

## **Appendix F**

### **Memorandum Regarding Steelhead Habitat and Passage Effects Assessment: Salinas River**

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# Pure Water Monterey Groundwater Replenishment Project

## Steelhead Habitat and Passage Effects Assessment Technical Memorandum

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## 1 INTRODUCTION

The Pure Water Monterey Groundwater Replenishment Project is a water supply project that will serve northern Monterey County. The project will provide purified water for recharge of a groundwater basin that serves as drinking water supply, and recycled water to augment the existing Castroville Seawater Intrusion Project's crop irrigation supply. The project is jointly sponsored by the Monterey Regional Water Pollution Control Agency (MRWPCA) and the Monterey Peninsula Water Management District (Water Management District), and also includes participation by the City of Salinas, the Marina Coast Water District, and the Monterey County Water Resources Agency.

The project includes the collection of a variety of new source waters for conveyance to the Regional Wastewater Treatment Plant (Regional Plant) for treatment and recycling. The water will then be used for two primary purposes: replenishment of the Seaside Groundwater Basin and additional recycled water supply for agricultural irrigation in northern Salinas Valley (both described below).

The new source waters would supplement the existing incoming wastewater flows, and would include the following:

1. Water from the City of Salinas agricultural wash water system that currently flows to the Salinas Industrial Wastewater Treatment Facility (Salinas Treatment Facility)
2. Stormwater flows from the southern part of Salinas and the Lake El Estero facility in Monterey,
3. Surface water and agricultural tile drain water that is captured in the Reclamation Ditch and Tembladero Slough, and
4. Surface water and agricultural tile drain water that flows in the Blanco Drain.

Most of these new source waters would be combined within the existing wastewater collection system before arriving at the Regional Plant; water from Blanco Drain would be conveyed on its own directly to the Regional Plant. The combined flow would be treated using the existing Regional Plant processes and then further treated to recycle it for replenishment of the Seaside Groundwater Basin and to provide additional recycled water for agricultural irrigation in the northern Salinas Valley.

HDR, Inc. (HDR) has reviewed the potential effects of the Seaside Groundwater Replenishment Project (GWR Project) on flows in the Salinas River and assessed the potential resulting effects on the river's steelhead population. Results reported by Schaaf & Wheeler Consulting Civil Engineers (Schaaf & Wheeler) on the proposed project's effects on river surface flow show that the GWR Project would reduce the volume of water entering the Salinas River from the vicinity of Davis Road, and potentially reduce Salinas River in-stream flows. Schaaf & Wheeler provided simulated river flows resulting from each of the diversion scenarios, as well as the baseline condition near Spreckles (USGS Gage 11152500) (RM 13.2), upstream of the Salinas Treatment Facility (RM 11.2). Based on the estimated changes in instream-flow and water quality, HDR, Inc. evaluated potential effects to the Salinas River steelhead population.

## 2 AQUATIC BIOLOGICAL RESOURCES

This section describes the aquatic (fishery) resources in the area and potential direct and indirect impacts to those resources resulting from implementation of the diversion actions of the GWR Project.

Aquatic biological resources, including native fish species and federally-listed species, specifically South- Central California Coastal (S-CCC) steelhead (*Oncorhynchus mykiss*) Distinct Population Segment (DPS) is known to occur within and adjacent to areas that could be affected by the Salinas River GWR Project. and tidewater goby (*Eucyclogobius newberryi*), are The following analysis is based on a review of the most current program description, previous biological investigations and reports, and literature from federal, state and local agencies. It provides the existing setting (baseline) and identifies potential adverse effects resulting from implementation of the GWR Project.

## 3 ENVIRONMENTAL SETTING

The study area includes the immediate project vicinity (i.e., adjacent to the stormwater and Salinas Treatment Facility outflow locations at RM 11.2 and the Blanco Drain confluence with the Salinas River at RM 5.1) and upstream and downstream areas that could be influenced by diversion actions associated with the GWR Project. Areas upstream of the immediate project vicinity that could be influenced by GWR Project diversion actions are the Arroyo Seco (RM 50), San Antonio (RM 105), and Nacimiento (RM 108) rivers. The Salinas River Lagoon is downstream of the immediate project vicinity and could potentially be affected by actions associated with the GWR Project.

Unless otherwise noted, much of the discussion in the Environmental Setting Section, below is provided from MCWRA 2013b.

### 3.0.1 Salinas River Basin

#### 3.0.1.1 *Salinas River*

The Salinas River flows approximately 184 miles north/northwest from its headwaters in the Santa Lucia and La Panza Mountain Ranges in San Luis Obispo County, through the Salinas Valley and reaches the Monterey Bay near Castroville. With a drainage area of approximately 4,240 square miles, the Salinas River watershed is the largest in the central California coast area. Minor tributaries to the Salinas River include Santa Margarita Creek, Trout Creek, Tassajero Creek, Atascadero Creek, Santa Rita Creek, Paso Robles Creek, Jack Creek, Huerhuero Creek, San Juan Creek, and Big Sandy Creek. Major tributaries include the Estrella River, the Nacimiento River, the San Antonio River, San Lorenzo Creek, and the Arroyo Seco River.

