-stream diversions, which can reduce flows

- Road crossings (e.g. bridges), which constrict the channel
- Inputs from agricultural fields and water treatment plants, which alter stream flows as well as water quality.

1.2.3 Current Hydrological Conditions

Due to groundwater pumping and reservoir storage, the flow of the Salinas River to the lagoon and ocean has been reduced from 533,000 acre feet per year (Simpson 1946) to a current estimate of less than 240,000 acre feet per year (EDAW 2001).

A recent survey of the entire Salinas basin identified only 150 miles of perennial water within 112 stream reaches, most of which were less than one mile long (CSUMB Watershed Institute, unpublished data). North of the San Luis Obispo County line, the perennial reaches within the Salinas Basin are:

1. San Antonio Creek: Approx. 4.5 miles located upstream of the dam.
2. Pancho Rico Creek: Four, isolated approx. half mile perennial reaches within the canyon, and an approximately 4.5 mile headwaters reach beginning at the south end of Peach Tree Valley (total length: 7.1 miles)
3. San Lorenzo Creek: An approximately 27 mile reach from the headwaters in Peach Tree Valley to the mouth of San Lorenzo Creek Canyon (approx. 3 miles east of the airport)
4. Chalone Creek: Fourteen isolated approx. 0.25-2 mile reaches east of King City, including one on Topo Creek, a tributary to Chalone Creek (total length: 7.4 miles).
5. Arroyo Seco: 23 miles west of the canyon mouth extending into the Ventana Wilderness.
6. Gabilan Creek: An approx. 14.6 mile reach from the hills east of Salinas to Monterey Bay at Elkhorn Slough, via the Old Salinas River channel
7. Salinas River: An approx. 7.5 mile reach from Blanco Road to Monterey Bay, which includes the estuary and lagoon.

In addition, TNC surveys have revealed perennial reaches on Pine, Paloma, Horse, and Los Vaqueros Creeks (C. Fischer, pers. comm. 2007). These observations represent a snap shot; as a result, additional perennial reaches likely occur within the project area.

1.3 Water Quality

Water quality in the Salinas River varies greatly along its length, as a result of variability in land uses and associated inputs both adjacent to and upstream of the site. Fairly extensive research has been conducted on factors influencing water quality within the Salinas, which include:

- Sedimentation and agricultural run off, including fertilizers, herbicides, and pesticides
- Inputs from urban areas, including stormwater and dry weather run-off
- Sewage and wastewater

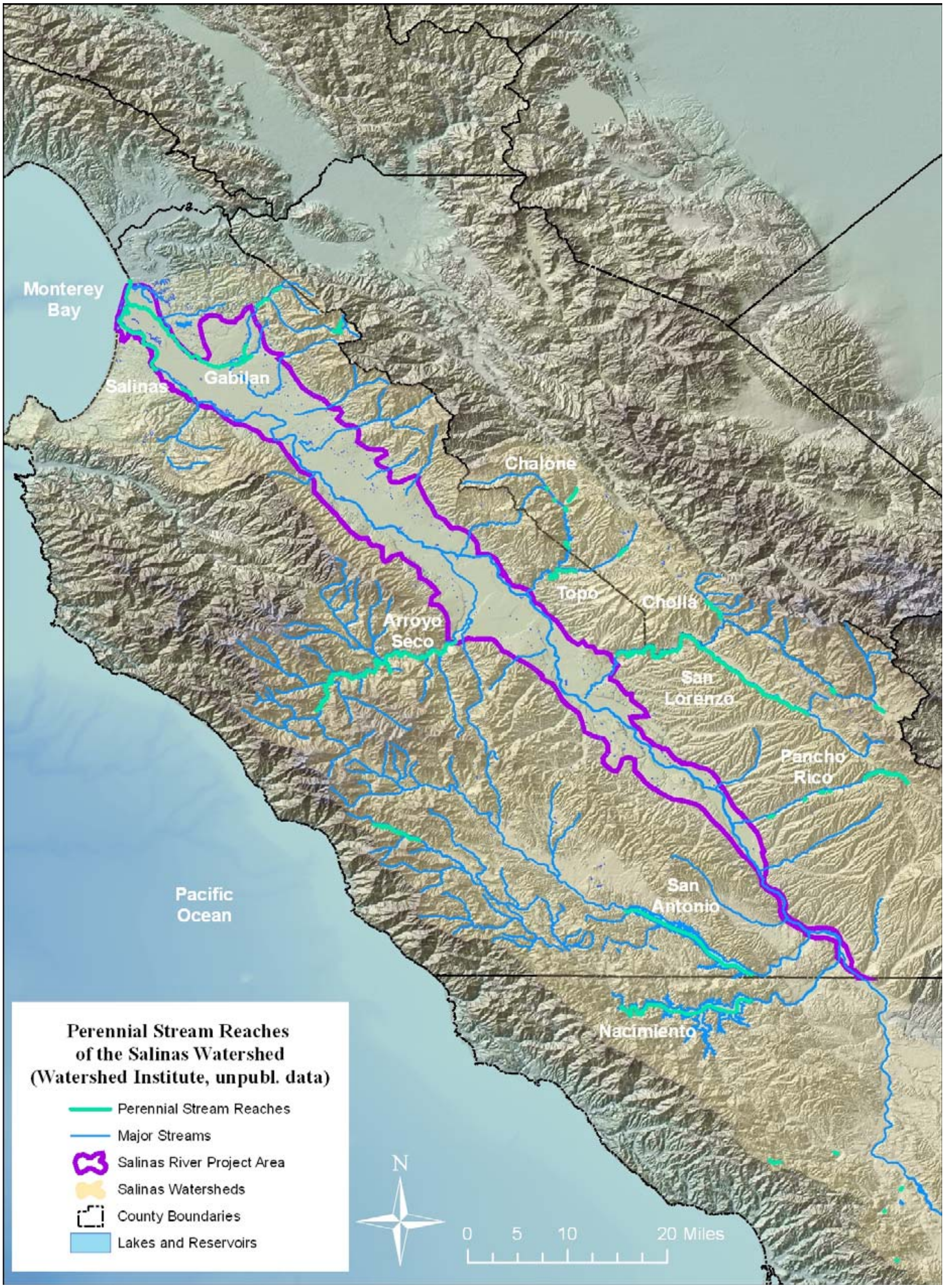


Figure 2: Observed perennial stream reaches within the Salinas River Watershed in central coastal California. Map Prepared by Jodi M. McGraw with data provided by the Watershed Institute, California State University Monterey Bay.

Within the project area, the Salinas River is listed on the 2002 Clean Water Act Section 303(d) list as being adversely impacted by: fecal coliform, nutrients, pesticides, salinity/TDS/chlorides, and sedimentation/siltation (Casagrande et al. 2003). Effluent from mercury mines has created high levels of mercury in the upper Nacimiento River basin, and probably other streams in the Santa Lucia Mountains (USFWS 2002a).

Water quality in the Salinas River can greatly alter aquatic communities by influencing aquatic food webs, and the distribution and abundance of special status species.

1.4 Land Use

The use of land within the project area can greatly influence the biological resources of the Salinas River. This section provides an account of the historic and current land uses, and describes current trends in land use that can have implications for conservation.

1.4.1 Historic Land Use

For more than 10,000 years, the Salinas basin was inhabited by Native Americans including the Salinan Indian Tribe, which occupied the region from Carmel Valley to Morro Bay (California Indian Library Collections 2007). They established villages located primarily along the Salinas River and its tributaries, including the lower San Antonio River, which was an important village site. As hunter-gatherers, the Salinans relied on local fish, game, and native plants, and also traded with coastal tribes, including the Costanoan people of the California's Central Coast. Within the Salinas Valley floor, they used frequent fire to promote new plant growth, to maintain open conditions desired by deer, and to expose acorns that fell on the ground (Gordon 1996, Taylor 2007). The frequent burning, which continued into the 1700s, is likely to have significantly influenced the vegetation described by early Spanish explorers and missionaries.

Beginning in the 18th century, the Native Americans began to be displaced by European and Spanish-Mexican settlers. Following exploration of the region by the Spanish in the 1600s, the Spanish priests established a series of missions, including three located in the Salinas basin: San Miguel, San Antonio, and Soledad. With establishment of the missions began widespread grazing of livestock (primarily sheep and cattle), as well as crop agriculture irrigated from the Salinas River (Breschini et al. 2000).

In the first half of the 19th century, numerous Spanish and Mexican Land grants were established throughout the Salinas Valley and adjacent areas. Grants often exceeded 10,000 acres, the bulk of which was used for livestock grazing, with crop agriculture limited. In his travels within the Salinas Valley in 1861, William H. Brewer observed ranch houses along the river "every fifteen to eighteen miles," and inordinately high density herds of cattle and sheep (6,000-8,000 head) grazing on what he characterized as insufficient feed in a nearly desert area (Brewer 1864). Cattle herds of 700-1,000 are thought to be more commonly grazed on ranchos in the valley (Breschini 2007).

In the mid- to late 1800s, homesteaders moved into the region, establishing farms around available water, typically in the canyon mouths on tributaries to the Salinas River (Breschini

2000). Most were largely subsistence farms, and featured a mix of crops and livestock (Gordon 1996). Grazing remained the primary land use in the Salinas Valley through the early 1900s, when irrigation became more widespread and land within the floodplain began to be converted to grow extensive fields of row crops (Brechini 2000).

By the early 1940s, groundwater pumping primarily for agricultural use had already begun to deplete the aquifer (Ca. Division of Water Resources 1946). Concerns about water availability and flooding prompted construction of dams on the Nacimiento and San Antonio Rivers.

In the latter half of the 1900s, much of the remaining grazing land within the floodplain was converted for crop agriculture, while remaining grazing land on the stream benches and foothills surrounding the Salinas floodplain began to be converted for vineyards. In the late 1900s, towns originally established along the Southern Pacific Railroad line, including Salinas, Greenfield, Soledad, Chualar, and Gonzales, as well as King City, grew rapidly, converting adjacent farmland to urban use (Breschini et al. 2000).

1.4.2 Current Land Use

As part of a recent effort to characterize land use in the Salinas Watershed, remote sensing techniques were used to classify land use into several categories (Newman and Watson 2005). These data were used to evaluate current land use within the Salinas River project area (Table 1). It is important to note that examination of the data as part of this report revealed misclassified regions, such that the acreages should be considered as approximations.

1.4.2.1 Agricultural Land

The Salinas River Project Area is dominated by agricultural land, much of which has been identified as an important resource. As mapped through the California Farmland Mapping and Monitoring Program, the Salinas River Project Area contains 155,000 acres of Prime Farmland: land deemed to have the best combination of physical and chemical features able to sustain long term agricultural production, as it features soil conditions, growing season, and moisture supply needed to produce sustained high yields. The project area contains an additional 30,000 acres of

Table 1: Land use within the Salinas River Project Area, from Newman and Watson (2005). Details provided in text.

Category		Approx. Total Acres	Percent of Project Area
agricultural land		212,812	84
native vegetation		26,643	10.47
urban development		13,737	5.40
water		1,089	0.43
other		106	0.04
	Total	254,388	100.00

Farmland of Statewide Importance, which is similar to Prime Farmland but features minor shortcomings, such as greater slopes or less ability to store soil moisture. In addition, the project area contains 14,000 acres of Unique Farmland: land of lesser quality soils used for the production of the state's leading agricultural crops (CDC 2004).

Within the Salinas River project area, an estimated 84% of the land is used for irrigated agriculture. Dubbed "America's Salad Bowl", the Salinas Valley primarily grows vegetable row crops, such as lettuce, spinach, tomatoes, celery, and broccoli, though strawberries are also commonly produced.

Vineyards comprise an estimated 7% of the land in the project area (Newman and Watson 2005). In 1999, approximately 1% of the Salinas Valley was said to be converted to vineyards each year (Watson et al. 1999). This conversion rate is likely to be greater at present (C. Fischer, pers. comm. 2007).

Irrigated crop agriculture dominates the Salinas Valley floor from King City to the Salinas River mouth, where it is interspersed only by urban areas. Irrigated crop agriculture also occurs in the broader, typically lower-lying regions of some of the larger tributaries to the Salinas River, including: Hames Valley near Bradley, Wildhorse Canyon and San Lorenzo Valley near King City; Arroyo Seco near Gonzales; and Gabilan Creek near Salinas.

Though much of the historic grazing land has been converted for row crops, patches of grassland grazed by cattle still occur within the project area. They are most prevalent on the elevated terraces above the river adjacent to the foothills.

1.4.2.2 Urban

The project area contains five incorporated cities (Table 2), which together cover an estimated 14% of the Salinas River project area. Additionally, much smaller concentrations of urban development occur within a series of unincorporated towns, which located from south to north are: Bradley, San Ardo, San Lucas, and Chualar. These towns each have populations of fewer than 2,000 people, and developed areas of less than 1,000 acres.

Table 2: Size and estimated population of the incorporated cities within the Salinas River Project Area.

City	Approx. Size (Acres)	Population (Approx.)
Salinas, CA	28,748	140,000
King City, CA	1,674	11000
Greenfield, CA	1,945	15400
Soledad, CA	1,470	11200
Gonzales, CA	1,260	8300
All	35,096	185,900

1.4.3 Current Land Use Changes

The following land use changes have been observed during the last two decades within the Salinas Valley (Watson et al. 1999):

1. Conversion of grazing land to irrigated agriculture, particularly for vineyard
2. Conversion of agricultural lands to urban land

These trends are anticipated to continue into the future (LandWatch Monterey County 1999).

SECTION 2: HIGH PRIORITY SPECIES AND COMMUNITIES

The Salinas River and its tributaries support several aquatic and riparian communities and species identified as priorities for conservation, due to their rarity, sensitivity to human impacts, and/or special status.

2.1 Aquatic Communities

2.1.1 Coastal (Tidal) Wetlands

Saltwater and brackishwater wetlands historically occurred throughout the lower Salinas River. The low-lying areas surrounding the current river and the Old Salinas River channel, which connects the Salinas River to Elkhorn Slough, are thought to have supported extensive wetlands within reach of tidal influence, and thus experienced a range of conditions from saltwater to freshwater (Gordon 1996). The lower Salinas River wetlands likely provided important rearing habitat for steelhead and important roosting and breeding habitat for shorebirds, which are are currently abundant in the Elkhorn Slough.

Reclamation of the coastal wetlands primarily for agriculture, along with other alterations to the hydrology and water quality of the river has resulted in the extirpation of four fish species that historically inhabited the lower Salinas River: the thicktail chub (*Gila crassicauda*), Sacramento perch (*Archoplites interruptus*), tule perch (*Hysterocarpus traski*), and the tidewater goby (Moyle 2002, Casagrande et al. 2003).

Today, the saltwater wetland habitats of the Salinas River are limited to the Salinas estuary and lagoon area located west of Highway 1. This approximately 1.75 mile long reach provides valuable habitat for saltwater, freshwater, and resident brackishwater fish, and a narrow strip of mudflats supporting saltwater wetland habitats and shorebirds (Gilchrist and Associates et al. 1997). The subject of prior extensive conservation efforts, as described in the Salinas River National Wildlife Refuge Comprehensive Conservation Plan (USFWS 2002b), the Salinas River lagoon habitats and special status species are not further evaluated as part of this plan.

2.1.2 Freshwater Wetlands

Historically, freshwater wetlands were widespread throughout the Salinas Valley and lowland reaches of its major tributaries. In the mid-1880s, the northern portion of the Salinas Valley was described as “swampy and overgrown with tule, rush, willows, and marsh vegetation" (Gordon 1996, p. 85). The lower Salinas River wetlands supported a high abundance of water birds, according to one account:

> “It is astonishing to see the number of wild fowl that have taken up their abode for the winter in this vicinity, and fly back and forth between the lakes and sloughs where they rest, and the fields and marshes where they feed. The air is sometimes positively alive with them for miles, and their clangor is almost deafening. All kinds are represented, from the useless and ugly mudhen to the coveted honker." (The Castroville Argus, Dec. 4, 1869, *in* Gordon 1996)

Wetland habitat is thought to have surrounded much of the middle Salinas River as well. In the 1800s, the stagecoach route between the end of the South Pacific Railroad in Soledad and destinations in the southern Salinas Valley went inland to follow the Arroyo Seco in order to avoid the marshy conditions of the Salinas Valley (Breschini et al. 2000). Accounts of the Salinan Indians creating clothing and structures from tule (*Scirpus* spp.), a dominant plant of California’s freshwater wetlands, similarly suggest the larger valley historically supported more extensive wetlands.

Reclamation of the wetlands to accommodate agriculture and development beginning in the 1900s removed much of the wetland habitat in the project area. As part of the National Wetlands Inventory, staff within The Watershed Institute at California State University Monterey Bay mapped wetlands within the Salinas River Valley between Moss Landing and King City, including permanent and seasonal, natural and anthropogenic wetlands (J. Casagrande pers. comm. 2007). Results of the inventory including GIS data should be available via the US Fish and Wildlife Service website soon (http://wetlandsfws.er.usgs.gov/wtlnds/launch.html).

Currently, the Watershed Institute is working to restore wetland and riparian habitat located along creeks and ponds within the City of Salinas, including Gabilan, Sanborn, Natividad, Carr Lake, and Upper Carr Lake.

2.2 Aquatic Species

The Salinas project area supports nine high priority aquatic species (Table 3).

2.2.1 Pinnacles Riffle Beetle

The Pinnacles riffle beetle (*Optioservus canus*; Elmidae, Coleoptera) is a narrowly endemic aquatic invertebrate known only from eight streams in San Benito and Monterey Counties. The small (approx. 2 mm long), entirely aquatic beetle primarily inhabits fast-flowing water where it feed on algae and detritus. Due to its limited geographic range and narrow habitat specificity, this species is naturally rare, and may be threatened by activities that degrade stream habitat.

The Pinnacles riffle beetle is known to occur within two tributaries to the Salinas River: Chalone Creek and Arroyo Seco, including its tributary Piney Creek (Shepherd 1990). Surveys might reveal additional populations elsewhere.

Table 3: Aquatic species of interest within the Salinas River Project Area. Details provided in te			
Common Name	Scientific Name	Regulator y Status	Occurrences
Pinnacles riffle beetle	*Optioservus canus*	none	Chalone Creek, Arroyo Seco
Pacific lamprey	*Lampetra tridentata*	FSC, CSSC	Arroyo Seco, mainstem Salinas
Monterey roach	*Lavinia symmetricus subditus*	CSSC	Arroyo Seco, Gabilan Creek, mainstem Salinas
Sacramento speckled dace	*Rhinichthys osculus*		Arroyo Seco, Sandy Creek
Steelhead trout	*Oncoryhnchus mykiss irideus*	FT	Arroyo Seco (and tribs), Nacimiento Creek, San Antonio Creek, mainstem Salinas
California red-legged frog	*Rana aurora draytonii*	FT	Nacimiento Creek, San Lorenzo River, Chalone Creek
Foothill yellow-legged frog	*Rana boylii*	CSSC	Arroyo Seco, Reliz Canyon, Tajas Ranch (near Soledad)
Southwestern pond turtle	*Actinemys marmorata pallidc*	FSC, CSSC	Arroyo Seco, San Lorenzo Creek, Nacimiento River,

FT: Federally Threatened
FSC: Federal Species of Concern
CSSC: California Species of Special Concern

2.2.2 Pacific Lamprey

A federal Species of Concern and California Species of Special Concern, the Pacific lamprey (*Lampetra tridentata*) is an eel-like fish of coastal streams in the Pacific Rim. Like steelhead, pacific lamprey are anadromous: they are born in freshwater streams, migrate out to the ocean, and return to fresh water as adults to spawn in low gradient streams with gravel and sand substrate (Moyle 2002). Given their similar life history and spawning habitat requirements to steelhead, it is not surprising that pacific lamprey populations are in decline and face similar threats, which include:

- Alterations to hydrology that negatively impact migration, including dams, insufficient flows, and channel alterations which create conditions that impede migration (e.g. removal of woody debris and vegetation increases velocity).
- Sedimentation which removes and degrades spawning gravels

Within the Salinas basin, pacific lamprey were historically recorded in the mainstem Salinas River near Salinas, and in the upper reaches of Nacimiento Creek (Snyder 1913). In a recent study, juvenile pacific lampreys (ammocoetes) were observed in the Arroyo Seco, Paso Robles Creek, and the mainstem Salinas. They occurred in stream reaches with less than 30% overhead vegetative cover where their preferred algae and associated microscopic plants and animals are abundant on the stream bottom (Casagrande et al. 2003). Pacific lampreys are also known to occur in the Nacimiento River on Camp Roberts (Snyder 2001).

2.2.3 Monterey Roach

A California Species of Special Concern, Monterey roach (*Lavinia symmetricus subditus*) is a small fish endemic to coastal streams draining to Monterey Bay, including the Salinas, Pajaro, and San Lorenzo rivers. They inhabit warm, small to moderate-sized tributaries where they feeds primarily on filamentous algae and small aquatic insects. Monterey roach spawn in

schools between March and early July in shallow, flowing water with gravel substrate. Their populations are declining due to channelization, pollution, diversions, as well as the expansion of hitch, with which they hybridize. Dams are also thought to threaten populations by preventing recolonization of isolated populations following extirpations due to drought (Moyle 2002).

Within the Salinas River, Monterey roach were historically known from the mainstem river in locations near San Miguel, Spencers, Salinas, Spreckels, and Blanco (Snyder 1913). Recently, they were observed in the mainstem, Arroyo Seco, and Gabilan Creek, as well as Atascadero Creek and Paso Robles Creek where they were found primarily along the edges of pools remaining in the intermittent streams (Casagrande et al. 2003).

2.2.4 Sacramento Speckled Dace

The Salinas basin supports Sacramento speckled dace (*R. o. carringtoni*), a small minnow which occurs only in the Sacramento, Pit, San Lorenzo, and Pajaro Rivers (Moyle 2002). In several of these drainages, speckled dace are limited to small reaches, rendering their populations vulnerable to extinction, as occurred in the San Francisco Bay drainage (Moyle 2002).

Within the Salinas basin, Sacramento speckled dace occur in a wide variety of habitat conditions, from small, spring-fed streams to large rivers. It is found in pools of intermittent streams as well as perennial reaches. Speckled dace habitat typically consists of clear, well-oxygenated water, abundant cover such as rocks and overhanging vegetation, and low abundance or absence of nonnative predators. The small minnows typically spawn in riffles and in pools over clean gravel (Moyle 2002, Casagrande et al. 2003).

In a recent survey of fish in the Salinas basin, speckled dace were observed in Arroyo Seco, Sandy Creek (a small tributary to Chalone Creek), and Willow Creek (a small tributary to Paso Robles Creek; Casagrande et al. 2003).

2.2.5 Steelhead Trout

Steelhead trout (*Oncoryhnchus mykiss irideus*) are the anadromous form of rainbow trout. Steelhead trout ("steelhead") spawn in cool streams with gravel substrate and good flow. After one to two years, young steelhead migrate downstream to the ocean, where they live and grow for one to two years before returning to spawn in freshwater, often in their natal stream.

The Salinas River supports the South-Central California Coast (SCCC) Steelhead Evolutionary Significant Unit (ESU)—a substantially reproductively isolated population that represents an important component of the evolutionary legacy of the species. Federally threatened, the SCCC

ESU is found in coastal river basins from the Pajaro River in the north to Arroyo Grande in the south, of which the Salinas is one of the largest (Boughton et al. 2006). Historically, the mainstem Salinas River served as a migration corridor to an estimated 435 miles of spawning and rearing habitat located in three main tributaries: Nacimiento River, San Antonio River, and Arroyo Seco (NOAA 2007).

Historically, steelhead are thought to have occurred throughout much of the perennial stream reaches within the Salinas basin, which are primarily located on the western and southern portion of the watershed, as the eastern portion is relatively arid and contains primarily intermittent streams. Within the project area, the Nacimiento and San Antonio Rivers are thought to have supported the largest steelhead runs, owing to their extensive spawning habitat and relatively high flows (Snyder 1913, Casagrande et al. 2003). The Arroyo Seco is also likely supported extensive steelhead runs historically (Casagrande et al. 2003, NOAA 2007).

Within the Salinas basin, steelhead are currently known to occur in the Nacimiento River (below the dam), Arroyo Seco, and several tributaries located in San Luis Obispo County (and therefore outside of this project area), including: Santa Margarita Creek, Paso Robles Creek, and Atascadero Creek (NOAA 2005, 2007).

Research suggests that the Salinas basin may support three distinct population segments of steelhead:

- Southern Salinas basin population, based primarily in the Nacimiento River but also occurring in the San Antonio and upper Salinas river tributaries upstream of the confluence with the Nacimiento River;
- Northern Salinas basin, occurring primarily in the Arroyo Seco and its tributaries; and
- Gabilan Creek, which currently flows to the Old Salinas River (Boughton et al. 2005).

Steelhead were observed to decline in the Salinas basin following construction of the dams, which cut off access to more than 200 miles of spawning habitat located upstream of the Nacimiento and San Antonio reservoirs (Casagrande et al. 2003, NOAA 2005). Declines in steelhead populations can also likely be attributed to other alterations to the streams hydrology (Section 1.3), water quality (Section 1.4), and riparian vegetation (Section 2.3).

Within Monterey County, steelhead currently occur in more than 85 miles of stream within San Antonio Creek, Nacimiento Creek, and the Arroyo Seco, along with six of the Arroyo Seco's major tributaries (Table 3; Figure 3). Steelhead are likely to occur within an additional 20 miles of streams tributary to the Arroyo Seco. Meanwhile, the occurrence of steelhead is unknown within 93 stream miles in the Arroyo Seco and Nacimiento watersheds, as well as the San Lorenzo River (NOAA 2005). Steelhead also occur within approximately 33 stream miles on Gabilan Creek, the lower reaches of which have been diverted through agricultural channels to the Old Salinas River channel, and is now technically part of the Elkhorn Slough Watershed.

Considered to have the best steelhead spawning and rearing habitat remaining in the watershed, Arroyo Seco could support an estimated run of a few thousand spawning fish. However, access to the Arroyo Seco is limited by low flows near its confluence with the Salinas River, where porous gravel and sand allow flow across the braided, shallow streambed to seep into the ground during migration (NOAA 2003). Five structures within the Arroyo Seco also create obstacles to migration under certain flow conditions: Thorne Road crossing near Greenfield, a concrete apron across the channel associated with an agricultural diversion maintained by Clark Colony, and three improved fords providing seasonal stream crossings, which are located at Sycamore Flat, Millers Lodge and Fred's Camp. Thorne Road, the most problematic barrier, is scheduled for removal in 2008 (C. Fischer, pers. comm. 2007).

Table 4: River miles of streams within the Salinas Basin for which the presence of the South-Central California Coast Steelhead ESU is known, likely, or unknown. (NOAA 2005).

	Presence of South-Central California Coast Steelhead ESU					
	Presence Known		**Presence Likely**		**Presence Unknown**	
Watershed	**Stream Reach**	**Total Miles**	**Stream Reach**	**Total Miles**	**Stream Reach**	**Total Miles**
Arroyo Seco	Arroyo Seco (mainstem)	31.7	Calaboos Cr.	0.9	Basin Cr.	4.9
	Church Cr.	3.3	Horse Cr.	4.5	Big Sand Cr.	4
	Paloma Cr.	7.4	Relix Cr.	10.3	Calaboose Cr.	4
	Piney Cr.	8.1	Rock Cr.	3.4	Corral Cr.	1.5
	Santa Lucia Cr.	2.5	Vaqueros Cr.	1.7	Little Sand Cr.	1.9
	Tassajara Cr.	9.7			Paloma Cr.	8.8
	Willow Cr.	2.1			Reliz Cr.	6.5
					Sand Cr.	5.3
					Sweetwater Cr.	5.3
					Tash Cr.	6.1
	Subtotal: Arroyo Seco	**64.8**		**20.8**		**48.3**
Nacimiento	Nacimiento River (mainstem	12.3			Cantinas Creek	3.1
San Antonio	San Antonio River (mainstem	8.3				
					San Lorenzo Cr. (mainstem	41.7
	Total	**85.4**		**20.8**		**93.1**

Suitable habitat for steelhead spawning has been observed in over 288 miles of stream reaches that are known to not currently support steelhead; however, though the vast majority of this length is upstream of Nacimiento and San Antonio dams (Casagrande et al. 2003, NOAA 2005). Spawning habitat accessible by steelhead has been degraded by several factors including:

- Altered flows due to dam operations and the reduced water table
- Sedimentation

Introduction of non-native fish, including hatchery rainbow trout, that compete with and predate upon young fish

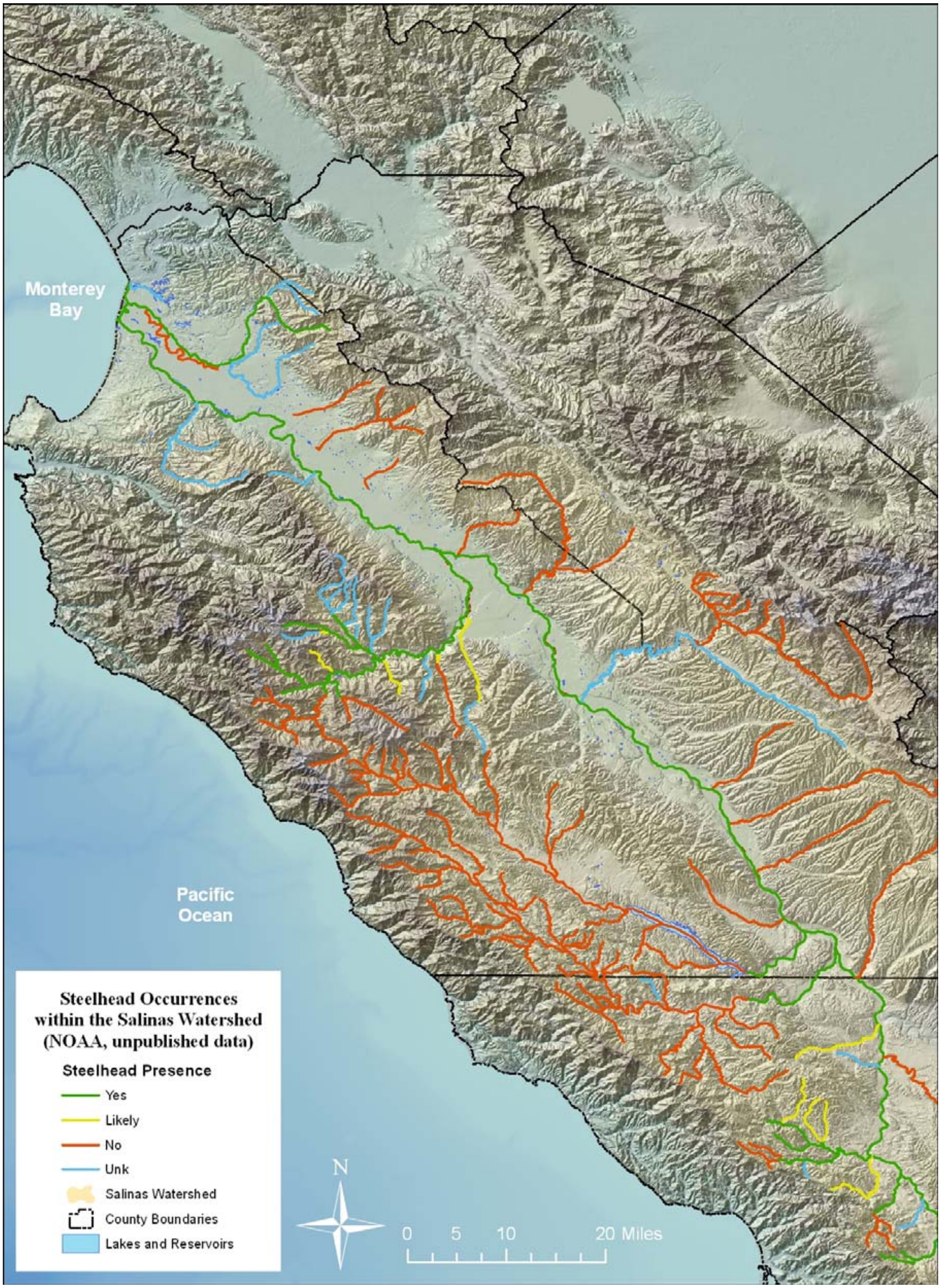


Figure 3: Steelhead trout occurrences within the Salinas River Watershed in central coastal California. Map Prepared by Jodi M. McGraw with data provided by the National Oceanic and Atmospheric Association (confidential).

Presently, steelhead must migrate through up to 100 miles of habitat on the mainstem Salinas River to reach the ocean from the Nacimiento and Arroyo Seco Rivers (NOAA 2007). While the long distance and high variation in flow resulting from interannual variability in precipitation historically presented challenges to steelhead migration, human alterations to the stream have greatly exacerbated these conditions. As summarized in other sections of this report, much of the habitat within the mainstem Salinas River has been degraded due to hydrological alterations (Section 1.2), water quality (Section 1.4), and loss of riparian vegetation (Section 2.3). Challenges to effective steelhead migration within the mainstem include (NOAA 2003, 2007):

- Reduction of flows and increased water temperature in the spring, which can reduce or eliminate spring outmigration
- Closure of the sand bar at the lagoon during spring, which can prohibit outmigration
- Reduction of flows during winter storms as a result of storage in dams, inhibiting upstream migration, particularly during average or dry years
- Channel alterations including vegetation clearing and levees, which increase stream velocity and remove cover, thus reducing upstream migration
- Degradation of water quality, which can weaken or kill fish, reduce prey availability, and reduce dissolved oxygen

Steelhead populations within the Salinas River also face challenges due to the status of the lagoon and estuary. Historically, the mouth of the Salinas River is thought to have supported an extensive estuary and wetland similar to that of the Elkhorn Slough, which would have provided important rearing habitat for juvenile steelhead. Extensive reclamation efforts removed the much of the estuarine habitat, of which a narrow band of only approximately 1.75 miles in length remain (Section 2.1.1). Lagoon habitat for steelhead has been impacted by several factors including:

- Loss of native aquatic vegetation and other shelter, due to steep levees and channel clearing
- Inputs from water treatment plants and adjacent farms that reduce water quality
- Artificial breaching and closing of the lagoon for flood control, which limits the period in which migration can occur, alters salinity of the estuary, and exposes juvenile steelhead to predation
- Non-native predatory fish in the lagoon, including carp (*Cyprinus carpo*), white bass (*Morone chrysops*), bluegill (*Lepomis macrochirus*), green sunfish (*Lepomis cyanellus*), and threadfin shad (*Dorosoma petenense*) (USFWS 2002b).

During the last century, there has been a progressive decline in steelhead abundance, as estimates of the adult population declined from 3,600 in 1946, to 900 in 1951, and then 500 in 1983 (NOAA 2007). Due to low survivorship in multiple life stages, the anadramous population in the Salinas River is thought to no longer be self-reproducing, and instead persistence to date has been attributed in part to ‘strays’ moving up the system from other watersheds (NOAA 2007).

The small population is at high risk of extinction due to a variety of factors including environmental stochasticity (NOAA 2007).

Currently, NOAA is working to develop a strategy to recover the SCCC steelhead ESU. As part of the Monterey County Water Resources Agency (MCWRA) Salinas Valley Water Project, NOAA has recommended a series of steps to enhance conditions for steelhead, including (NOAA 2007):

- Improving the duration and magnitude of spring flows to enhance outmigration
- Facilitating upstream migration by augmenting flows following winter storms, to create a more natural flow regime
- Establishing continuous flows into the lagoon to maintain fresh water
- Maintaining the river mouth open for at least 10 days once the Arroyo Seco flows to the Salinas river
- Addressing run off from the Blanco drain by creating vegetative swales or establishing a pump
- Preventing steelhead use of the Old Salinas River channel

The Arroyo Seco population is regarded as the most viable of the three potentially distinct population segments within the Salinas basin. NOAA is also seeking to enhancing steelhead populations within the Nacimiento River by reducing competition with non-native fish, including stocked rainbow trout (J. Ambrose pers. comm. 2007).

2.2.6 California Red-Legged Frog

California red-legged frog (*Rana aurora draytonii*) is a federally threatened species that is endemic to California and Baja California, where it occurs in habitat characterized by still or slow moving water that it at least three feet deep. Due to widespread habitat loss and degradation, California red-legged frogs have been extirpated from an estimated 70% of their range, with the majority of remaining occurrences found within rivers and coastal drainages in the central California (USFWS 2002a). California red-legged frogs are negatively affected by non-native animals including bullfrogs (*Rana catesbeiana*), mosquito fish (*Gambusia affinis*), and numerous predatory fish, as well as emergent diseases such as the Chitrid fungus that is associated with declining amphibian populations (USFWS 2002a).

Though California red-legged frogs were historically widespread and abundant in the Inner Coast Range Mountains between the Salinas basin and the San Joaquin Valley, fewer than 10 percent of the historic localities remain (Jennings and Hayes 1994). In the recovery plan for the threatened frog, the Diablo Range and Salinas Valley Recovery Unit recovery status was categorized as “medium: numerous existing populations, some areas of medium habitat suitability, high levels of threats”. Listed threats within the recovery unit include: agriculture, livestock, mining, non-native species, recreation, urbanization, and water management (i.e. diversions, reservoirs, etc.; USFWS 2002a).

There have been no known comprehensive surveys for California red-legged frog within the Salinas River and its major tributaries, much of which flows through private land. A search of museum collections revealed the following historic occurrences (Cal. Acad. 2007):

- Nacimiento Creek, near the Nacimiento-Ferguson Road (1981)
- San Lorenzo River, seven miles west of King City (1949)
- Chalone Creek in Pinnacles National Monument (1939).

The Nature Conservancy scientists have observed red-legged frogs within Los Vaqueros Creek, a tributary to Arroyo Seco, and in upper Gabilan Creek while Pinnacles National Monument staff have observed them in Chalone Creek (C. Fischer, pers. comm. 2007). Suitable breeding habitat for California red-legged frogs occurs within the Salinas River, and the species is thought to occur within the mainstem Salinas, albeit at low abundance (USFWS 2003).

2.2.7 Foothill Yellow-Legged Frog

A California Species of Special Concern, foothill yellow-legged frog (*Rana boylii*) is a moderate-sized frog of aquatic habitats in the foothill portions of coastal drainages in Oregon and California. The species occurs in shallow, slow-moving, gravelly streams and rivers with sunny banks, in forests, chaparral, and woodlands below 6,700 feet. Foothill yellow-legged frogs occur infrequently in habitats occupied by introduced aquatic predators. Though once widespread, populations are thought to have declined by 45% in California, while the species has been apparently extirpated south of southern Monterey County (Jennings and Hayes 1994).

A search of museum collections revealed the following collections from the Salinas basin:

- Arroyo Seco near Abbots Ranch, 1919 (MVZ 2007).
- Reliz Canyon (a tributary to Arroyo Seco), 1939 (Cal. Acad. 2007)
- Tajas Ranch (16 miles from Soledad) 1950 (Cal. Acad. 2007).

2.2.8 Southwestern Pond Turtle

A subspecies of the western pond turtle, the southwestern pond turtle (*Actinemys marmorata pallida*) occurs in freshwater and brackish systems with permanent or semi-permanent water including ponds, lakes, streams, and irrigation ditches west of the Central Valley and deserts between the San Francisco Peninsula and northern Baja California. They require slow moving water and are typically not found in high gradient streams. Within their aquatic habitat, western pond turtles require basking sites such as partially submerged logs, rocks, mats of floating vegetation, or open mud banks, which along with undercut banks, also provide suitable refugia from predators. Pond turtles move into adjacent terrestrial habitat to nest, aestivate, and overwinter, and turtles have been observed more than 1,000 feet from water (Jennings and Hayes 1994).

Southwestern pond turtles have shown dramatic population declines in southern California, with central California populations, including those in the Salinas basin doing poorly. Declines are thought to be related to habitat loss and degradation, and the introduction of several non-native predators, including bullfrogs, sport fish (e.g. bass and sunfish), and red foxes. Many remaining populations exhibit an age structure that suggests little recruitment (Jennings and Hayes 1994).

Within the Salinas basin, southwestern pond turtles have been observed in three areas:

- Arroyo Seco and one of its tributaries, Horse Creek, (L. Serpa, pers. comm. 2007)
- San Lorenzo Creek, four air miles east of King City (Cal. Acad. 2007)
- Salinas River and Nacimiento River on Camp Roberts (Snyder 2001).

2.3 Riparian Communities

The Salinas River project area support significant occurrences of riparian communities, which are an important biological resource for several reasons including:

- They support plant species adapted to the unique conditions found only along streams
- They provide essential habitat for many native animal species, including breeding habitat for many migratory birds
- They are critical to maintaining appropriate abiotic conditions and food webs within riverine systems
- They provide cover for terrestrial animal species requiring access to water
- They act as important corridors for the dispersal of plants as well as animals, linking remnant patches of terrestrial vegetation within the valley (Gregory et al. 1991, Johansson et al. 1996).

In California, over 225 vertebrate species require riparian habitats, which harbor the most diverse bird assemblages in the arid and semi-arid regions of the western United States (Knopf et al. 1988, Dobkin 1994, Saab et al. 1995). During the bird breeding season, riparian areas can harbor birds at densities up to ten times greater than the surrounding terrestrial habitats (RHJV 2004). Mammals, such as gray fox *(Urocyon cinereoargenteus)*, coyote *(Canis latrans)*, ringtail *(Bassariscus astutus)*, raccoon *(Procyon lotor)*, and striped skunk *(Mephitis mephitis)* rely heavily upon riparian habitats.

2.3.1 Historic Occurrence and Condition

Efforts to determine the historical occurrence and condition of riparian vegetation and adjacent upland vegetation within the Salinas Valley have been met with several challenges. Aerial imagery of the region only dates back to the late 1930s, when the region had already experienced a long history of human land uses that are likely to have greatly altered vegetation, including:

- Frequent burning of the valley floor by Native Americans to create and maintain conditions appropriate for hunting and gathering (Section 1.5.1)
- Extensive grazing by livestock (cattle, sheep) on the valley floor and adjacent foothills beginning in the era of the Spanish Missions, which altered natural vegetation through the

direct impacts of grazing (herbivory, trampling) and by introducing European annual grasses and forbs

- Land uses by early homesteaders which included timber harvest, clearing, and crop agriculture
- Rapid spread of irrigated crop agriculture in the valley beginning in the early 1900s

Incidental observations of vegetation provided in historic accounts of the Salinas Valley provide some indication of what might have occurred, though apparent contradictions in the accounts reflect variability of observations in space (i.e. different positions in the landscape) and time.

During his expedition with Portola in 1769, Father Juan Crespi described the vegetation between present day Greenfield and Spreckels as including newly burned grassland on the valley floor, at least one isolated grove of live oaks and a broad strip of riparian forest, which was described as being 365 meter (0.23 mile) wide and located near present day Chualar (Gordon 1996). In May of 1861, William H. Brewer provided the following account of vegetation in the Salinas Valley:

> "The Salinas Valley for a hundred or more miles from the sea, up to the San Antonio hills, is a great plain ten to thirty miles wide. Great stretches are almost perfectly level, or have a very slight slope from the mountains to the river which winds through it. The ground was dry and parched and the very scanty grass was entirely dry. One saw no signs of vegetation at the first glance—that is, no green thing on the plain—so a belt of timber by the stream, from twenty to a hundred rods wide, stood out as a band of the liveliest green in this waste." (pages 97-98, Brewer 1864)

Presently, the width of riparian vegetation within the Salinas Valley is thought to be greatly reduced relative to these historic accounts, primarily due to habitat conversion within the broader floodplain, but also localized timber harvest. However, the density or width of riparian vegetation *within* the river channel itself may have increased relative to the historical occurrences, as discussed in greater detail below.

2.3.2 Historical Alterations

The natural riparian vegetation along the Salinas River and lowland reaches of its major tributaries has been directly affected by several human activities (White and Broderick 1992):

- Livestock grazing and/or burning
- Timber harvest and clearing for agriculture and development
- Construction of flood control levees
- Channel clearing designed to reduce flood risk
- Gravel mining
- Off-highway vehicle riding within the channel
- Groundwater pumping, which has lowered water table accessed by riparian trees

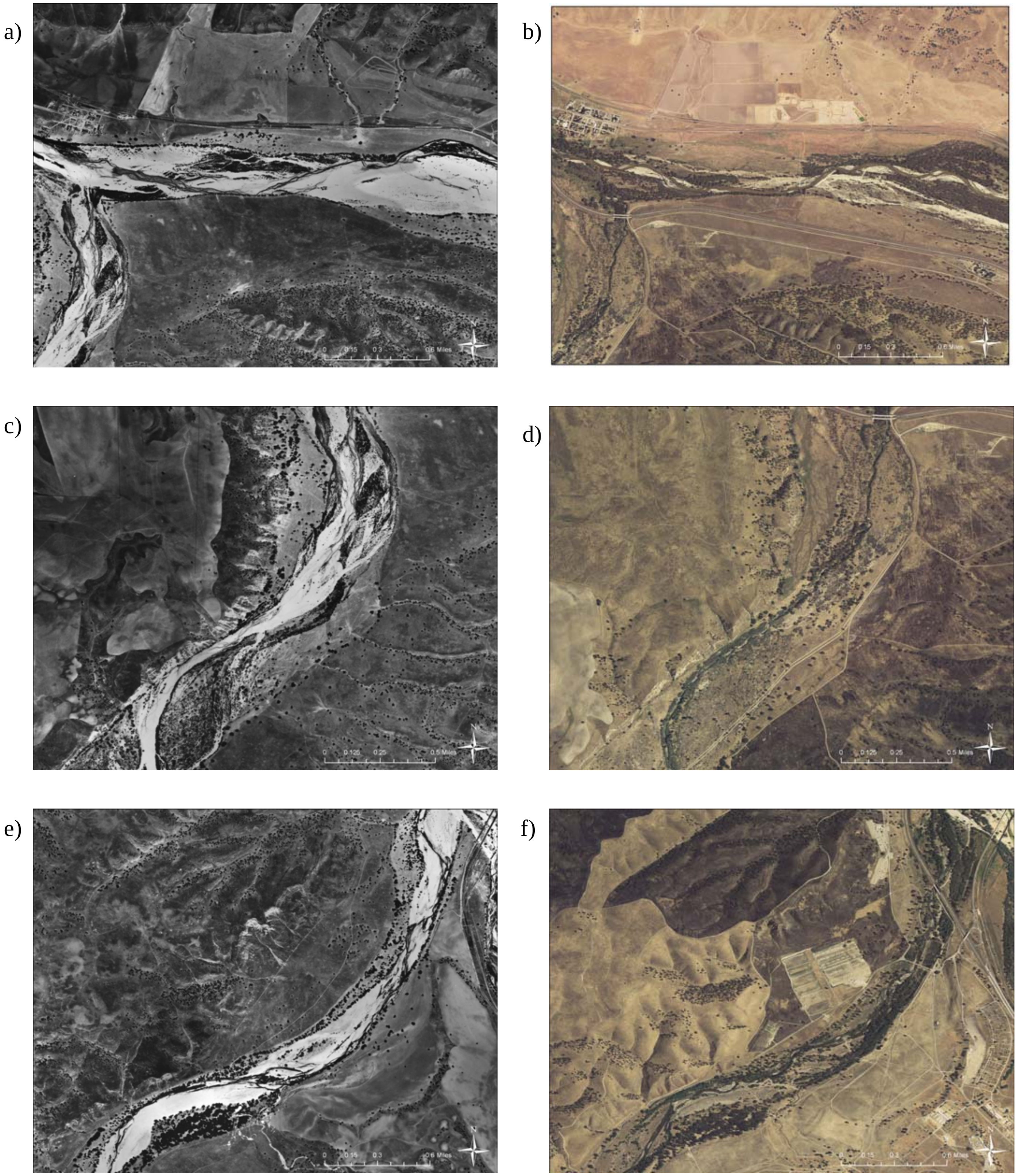


Figure 4: Comparison of riparian vegetation on the Salinas River and low-lying sections of two of its major tributaries within Camp Roberts in 1939 and 2005: a) mainstem Salinas 1939, b) mainstem Salinas 2005, c) San Antonio 1939, d) San Antonio 2005, e) Nacimiento River 1939, and f) Nacimiento River 2005.

While development adjacent to the river and river channelization might have reduced the width of the riparian vegetation, the width of riparian vegetation within the river channel itself appears to have actually increased in recent decades. Relative to 1939, the density and width of woody vegetation in 2005 is greater within the channels of the mainstem Salinas River and lower San Antonio and Nacimiento Rivers (Figure 4). Whereas these channels featured wide expanses of open substrate interspersed by relatively narrow threads of riparian vegetation in 1939, the riparian woodland and forest appears thicker and open substrate much reduced in 2005. A similar increase in the extent of riparian vegetation has been reported for the mainstem Salinas River (Entrix 2002 *in* NOAA 2003).

Based on history of the region and the factors that influence establishment and growth of riparian vegetation, this increase could result from three, non-mutually exclusive factors:

- Increased survival of shrubs and trees due to reduced frequency and intensity of flooding following dam and levee construction in the 1940s and 1950s
- Increased survival and growth of shrubs and trees in response to dam releases which create greater summer flows than historical averages.
- Increased establishment and survival of shrubs and trees following a reduction in the intensity and/or frequency of livestock grazing and/or burning in the riparian areas.

2.3.3 Current Conditions

Riparian vegetation within the lowland reaches of the Salinas River represents a complex mosaic of communities (Figure 5a,b), which vary in terms of species composition due to several factors including:

- Hydrology: distance from the wetted channel, distance to the water table, etc.
- Disturbance history: time since last flood or other clearing event

A previous effort to map riparian communities on the Salinas, Nacimiento, San Antonio, and Arroyo Seco Rivers identified four main community types, each of which includes numerous series (White and Broderick 1992; Table 5). In general, central coast riparian scrub communities are thought to succeed to central coast riparian forest communities in the absence of flooding, or other disturbance which removes established trees and shrubs. Riparian woodland, including sycamore alluvial woodland, typically occurs on secondary channels, oxbow lakes, and other areas higher in the floodplain where flooding is less frequent and severe.

Invasive exotic plants have also altered plant community structure and species composition within the riparian communities of the Salinas River. Giant reed (*Arundo donax*) has infested an estimated 3,700 acres of riparian habitat in the Salinas Valley between King City and the Salinas Lagoon (Monterey County Agricultural Commissioners Office 2006). This highly competitive grass outcompetes native vegetation, often creating single species stands where it takes up an estimated three times as much water as native riparian species and creates a fire hazard, while providing little to no shade for in-stream habitat (Santa Ana Watershed Project Authority 2002 *in* NOAA 2003).

Saltcedar or tamarisk (*Tamarix ramosissima*) is another invasive plant of riparian areas, particularly in drier regions. It occurs on the Nacimiento River within Camp Roberts (Snyder 2001) and, as of the early 1990s, was characterized as occurring "relatively infrequently along the Salinas River" (White and Broderick 1992, p. 22).

A comprehensive, fine scale vegetation map of the riparian communities of the Salinas River project area has not been developed. The following are four riparian communities of special interest due to their uniqueness, rarity, and diversity (CNDDB 2003), and because they support rare animal species.

2.3.3.1 Mixed Central Coast Riparian Forest

In the central coast region, mixed stands of riparian forest support a diversity of trees including black cottonwood (*Populus balsamifera* ssp. *trichocarpa*), Fremont cottonwood *(P. fremontii* ssp. *fremontii*), white alder (*Alnus rhombifolia*), California sycamore, California box elder (*Acer negundo* var. *californicum*) and a variety of large (i.e. tree-sized) willows including red willow (*Salix laevigata*) and arroyo willow (*S. lasiolepis*). Mature stands of the mixed riparian forest help maintain aquatic habitat conditions required by several special status species, and provide habitat for riparian species including both resident and migratory riparian obligate birds.

Central coast riparian forest and woodlands (incl. sycamore alluvial woodland and valley oak woodland) were mapped as occurring on 4,900 acres along the Salinas River (White and Broderick 1992), with the bulk of this acreage likely comprised of mixed central coast riparian forest. This community is greatly limited in the lower sections of the Salinas River, where agricultural conversion within the floodplain and river channelization have left only narrow stands of mixed riparian forest inside the levees (White and Broderick 1992).

Between the confluence of the Nacimiento River and the San Ardo oilfield, there are about nine river miles of high quality, unfragmented, mature, mixed central coast riparian forest adjacent to native upland vegetation (Figure 5c,d). As described in the next section, this area has been identified as important habitat for several special status riparian bird species (D. Roberson pers. comm. 2007).

2.3.3.2 Central Coast Riparian Scrub

Central coast riparian scrub is the term used to describe central coastal California's streamside thickets dominated by shrubs including red and arroyo willow that are typically less than 15 feet tall, and mule fat (*Baccharis salicifolia*; White and Broderick 1992). This community is thought to establish following flood and, in the absence of flood, succeed to central coast riparian forest as riparian trees become established.

Riparian vegetation dominated by willows can provide important habitat for many animal species, including neotropical migratory birds, many of which nest exclusively in riparian vegetation (Figure 5d,f). For example, the Least Bell's vireo nests exclusively in dense willow stands (Section 2.4.6).

Table 5: Structure and species composition of the main types of riparian plant communities mapped in the Salinas River mainstem and lower reaches of the Arroyo Seco, San Antonio River, and Nacimient River (*sensu* White and Broderick 1992).

Community Type	Subtypes	Structure	Species Composition
Central coast riparian forest	Central coast cottonwood-sycamore forest, central coast live oak riparian forest, central coast arroyo willow riparian forest, white alder riparian forest	Broad-leafed, deciduous trees and shrubs (>15 feet tall) with tree canopy cover up to 80% and shad tolerant shrubs and herbs in the understory	black cottonwood, Fremont cottonwood, arroyo willow, red willow, box elder, white alder, and California sycamore
Central coast riparian scrub		Scrubby thicket of open to impenetrable shrubs dominated by willow species and mule fat (<15 feet tall), with invasive herbs and establishing riparian tree seedlings and saplings in the understory	Willows including red and arroyo willow, and mule fat
riparian woodland	Sycamore alluvial woodland	Open woodland of deciduous trees often with an understory of herbs	California sycamore, white alder, valley oak, live oak, and Fremont cottonwood
marsh	freshwater marsh, coastal brackish marsh, coastal salt marsh	Perennial, emergent monocots (<15 feet tall) largely in wetlands	various sedges, rushes, and halophytes

2.3.3.3 Sycamore Alluvial Woodland

The Salinas River project area supports scattered patches of riparian vegetation characterized by the presence of scattered California sycamore (*Platanus racemosa*) as the dominant canopy tree. Known also as the California Sycamore Woodland (Sawyer and Keeler-Wolf 1995), the Sycamore Alluvial Woodland is primarily restricted to braided, depositional channels usually with cobble or boulder substrate in the South Coast Ranges between Alameda and Santa Barbara Counties. Scattered, large coast live oaks or valley oaks often occur within this community, which typically features an understory of herbaceous plants.

Due to its rarity, sycamore alluvial woodland has been identified as a Sensitive Plant Community (CNDDB 2003). Though likely originally more widespread, its current distribution is likely limited because of its occurrence in fertile alluvial soils targeted for agricultural use.

a)

b)

Figure 5: Riparian communities along the Salinas River, showing: a) mosaic of communities north of San Ardo, showing riparian woodland (foreground), riparian scrub (along river), Valley Oak Woodland on banks (center), and adjacent upland community dominated by California annual grassland (top); b) mosaic of riparian scrub communities near King City. Photographs by Jodi M. McGraw.

c)

d)

Figure 5 (cont.): c) and d) mature riparian woodland near Bradley, dominated by cottonwoods (*Populus* spp.), willows (*Salix* spp.), and white alder (*Alnus rhombifolia*). Photographs by Jodi M. McGraw.

e)

f)

Figure 5 (cont.): e) broad expanse of riparian scrub dominated by willows with scattered cottonwoods along the San Antonio River near the confluence with the mainstem Salinas River; f) dense riparian scrub dominated by willows overhanging the San Antonio River near its confluence with the Salinas River. Photographs by Jodi M. McGraw.

g)

h)

Figure 5 (cont.): g) Sycamore alluvial woodland along the Arroyo Seco River, representing what might have historically occurred along the mainstem Salinas River; h) mature riparian woodland adjacent to intact upland habitat dominated by blue oak woodland. Photographs by Jodi M. McGraw.

Within the Salinas River project area, sycamore alluvial woodland occurs in three known locations:

- Salinas River, north of Hames Valley and South of San Ardo: approx. 11 acres (CNDDB 2007)
- Salinas River near the San Ardo oil fields: approx. 62 acres (CNDDB 2007)
- Arroyo Seco River: scattered patches between Greenfield Bridge and the Arroyo Seco campground (J. McGraw, pers. obs.; Figure 5g)

Additional patches of sycamore alluvial woodland could occur in other low-lying riparian areas, including along the Nacimiento and San Antonio Rivers downstream of the dams, and along the mainstem Salinas River.

Persistence of these woodlands could require aspects of the flooding regime to which the species is adapted. In addition, California sycamore and other riparian tree populations could be impacted by declines in the water table due to groundwater pumping.

2.3.3.4 Valley Oak Woodland

Valley oak woodland is characterized by an open canopy of valley oaks (*Quercus lobata*) with an herbaceous understory dominated by non-native annual grasses. It occurs primarily on deep, alluvial soils found on floodplains, where it is regarded as a late successional series of riparian vegetation. Valley oak woodlands provide habitat for numerous wildlife species, which in the Central Coast region includes yellow billed magpies.

Though historically patchily distributed throughout lowland valleys in California, valley oak woodlands have become rare as a result of their conversion for irrigated agricultural use and urban development. Remnant patches of this habitat are found in the Sacramento Valley, San Joaquin Valley, Tehachapi Mountains, and in valleys of the Coast Range from Lake County to western Los Angeles County.

In the Salinas Valley, there is only one small mapped patch of valley oak woodland remaining in the western foothills west of San Lucas. The rare community is also found along the San Antonio River, Nacimiento River, and Arroyo Seco. Though outside of this project focus, valley oak woodlands also occur in middle-elevation foothills of the Gabilan Mountains and the Santa Lucia Mountains.

Maintenance of valley oak woodland will require recruitment of valley oaks, which is uncommon in many areas, and survivorship of established oaks, which might be affected by reduction in groundwater required by adult trees. Also, there is some concern that flood prevention will slow development of the floodplain, limiting succession toward valley oak woodland. However, conversion of much of the land within the flood plain for urban and agricultural uses has greatly limited the area of natural vegetation and thus the potential for valley oak to recolonize.

During the most recent effort to map riparian vegetation within the Salinas River, central coast riparian scrub was mapped to include the open sand bar as well as the river channel, resulting in a total of 17,400 acres (White and Broderick 1992). It is unknown how much of this acreage is actually occupied by riparian scrub communities. Significant occurrences of the community have been observed in several locations including:

- Three river miles on the Salinas upstream of San Lucas (White and Broderick 1992)
- One river mile on the east side of the Salinas River south of Greenfield (White and Broderick 1992)
- Reaches along the lower San Antonio River within Camp Roberts (J. McGraw pers. obs.)

2.4 Riparian Species

Like other riparian areas, the riparian communities within the Salinas River have been found to support a disproportionately high diversity of animal species, when compared with other terrestrial habitats (White and Broderick 1992; Table 6). Arguably the most significant biological resource within the Salinas River project area are the populations of numerous rare bird species that rely on the riparian vegetation and adjacent aquatic and terrestrial habitat for all or a significant portion of their life history, including breeding.

Table 6: Riparian species of interest within the Salinas River Project Area. Details provided in text.

Common Name	Scientific Name	Regulatory Status	Occurrences
California Yellow Warbler	*Dendroica petechia brewsteri*	CSSC	Arroyo Seco, Nacimiento River, San Antonio River, mainstem Salinas
Tricolored Blackbird	*Agelaius tricolor*	FSC,	mainstem Salinas
Yellow-Breasted Chat	*Ictera virens*	CSSC	lower San Antonio River and adjacent mainstem
Least Bell's Vireo	*Vireo bellii pusillus*	FE, CE	Arroyo Seco, Sandy Creek
California Yellow-Billed Cuckoo	*Coccycus americanus occidentalis*	CE	none currently known
Bank Swallows	*Riparia riparia riparia*	CT	San Lorenzo Creek and mainstem Salinas near Gonzales
Foothill yellow-legged frog	*Rana boylii*	CSSC	Arroyo Seco, Reliz Canyon, Tajas Ranch (near
Southwestern pond turtle	*Actinemys marmorata pallida*	FSC, CSSC	Arroyo Seco, San Lorenzo Creek, Nacimiento River, mainstem Salinas

FE: Federally Endangered
FT: Federally Threatened
CE: California Endangered
CT: California Threatened
FSC: Federal Species of Concern
CSSC: California Species of Special Concern

2.4.1 Important Bird Areas

Between 1988 and 1992, Monterey Audobon Society observed a total of 11 bird species within the Salinas River riparian habitat located near Blanco Crossing, River Road, King City, and Bradley. This includes 11 California Species of Special Concern and numerous neotropical migratory birds which are vulnerable due to habitat loss. The intact riparian vegetation has been included in two Important Bird Areas.

2.4.1.1 Salinas River-Lower

The lower approximately 13 miles of the Salinas River, from Highway 68 west to the river mouth, is an important bird area for several reasons including (Cooper 2004):

- It contains riparian habitat that supports large populations of migrant and wintering shorebirds, wading birds, and raptors;
- It includes a lagoon, estuary, saltwater and brackish water marsh habitats, which adjoin extensive beach dunes, with the river mouth providing an undisturbed roost site for wintering and migrating waterbirds; and
- It supports 10 sensitive bird species

This area supports a notable stand of central coast arroyo willow riparian forest, brackish marsh, and freshwater marsh habitats (White and Broderick 1992).

2.4.1.2 Salinas River-Middle

The riparian habitat located along the Salinas River between the Nacimiento River and Spreckels was identified as an important bird area for several reasons including (Cooper 2004):

- It supports migrating and wintering birds;
- Portions of the area are adjacent to grassland habitat, thus providing an extension of the important bird habitats that were once more widespread in the adjacent San Joaquin Valley; and
- It supports populations of 12 sensitive bird species

This area includes several stands of mature central coast riparian forest as well as intact patches of central coast riparian scrub (White and Broderick 1992).

2.4.2 Neotropical Migratory Birds

Neotropical migratory birds are songbirds, shorebirds, waterbirds, and waterfowl species with at least some populations breeding in the United States and/or Canada that spend their non-breeding months in the tropics. Attention has centered on neotropical migrants, since this group is experiencing steep rates of population declines. However, decreasing populations have also been observed in resident bird species, which do not migrate, and temperate-zone migrants, which only migrate within North America (Roberson 2002).

The Salinas Valley and its riparian habitats in particular provide important habitat for migrating birds. Due to its north-south orientation and location near the coast, the Salinas Valley is a natural ‘funnel’ for migrating birds, which move through the valley in large numbers during spring and fall (White and Broderick 1992). Several species of flycatchers, swallows, vireos, and warblers that overwinter in the topics and breed in the California require the mature vegetation associated with intact riparian areas (Faber et al. 1989). The Salinas River also supports a diverse assemblage of birds that winter in the riparian forests, woodlands, and marshes (White and Broderick 1992).

2.4.3 California Yellow Warbler

A California Species of Special Concern, the California yellow warbler (*Dendroica petechia brewsteri*) is a summer resident of California that nests in riparian woodlands, particularly those comprised of deciduous trees and shrubs including alders, cottonwoods, and willows. Yellow warblers migrate to Mexico and South America in early fall and return to California to breed in April. Though formerly widespread and abundant, the species has experienced dramatic declines throughout much of its range likely due primarily to loss of riparian habitat, but also nest parasitism by brown-headed cowbirds (Roberson 2002).

In Monterey County, California yellow warbler are restricted to the major riparian corridors, including the Salinas River and its major tributaries; Arroyo Seco, Nacimiento, and San Antonio, but also the Carmel River. Yellow warblers also nest along Gabilan Creek. They are uncommon on non-perennial streams (Roberson 2002).

As elsewhere, yellow warblers in the Salinas basin are threatened by loss of riparian habitat to agriculture. They are also highly susceptible to nest parasitism by brown-headed cowbirds, which are much more common along the Salinas now than in the 1940s. Counts of singing yellow warblers in the high-quality riparian woodland on the Salinas River near Bradley were observed to decline by 50% during the 1980s (Roberson and Tenney 1993).

2.4.4 Tricolored Blackbird

A federal Species of Concern and California Species of Special Concern, the tricolored blackbird (*Agelaius tricolor*) is a permanent resident of California and southern Oregon that is most abundant in the Central Valley, central coast, and south coast. Highly colonial, tricolored blackbirds form dense nesting colonies between mid-April and late July in tall, dense cattails, tules, or blackberry and rose thickets near freshwater wetlands. Outside the breeding season, they forage more widely in large flocks over grasslands, pastures, and agricultural fields.

The Salinas Valley is thought to have supported large populations of tricolored blackbirds prior to widespread agricultural conversion and draining of the marshes around the lower Salinas River. More recently, tricolored blackbirds have been observed nesting along the Salinas River between the City of Salinas and the lagoon, near the confluence of Arroyo Seco, and between Bradley and San Ardo (Roberson 2002). A nesting colony was also observed in Pancho Rico Canyon east of San Ardo, despite the lack of water in the typically intermittent creek. In 1993, tricolored black bird nest colonies in Monterey County were estimated at 50-100 pairs and wintering populations were described as abundant around pastures, grasslands, cattle pens, and local marshes, when their numbers were potentially augmented by migrants from the Central Valley (Roberson and Tenney 1993).

2.4.5 Yellow-Breasted Chat

A California Species of Special Concern, yellow-breasted chat (*Ictera virens*) is a migratory songbird that breeds in riparian areas throughout much of the United States. On California's Central Coast, it is a rare and local summer resident that nests in extensive, dense riparian thickets between April and August (Roberson 2002).

Within Monterey County, yellow-breasted chats breed almost exclusively in riparian areas along the interior reaches of the Carmel and Salinas Rivers. Historically abundant and widespread, yellow-breasted chats are in decline, presumably due to loss of riparian habitat and brown-headed cowbird nest parasitism (Roberson and Tenney 1993). Currently, they are most abundant in riparian woodlands between Camp Roberts and Bradley on the Salinas River and lower San Antonio River, where fewer than 40 pairs are estimated to occur (Roberson 2002). As of 1993, a few nesting pairs were observed on Paloma Creek (tributary to Arroyo Seco), and on Gabilan Creek (Roberson and Tenney 1993).

2.4.6 Least Bell's Vireo

A federally and state Endangered Species, Least Bell's vireo (*Vireo bellii pusillus*) is a summer migrant that nests in dense, willow-dominated lowland riparian woodlands in California. It migrates to southern Baja California during the fall, and returns to nest in California in March. The species exhibits high site fidelity, as many birds return to the same territory, often placing their nests in the same shrub used the prior year (Kus 2002).

Nesting Least Bell's vireos were historically common throughout coastal southern California and the Central Valley, and were regarded as abundant in the upper Salinas Valley in the early part of last century (Roberson 2002). Within Monterey County, Least Bell's vireos are thought to have been found only on inland stream reaches away from the summer fog, as none are known to have occurred on the Carmel River, nor the Salinas River north of Greenfield. Populations have declined dramatically due to loss of habitat and nest parasitism by brown-headed cowbirds, which arrived in the Salinas Valley by the 1920s and are implicated as the main cause of the Least Bell's vireos's absence from apparently suitable habitat (Roberson and Tenney 1993).

The last sighting of Least Bell's vireo occurred in the Salinas basin occurred in 1993 in the riparian woodland on the Salinas River near Bradley. Local experts hope that, with habitat protection and brown-headed cowbird control efforts, the area will one day be recolonized (D. Roberson, pers. comm. 2007).

2.4.7 California Yellow-Billed Cuckoo

The California yellow-billed cuckoo (*Coccycus americanus occidentalis*) is a state endangered bird that nests in humid, lowland riparian woodlands primarily in the Sacramento Valley. Historically, the California yellow-billed Cuckoo was a common breeding species in riparian habitat throughout much of the low-elevation California. Habitat loss and pesticides (i.e. DDT) are though to have lead to the dramatic declines (Laymon 1998).

California yellow-billed cuckoos are not currently known to nest within Monterey County (Roberson 2002). They are thought have been a regular summer resident of the Salinas River riparian forests. Efforts to restore riparian woodlands could result in their use by yellow-billed cuckoos (Roberson and Tenney 1993).

2.4.8 Bank Swallows

A California threatened species, bank swallows (*Riparia riparia riparia*) are California summer migrants that breed in colonies located on vertical banks or bluffs in alluvial soils above streams, lakes, and the ocean. Though historically found throughout much of California, bank swallows have been extirpated from southern California, due largely to conversion of streams for flood control. Today, they primarily occur in riparian areas, especially in larger, lowland valleys within northern California (Garrison 1998).

Historically, bank swallows were common in the upper Salinas Valley. Currently, Monterey County supports only three known colonies, all of which are within the Salinas basin: two small colonies associated with a quarry along River Road near Gonzales (1-5 pairs), and a colony San Lorenzo Creek, three miles east of King City (50-70 pairs; Roberson 2002). These colonies, which are all located on private land that currently lacks permanent protection, are the southernmost colonies in California (Roberson and Tenney 1993), with the next-nearest colony located near Año Nuevo in San Mateo County (Roberson 2002).

SECTION 3: LANDSCAPE LINKAGES/WILDLIFE CORRIDORS

In addition to supporting important biological communities and sensitive species populations, the Salinas River and its tributaries play an important role in the landscape ecology of the broader Central Coast Ecoregion by functioning as a landscape linkage or wildlife corridor (TNC 2006). The intact, often dense riparian vegetation lining the streams provides cover for animals moving within what is otherwise open, and often converted habitat (i.e. agricultural fields). While the mainstem Salinas River facilitates north-south wildlife movement through the Salinas Valley, the tributaries connect foothill habitat of the Santa Lucia Range to the Gabilan and South Diablo Ranges, thus facilitate east-west movement (Figure 5h).

3.1 Importance for Conservation

Wildlife movement corridors, also called dispersal corridors or landscape linkages, can play a crucial role in maintaining biodiversity. Though historically focused on animals, more recent research indicates that corridors can also facilitate plant dispersal and populations (Johansson et al. 1996). Corridors can maintain populations and thus species through several mechanisms including:

- allowing exchange of genetic material between otherwise isolated populations
- creating connected habitat areas that are large enough for species with large home ranges, including top predators which are important for ecosystem balance (e.g. mountain lion and San Joaquin kit fox)
- increasing the size of populations and thus reducing likelihood of extirpation
- allowing recolonization of uninhabited areas after populations are extirpated
- allowing temporary redistribution (escape/recolonization) of wildlife during and after times of stress, including drought, fire, and flood

Corridors will also prove crucial to long-term persistence of species by facilitating gradual movement of plants and animals in response to a changing climate. As a north-south corridor, the Salinas River can facilitate migration along a latitudinal gradient, while intact habitat along the major tributaries to the Salinas River can allow movement along the elevation gradient from the valley to the adjacent mountains.

3.2 Potential Corridors

A prior analysis of landscape linkages in the central coast region using the mountain lion as a focal species identified the area between Bradley and San Ardo as providing an important link between the southern Santa Lucia Mountains and the Southern Diablo Range Mountains (Thorne et al. 2002). There the Salinas River floodplain is narrow (<0.5 miles wide) and the river terraces and adjacent foothills of both mountain ranges primarily support native vegetation including California annual grassland and blue oak savanna. Land use is dominated by cattle grazing, with limited irrigated crop agriculture in Hames Valley and the Salinas Valley north of the oil and gas extraction fields near San Ardo. Below the dam, the San Antonio River features well-developed riparian willow scrub and riparian woodland, while the Salinas River in this region features mature riparian forest mixed with riparian scrub.

Challenges to wildlife movement within this corridor include Highway 101, which is a four-lane highway with the northbound and southbound lands separated by an approximately 50-100 foot median. Other factors influencing use include livestock fencing and the river itself, which has flows in the winter and summer. North of this potential corridor, the valley widens and becomes more extensively farmed, thus reducing permeability by wildlife.

TNC staff identified additional landscape corridors between the Salinas River and adjacent uplands by visually assessing aerial imagery dated between 2004 and 2006 and identifying the following areas:

1. High Quality Tributaries that connect to the mainstem and support well-developed natural vegetation and/or perennial water in their lower reaches

2. Other Drainages: Areas where drainages from either the Santa Lucia Mountains or Southern Diablo Range Mountains connects with the mainstem, including culverts as well as natural drainages
3. Contact locations: Areas where the outer edge of the riparian habitat on the mainstem Salinas River comes within 0.25 miles of intact upland habitat on the foothills of either adjacent range. Areas where the distance from the foothills is greater than 0.25 miles than, but the additional distance is predominantly intact habitat, were also deemed potential linkage areas.

Table 7 indicates the following aspects of each of the 46 potential linkages identified:

- Geographic location, habitat, and adjacent land use
- Importance: an initial assessment of the linkage's potential importance within the valley
- Confidence: an assessment of the degree to which the viability of the linkage could be determined based on analysis of aerial imagery, with an "x" in the groundtruth column indicating that on-the-ground assessment is required to determine whether there are enabling features (e.g. large culverts or bridges at road crossings) or obstacles (e.g. fencing or other barriers) affecting the usefulness of the linkage.

In evaluating potential obstructions to wildlife movement, Highway 101 was considered a substantial hindrance and as such, any linkages bisected by Highway 101 without a bridge or other confirmed 'wildlife crossing' have a low rating. Use of culverts and 'underpasses' associated with roadways by wildlife ranging from black bear and deer to foxes and weasels has been documented in other areas, and linkages connected by large culverts and bridges associated with road crossings are included as potential corridors where appropriate (Brudin 2003).

Examination of the landscape linkages revealed the following general results:

1. The lower Salinas River is well connected to intact upland habitat in Fort Ord and nearby large ranches, while connectivity to the eastern foothills is limited by the City of Salinas (Figure 6a)
2. Ranches on elevated stream terraces in the western foothills between (the latitudes of) Chualar and Soledad connect the river in several relatively fragile/narrow to the eastern slopes of the Santa Lucia Mountains; whereas wide swaths of agricultural fields likely limit connectivity in the east (Figure 6b)
3. Between Soledad and Greenfield, the river is well linked to upland grassland habitat on rangeland in foothills to the east (Figure 6c)
4. Between Greenfield and King City, where the Salinas Valley is at its widest, intact riparian habitat within floodplains of major tributaries including Arroyo Seco and San Lorenzo Creek have some potential to provide corridors between the western and eastern foothills (Figure 6d)
5. Between Lockwood and San Ardo, several small tributaries and drainages innervate the agricultural fields, potentially providing connectivity in this relatively narrow portion of the valley (Figure 6e)

Table 7: Landscape linkages providing potential corridors for plant and wildlife movement within the Salinas River Project Area, noting their geographic location, areas connected, adjacent systems and land uses; providing a qualitative assessment of their importance (I) and confidence (C) in their occurrence, where L=Low, M=Medium, and H=High; and noting whether the linkage requires ground truthing to verify conditions (G) and is deemed exceptional (E). Details provided in text.

Map ID	Location	West or East of Mainstem	Areas Connected	Adjacent System(s)	Adjacent Land Use(s)	I	C	G	E	Comments
1	NE or Marina	W	Armstrong Ranch and Salinas River	Grassland, Woodland	Agriculture, Industry	L	L	x		Secondary access to Armstrong ranch. Very narrow non-ag linkage. Continuous ag and dense urbanisation east of river.
2	NE or Marina	W	Armstrong Ranch and Salinas River	Grassland	Agriculture, Aviation	H	M	x	x	Primary access to Armstrong ranch. Wide, naturally vegetated linkagriculturee. Continuous agriculture and dense urbanisation east of river.
3	SW of Salinas	W	Fort Ord and Salinas River	Oak woodland	Agriculture	H	M	x	x	The only access west of Hwy 68. Wide, natural veg, includes critical reach of Salinas River. Continuous agriculture and dense urbanisation east of river.
4	SW of Salinas	W	Bollenbacher Ranch and Salinas River	Grassland, Oak woodland	Agriculture, Residential	M	L			While this linkage exceeds the 1/4 mile buffer, this area was previously identified as a viable corridor in TNC's Hwy 68 corridor evaluation.
5	SW of Spreckels	W	Marks Ranch and Salinas River	Grassland, Oak woodland	Agriculture, Industry, Residential	H	M	x		Critical corridor for movement between two areas of dense residential development.
6	SW of Spreckels	W	Las Palmas and Salinas River	Oak woodland	Residential, Agriculture	L	L	x		This corridor is very narrow and may close if development continues. It is, however, the only link westwards within a 3.75 mile stretch of river.
7	W of Chualar	W	Violini Ranch/Bengard/TMV and Salinas R.	Grassland, Oak woodland	Agriculture, rangeland	H	M	x	x	Link ag area includes large, woodland/scrub, non-agriculture area, (possibly mining?) serving as wildlife 'catchment' area, adjacent to mainstem abuttal with foothills.
8	SW of Chualar	W	Limekiln Creek and Salinas River	Oak woodland, Grassland	Agriculture	M	L			The extent and high quality of nearby upland compensates for a slightly greater tha 1/4 mile crossing.
9		W	Unnamed drainage and Salinas River	Grassland, Oak woodland	Vineyards, Agriculture	L	L	x		Linear narrow corridor between agriculture fields, but only direct mainstem to foothills crossing for many miles.
10	SW of Gonzales	W	Unnamed drainages and Salinas River via scarp edge	Vegetated scarp: scrub, oaks	Agriculture, Vineyards	L	L	x		Egress site from mainstem as a secondary connection to multiple narrow linkages through ag lands. Very frail. Low quality, narrow, a lot of human use within a narrow area.
11	SW of Gonzales	W	Unnamed drainage and Salinas River	Scrub, oak woodland, grassland	Agriculture, vineyards	L	L	x		Narrow drainage, initially along a road, heavy ag / vineyard encroachment

Table 7: (cont.) Landscape linkages providing potential corridors for plant and wildlife movement within the Salinas River Project Area.

Map ID	Location	West or East of Mainstem	Areas Connected	Adjacent System(s)	Adjacent Land Use(s)	I	C	G	E	Comments
12	SW of Gonzales	W	Fairview Road and Salinas River	Scrub, oak woodland, grassland	Vineyards, Agriculture	M	L	x		Narrow, along Fairview Road, heavy ag encroachment
13	SW of Gonzales	W	Unnamed drainage and Salinas River	Scrub, oak woodland, grassland	Vineyards, Agriculture	M	L	x		Substantial linkage threatened by upper slope ag operations?
14	SW of Gonzales	W	Unnamed drainages and Salinas River via scarp edge	Vegetated scarp: scrub, oaks	Vineyards, Agriculture	L	L			Narrow egress initially, but continuous drainage between mainstem and foothills.
15	NW of Soledad	W	Unnamed drainage and Salinas River	Oak woodland, Grassland	Vineyards, Agriculture	M	M			Substantial potential linkage, must cross some ag ground
16	NW of Soledad	W	Unnamed drainage and Salinas River	Scrub	Vineyards, Agriculture	M	H			Branch of corridor 16
17	W of Soledad	W	Arroyo Seco and Salinas River	Sandy wash	Agriculture	H	H		x	Arroyo Seco River confluence
18	SE of Soledad	E	Foothills and Salinas River via ag field	Riparian floodplain, grassland	Agriculture	H	H		x	Foothill connection to critical Salinas reach for cross-valley movement from Arroyo Seco
19	E of Greenfield	E	Chalone Creek/Singleton Ranch and Salinas River	Grassland, Wide floodplain	Industry, Agriculture	H	H			Chalone Creek, broad foothill connection to Salinas River at Singleton Ranch
20	S of Greenfield	W	Foothills, Moore Creek, and Salinas River	Scrub, Grassland	Agriculture, Vineyards, Developed node	L	M			Monroe Creek runs across across valley floor from the mainstem to the foothills; exact nature of development unclear, heavy ag encroachment. Low quality because so narrow and so long.
21	S of Greenfield	W	Thompson Canyon and Salinas River	Grassland	Agriculture, Vineyards	L	M	x		Thompson Canyon linkage from Salinas west to foothills. Low quality because no culvert.
22	N of King City	W	Branstetter Canyon and Salinas R.	Oaks, grassland	Agriculture	L	L	x		Vegetated break between ag and within the 1/4 mile buffer, but likely no culvert under 101

Table 7: (cont.) Landscape linkages providing potential corridors for plant and wildlife movement within the Salinas River Project Area.

Map ID	Location	West or East of Mainstem	Areas Connected	Adjacent System(s)	Adjacent Land Use(s)	I	C	G	E	Comments
23	King City:	W	Pine Canyon and Salinas River	Scrub, grassland	Agriculture, Vineyards, Urban	H	L	x		Pine Canyon west to foothills, constrained by heavy encroachment of homes, agriculture
24	King City:	E	San Lorenzo Canyon and Salinas River	Scrub, grassland	Urban, Agriculture	H	L	x		San Lorenzo Canyon, east to Gabilan Range near King City - very direct cross-valley linkage heavily constrained by homes and agriculture
25	San Lucas	W	Foothills and Salinas River via culvert	Wide floodplain, Rangeland	Agriculture, Residential	L	L			Culvert linkage under Hwy 101 at San Lucas.
26	S of San Lucas	W	Foothills and Salinas River via road scarp	Rangeland	Agriculture, Vineyards	L	M			Narrow unvegetated westward linkage along 101, Lockwood and Oasis Roads.
27	S of San Lucas	W	Foothills and Salinas River via road culvert	Rangeland, Oak woodland	Vineyards	L	M			Wide outer floodplain egress (buffer boundary needs refining) but only one culvert to under 101 then linikage along roadways.
28	N of San Ardo	E	Foothills and Salinas River via road culvert	Rangeland, Oak woodland	Vineyards, Agriculture	M	M	x		Narrow, unvegetated linkages through ag fields to western foothills
29	N of San Ardo	E	Unnamed drainage and Salinas River	Rangeland	Agriculture, Industry	H	L	x		Very narrow linkage east from mainstem, near Pine Valley Road.
30	N of San Ardo	E	Foothills and Salinas River	Rangeland	Agriculture	H	M	x	X	Linkage exceeds 1/4 mile buffer in places because of proximity to extensive intact uplands and/or inclusion of uplands between floodplain and ag.
31	San Ardo	E	Pancho Rico Valley and Salinas River	Rangeland	Vineyards, Urban, Agriculture	M	L			Pancho Rico Valley through San Ardo. Close proximity to roads, but linkage itself is segregated riparian corridor.
32	SW of San Ardo	W	Foothills and Salinas River	Rangeland, Oak woodland	Vineyards, Agriculture	M	M	x		Vegetated drainage with culvert under Hwy 101
33	SW of San Ardo	W	Foothills and Salinas River	Rangeland, Oak woodland	Vineyards, Agriculture	M	M	x		Vegetated drainage with culvert under Hwy 101
34	SW of San Ardo	W	Foothills and Salinas River	Rangeland, Oak woodland		M	M			Culvert under Hwy 101

Table 7: (cont.) Landscape linkages providing potential corridors for plant and wildlife movement within the Salinas River Project Area.

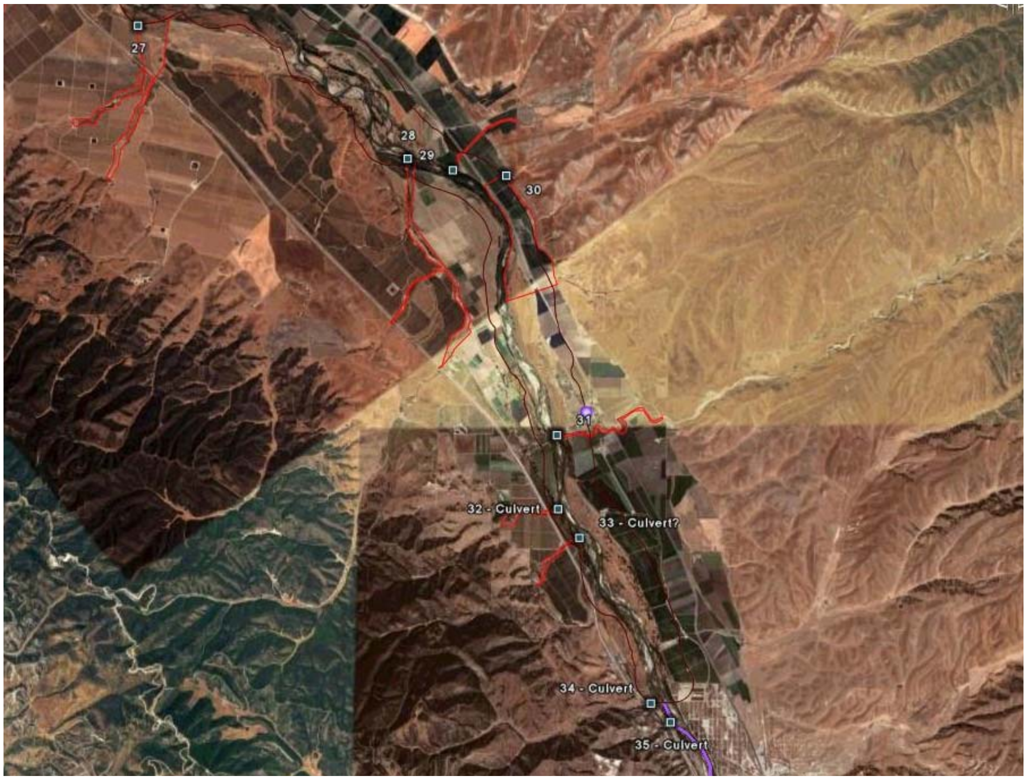
Map ID	Location	West or East of Mainstem	Areas Connected	Adjacent System(s)	Adjacent Land Use(s)	I	C	G	E	Comments
35	SW of San Ardo	W	Foothills and Salinas River	Rangeland, Oak woodland	Oilfield	M	M			Pipeline culvert under Hwy 101
36	SW of San Ardo	W	Foothills and Salinas River	Rangeland, Oak woodland	Oilfield	M	L	x		Possible culvert under Hwy 101
37	SW of San Ardo	W	Foothills and Salinas River	Rangeland, Oak woodland	Oilfield	M	L	x		Possible culvert under Hwy 101
38	SW of San Ardo	W	Foothills and Salinas River	Rangeland, Oak woodland	Rangeland	M	M			Culvert under Hwy 101
39	N of Bradley	W	Foothills and Salinas River	Rangeland, Oak woodland	Rangeland	M	M			Culvert under Hwy 101
40	N of Bradley	W	Foothills and Salinas River	Rangeland, Oak woodland	Rangeland	M	L			Possible culvert under Hwy 101
41	N of Bradley	W	Foothills and Salinas River	Rangeland, Oak woodland	Rangeland	M	M			Culvert under Hwy 101
42	N of Bradley	W	Foothills and Salinas River	Rangeland, Oak woodland	Rangeland	M	M			Culvert under Hwy 101
43	Bradley	W	San Antonio River and Salinas River	Rangeland, Oak woodland	Residential, Military	H	H		x	Nacimiento River confluence
44	S of Bradley	W	Foothills and Salinas River	Rangeland, Oak woodland	Military	M	M			Underpass linking San Antonio Drive and Bradley-Lockwood Road. Within Camp Roberts.
45	Camp Roberts	W	Nacimiento River and Salinas River	Rangeland, Oak woodland	Military	H	H		x	Broad east-west connection through reaches of S. Antonio and Salinas near confluence
46	San Ardo oilfield to county line	E	Foothills and Salinas River	Rangeland, Scrub, Oak Woodland	Rangeland, Oilfield, Residential	H	H		x	Uninterrupted eastward access for approx. 17 miles from mainstem into range as the 101 runs to the west of the river and there is almost no agricultural activity.

6. c)

d)

Figure 6 (cont.): Potential habitat linkages within the Salinas River Project Area (red polygons or yellow lines), showing: d) linkages 17-19 between Soledad and Greenfield, and d) linkages 20-26 between southern Soledad and Lockwood. Numbers correspond to map identification numbers ("Map ID") in Table 7.

e)



f)

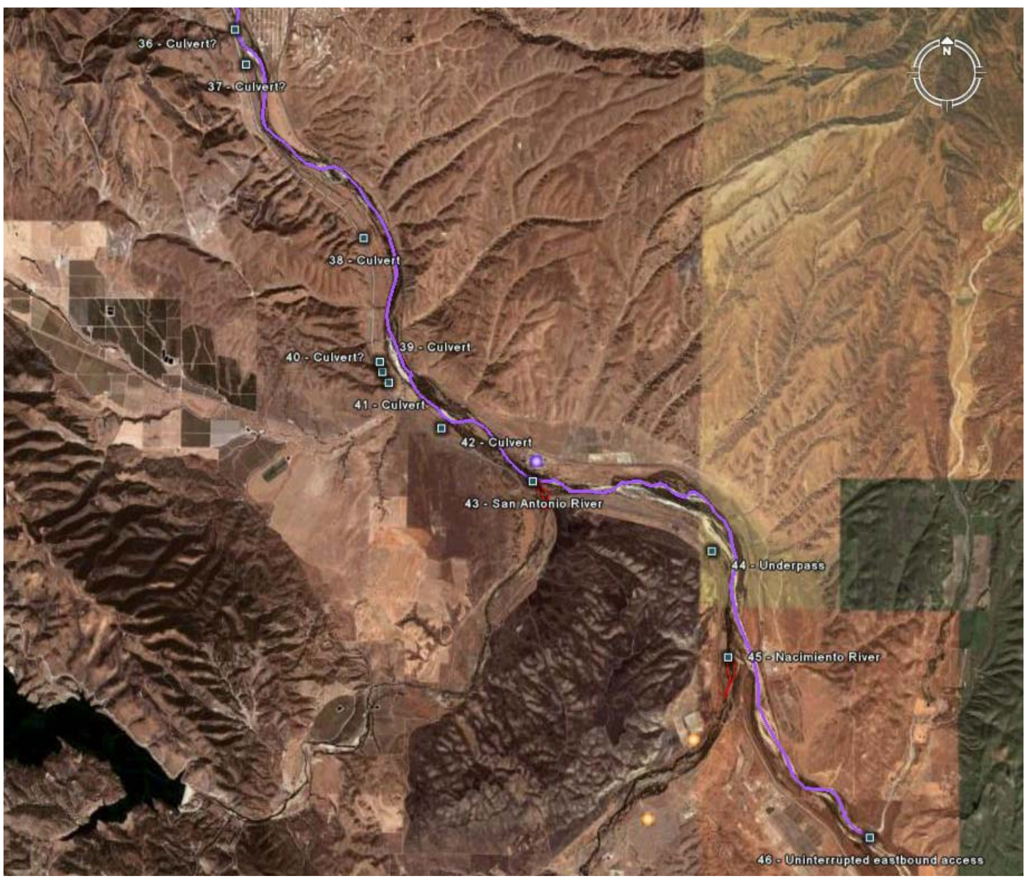


Figure 6(cont.): Potential habitat linkages within the Salinas River Project Area (red polygons or yellow lines), showing: e) linkages 27-35 between Lockwood and San Ardo, and d) linkages 36-46 between San Ardo and the Monterey County Line. Numbers correspond to map identification numbers ("Map ID") in Table 7.

6. Between San Ardo and the county line, the valley is narrow and intact riparian habitat abuts rangelands dominated by annual grassland and oak woodland in many places, such that Highway 101 presents the only major barrier to wildlife movement, with short fences typical of rangelands perhaps providing limited additional hindrance (Figure 6f)

It is important to note that the potential linkages were identified primarily based on examination of habitat structure visible in aerial imagery and personal observations from TNC staff. Further evaluation of the potential of the linkages to function as corridors would require on the ground assessment of the habitat conditions evaluated in the context of the aspects of animal species ecology and behavior which together would determine their effectiveness.

SECTION 4: THREATS

The persistence of the species and communities of the Salinas River are further threatened by factors that convert, degrade, and fragment their habitat (Table 8).

Table 8: Main threats to remaining intact upland and riparian and riverine habitats within the project area. Details provided in text.

Habitats	Threat Category	Sources
Upland	Habitat Conversion	Conversion of rangelands to cropland or ranchettes
	Habitat Degradation	Invasion and spread of non-native plant and animal species, in appropriate grazing practices, off-highway vehicle use
	Habitat Fragmentation	Road construction/widening; fence installation; development and agricultural conversion
Riparian and Riverine	Habitat Conversion	Dams, levees, gravel mining, vegetation clearing for food
	Habitat Degradation	Channel clearing, off-highway vehicle use, dumping, invasion and spread of non-native species
	Habitat Fragmentation	Roads, fences, vegetation clearing, elimination of hedgerows and silt barriers

4.1 Habitat Conversion

Very little remaining intact habitat within the Salinas River project area is protected from the threat of loss due to conversion for other uses. With the exception of the Salinas River Wildlife Refuge, there are no large protected areas, such as state parks, and instead, the vast majority of the land is privately held. Monterey County's land use policies and regulations provide limited protection to the sensitive biological resources within the region, and a lack of funding at the local and state level limits enforcement of existing protections. Voluntary efforts by landowners and local land trusts to place agricultural easements on crop lands in the Salinas Valley may reduce the threats of urban expansion towards the floodplain in some locations, and offer a useful tool for future conservation efforts.

4.1.1 Conversion of Upland Habitats

Much of the remaining intact upland habitat in the Salinas River project area, which is primarily used to graze livestock, is threatened by ongoing habitat conversion for crop agriculture. Located chiefly on the perimeter of the valley, this habitat is being converted to vineyards for wine grapes, rather than vegetable crops which dominate the lowland areas (Figure 7a).

Exurban development also threatens remaining intact habitat on the perimeter of the valley, where relatively low density housing (e.g. "ranchettes") is being developed. Meanwhile, growth in urban centers is expanding into existing farmland, much of which have been identified as prime farmland (CA Dept of Conservation 2004).

As of 2003, all or a portion of 687 parcels within the Salinas River Project Area were registered under the California Land Conservation Act (Williamson Act), and as such are voluntarily restrict to agricultural and open-space uses. These lands, which total 96,000 acres of primarily farmland and grazing land, are protected from development under the terms of 10-year rolling contracts, during which landowners pay property taxes based on their value as agricultural lands. They are not permanently protected, however, and can be developed at the end of the 10-year contract period, or sooner under certain conditions.

4.1.2 Conversion of Riparian and Riverine Habitats

Riparian and riverine communities could be further impacted by several factors that historically removed much of the original habitat, including:

- Dam construction, which converts streams to reservoirs and submerges existing riparian communities
- Channelization and in-stream vegetation management for flood control, which remove riparian vegetation along existing floodplains.
- Gravel mining, which removes in-stream habitats and riparian vegetation.
- Conversion of riparian areas for agricultural use or in response to food safety requirements (Figure 7b)

Throughout the latter half of the 20th century, several projects proposed to construct a dam on the Arroyo Seco River were ultimately abandoned (Coehlo 2001). The recent emphasis on food safety, which includes severe penalties for flooding of agricultural lands, has reignited landowner demands for increased flood protection, including calls for a flood-control dam or other structure on Arroyo Seco, the last large uncontrolled tributary to the Salinas (C. Fischer, pers. comm. 2007).

Recently, landowners have begun clearing native vegetation, including riparian vegetation, adjacent to their fields as part of food safety measures following a deadly outbreak of *E. coli*, which was linked to spinach from the Salinas Valley. Based on newly developed food safety guidelines for farming practices, which have heavily targeted the potential role of wildlife in transmitting this and other dangerous pathogens, many landowners are bulldozing intact a)

b)

Figure 7: Threats to the Salinas River ecosystem, including: a) conversion of riparian habitat for row crop agriculture, and b) conversion of adjacent upland habitat to create vineyards. Photographs by Jodi M. McGraw.

c)

d)

Figure 7 (cont): c) clearing of riparian vegetation and construction of fences along the river channel as part of recent food safety measures; d) use of river channel by off-highway vehicles can remove vegetation and degrade channel morphology. Photographs by Jodi M. McGraw.

vegetation adjacent to their fields, including that which might previously have been left intact as part of agricultural best management practices to reduce pollution of streams and provide habitat for beneficial insects (Stuart et al. 2006). In other areas, tall fences are being erected along the river to prevent wildlife access to fields (Figure 7c). Such fences also restrict movement of wildlife, including deer, badgers, and mountains lions, which might use the river as a corridor (Section 3).

4.2 Habitat Degradation

Because so little of the land within the Salinas Valley is protected or managed for natural resource values, virtually all remaining upland and riparian habitat within the project area is threatened by habitat degradation—factors that reduce the ability of the habitat to support plant and animal species, while not converting it permanently for other uses.

4.2.1 Degradation of Upland Habitats

Remaining upland habitats could be further degraded by the invasion and spread of exotic plants, non-native animals, inappropriate grazing practices, and destructive recreation by off-road vehicles, among other factors.

4.2.2 Degradation of Riverine and Riparian Habitats

Riverine and riparian communities continue to be threatened by a variety of factors which have historically degraded their habitat, including:

- Alterations to hydrology and water quality: dams, channelization, groundwater pumping, diversions, passage barriers, and point and non-point sources of pollution and sediment
- Invasive Plants: riparian species such as giant reed and numerous terrestrial species
- Non-native animals: sport fish, feral cats, feral pigs, European starlings, red foxes, etc.
- Human activities within the river: channel grading, vegetation clearing, recreational off-highway vehicle use, and dumping (Figure 7d).

4.3 Habitat Fragmentation

Factors that convert and degrade habitat also fragment riparian and upland habitats within the Salinas River project area, but reducing the size of contiguous, suitable habitat, and increasing the distance isolated habitat patches. Additional factors contributing to fragmentation include:

- Road building: creation of new roads and widening of existing roads
- Fences installation: building of new fences or increasing the height of existing fences (Figure 7c)

Elimination of existing corridors: destruction or modification of hedgerows, silt barriers, or other linear tracts of vegetation and habitat that previously allowed movement.

CONCLUSIONS

The Salinas River and the lowland reaches of its major tributaries contain numerous significant occurrences of communities and species of conservation significance that represent important opportunities for biodiversity preservation within the Central Coast Ecoregion. Despite alterations to the river's hydrology and habitat conditions, the Salinas River and several of its major tributaries supports diverse assemblages of inland freshwater fish, which include declining species such as the Pacific lamprey, Monterey roach, and Sacramento speckled dace. In addition, the Salinas basin supports important population segments of the Central California Coast (SCCC) Steelhead Evolutionary Significant Unit (ESU). Other important aquatic species known to occur in the river include the Pinnacles riffle beetle, southwestern pond turtle and the federally threatened California red-legged frog.

Though the riverine and riparian system and the adjacent upland habitats within the Salinas River project area have been altered by nearly 400 years of land use, they support relatively large occurrences of riparian communities, including mature central coast riparian forests and central coast riparian scrub. In addition to maintaining appropriate abiotic conditions and food webs for the riverine system, the riparian communities provide important habitat for numerous riparian obligate birds, including migratory birds such as the yellow warbler and the yellow breasted chat.

The Salinas River also provides an important landscape linkage between the Outer and Inner Coast Range Mountains. Intact habitat along the Salinas River and its tributaries may act as a corridor for wide-ranging terrestrial species including mountain lions, badgers, and the endangered San Joaquin kit fox, as well as other species moving between the Santa Lucia Mountains on the west side of the Salinas Valley and the Gabilan and Southern Diablo Ranges to the east. Such connectivity can be critical to maintaining genetic diversity, reduce the likelihood of extirpations of otherwise isolated populations, facilitate colonization of suitable upland habitat following extirpations, and allow plant and animal migration in response to climate change.

Persistence of the special status species populations and sensitive communities within the Salinas River is threatened by ongoing factors that convert, degrade, and fragment habitat. The riverine and riparian areas continue to be impacted by vegetation clearing both within the channel for flood control and along the banks as part of food safety measures designed to prevent wildlife entering adjacent farmlands. Ongoing alterations to the hydrology through reservoir releases greatly influence in-stream habitat conditions for animals, including most significantly, the anadromous steelhead and Pacific lamprey, which rely on seasonally timed flows for migration. The riverine and riparian systems are also being degraded by agricultural and other inputs that reduce water quality, non-native plants and animals, and use of the stream for off-highway vehicle recreation and dumping.

Remaining intact upland habitats adjacent to the river, which is critical to the maintenance of biodiversity in aquatic and riverine systems, is threatened by conversion for agricultural use and development, vegetation clearing as a food safety measure, and the invasion and spread of non-native plants and animals. Animal movement between riparian and adjacent upland habitats is being curtailed by the installation of tall fences to prevent animal movement into farm fields as part of food safety measures.

As a result, while the Salinas River ecosystem presents an important opportunity for protecting biodiversity within the Central Coast Ecoregion, successful conservation will also present many challenges. A comprehensive conservation plan is recommended to develop a strategy for conservation in the region. The conservation plan should identify steps that can be taken to protect and where feasible restore remaining riverine, riparian, and adjacent upland habitats. Because the vast majority of the land is in private ownership, the plan should identify opportunities to collaborate with landowners as well as agencies working on private lands in the region to promote conservation of the river system.

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APPENDIX:

ASSESSMENT METHODS

This assessment was conducted through a synthesis and critical analysis of the existing information about the two rivers, which was obtained through the available literature and data, local experts workshops, and interviews with local experts.

A.1 Literature Research

To obtain all information about the biological aspects of the Salinas River, the following literature databases were searched:

1. University of California Library database (Melvyl)
2. ISI Web of Knowledge (Thompson database)
3. Web-based searches of the internet using Google and Google Scholar

A variety of search terms designed to obtain information about the biology and conservation of the rivers were used. Unpublished literature including water management plans and reports was obtained from the library maintained by the Monterey County Water Resources Agency (Salinas, California). Local experts convened at workshops and interviewed to inform the project also provided important leads to additional literature, as described below. In addition, the Central Coast Regional Water Quality Control Board was contacted to request information about the Salinas River that could be incorporated in this assessment.

A.2 Database Research

To identify known occurrences of special status plants, animals, and communities (i.e. vegetation) within the project area, a records search was conducted in the California Natural Diversity Database (CNDDB 2007). In addition, TNC provided their geographic information system (GIS) data from the central coast ecoregional assessment, which includes a variety of data for TNC's conservation targets.

The GIS database compiled for this project, combined with aerial imagery available in Google Earth, was also used to identify landscape linkages that might act as corridors for wildlife movement (Section 3).

A.3 Local Experts

To obtain additional information about the biology of the project area, a series of workshops and interviews were conducted as part of this project. On May 22 and May 23, TNC project staff convened two workshops attended by agency representatives and other local experts who provided information about the project area.

Following the workshops, TNC project staff and I conducted a series of interviews with individuals and organization representatives knowledgeable about the project area. Several interviewees contributed additional unpublished reports or spatial data.

A.4 River Reconnaissance

Though a thorough evaluation of the existing site conditions was beyond the scope of this project, TNC project staff and I examined each of the two rivers through reconnaissance level surveys. The purpose of the surveys was to:

- Evaluate general conditions of the river and adjacent upland communities through inspection of each river at several locations along its length
- Examine habitat conditions within relatively intact portions of the river as previously identified by TNC.

On June 1, we examined the Salinas River and two if its major tributaries. The most upstream portion of the reconnaissance occurred on Camp Roberts, just north of Paso Robles, where we examined the Nacimiento River, San Antonio River, and upper Salinas River. From Bradley to King City, we examined the Salinas River from access points along Highway 101, which is west of the river from Bradley to Lockwood, where it crosses the river and is then on the east to King City. From King City to Soledad, the river was evaluated from Metz Road, located east of the river and highway. From Soledad to Salinas, the Salinas River was examined from access points provided off of River Road and Fort Romie Road, which are located on the west of the river and highway.