The Salinas River is a managed river system, influenced by flow regulation from upstream dams, levees, and land use on the adjacent floodplains. Construction of Nacimiento and San Antonio dams in 1957 and 1965, respectively, altered the natural hydrology of the Salinas River to provide flood protection and aquifer recharge (and recreation, although this was not a primary purpose of the dams) (MCWRA 2001, California Division of Dam Safety 2010). Additionally, the upper 110 mi<sup>2</sup> of the Salinas River are controlled by the Santa Margarita Dam

(RM 154, constructed in 1942), which impounds 4,000 acre-feet and forms Santa Margarita Lake (FISHBIO 2011a in MCWRA 2013).

The Salinas River is roughly divided into two reaches based on the channel morphology. The lower 21 miles of river generally has a more narrow channel top width, typically about 500 to 1,000 feet (ft), than the upper 73 miles of river. The Salinas River channel bed and banks are sand dominated along both reaches. The bed-form is usually plane-bed (i.e., relatively flat with little vertical oscillation in the bed topography) or low amplitude dune-ripples. Channel banks are usually well-vegetated, with widely varying amounts of vegetation growing on bars and the channel bottom.

The Salinas River Diversion Facility (SRDF) located at river mile 4.8 is a diversion to supply surface waters to the Castroville Seawater Intrusion Project's non-potable agricultural irrigation system. The SRDF operates April 1-October 31. The dam has pneumatically controlled interlocking steel gates that span the width of the river, the height of the spillway gate is controlled by inflatable bladders (NMS 2007). When in operation the dam will maintain upstream water surface elevation of the impoundment and a total operational storage volume of the impoundment is within 108 acre feet (AF). The SRDF includes a fish passage system with intake screens and fish ladders that comply with National Marine Fisheries Service (NMFS) and California Department of Fish and Wildlife (CDFW) criteria (NMFS 2007).

Non-native species have been spreading pervasively in the Salinas River Watershed. The watershed has an infestation of *Arundo donax* (Giant reed) which provides little shading in the stream, and can lead to increased water temperatures and reduced habitat quality for aquatic wildlife (MCWRA 2013b).

Habitat conditions in the Lower Salinas River are generally not suitable for steelhead spawning or rearing. The substrate is primarily sand throughout and gravel is only a minor component, primarily upstream of King City. Before Nacimiento and San Antonio Reservoirs were constructed, the Salinas River had little or no flow during most years (NMFS 2007). Even with present operations and release of water from the reservoirs throughout the summer, water temperature is reportedly too high for rearing juveniles (MCWRA 2001 Appendix C). Steelhead populations spawning in the Arroyo Seco or in other tributaries to the Salinas River use the lower Salinas River as a migration corridor only. Low stream flow in the Salinas River may result in areas that are too shallow for fish to pass. Based on an assessment conducted by Dettman (1988), NMFS (2007) reported the Arroyo Seco River had the potential to support an estimated run of a few thousand steelhead.

### ***Flow Considerations***

Within the Salinas River watershed, the wet season is considered to occur from November- May while the dry season is defined as June-October.

MCWRA (2001) estimated passage flow requirements using field measurement of channel and flow characteristics and the application of objective criteria for conditions suitable for upstream steelhead migration. The study involved development of criteria for passage based procedures developed by Thompson (1972) and CDFW (2012) using water depth transects at critical passage sites. Specifically, the minimum flow for steelhead migration occurs when, at the



shallowest cross-sections, there is a depth of at least 0.6 feet across 25% of the channel width and there is a continuous section this deep across at least 10% of the channel width.

Based on the evaluation conducted by MCWRA (2001), a flow of about 72 cubic feet per second (cfs) would meet the minimum migration needs for steelhead in the Lower Salinas River downstream of Spreckels and a flow of 154 cfs would meet the minimum migration criteria upstream of Spreckels. Less flow is required downstream of Spreckels since the channel is narrower and more confined in this reach.

Under some situations the 0.6 foot depth over 25% channel width criteria have been considered to be overly restrictive and less conservative criteria have been applied (USBR 1999 in MCWRA 2001). Using a less restrictive width criterion MCWRA (2001) estimated that passage flows for adult steelhead in the Salinas River would be 94 cfs upstream of Spreckels and 60 cfs downstream of Spreckels (**Table 1**).

**Table 1. Threshold Flows for Maintenance of Steelhead Migration**

<b>Life stage</b>	<b>Required Flow Depth</b>	<b>Channel Width</b>	<b>Threshold Flow</b>
Adult Immigration	0.6 feet	25% of channel	72 cfs
Adult immigration	0.6 feet	8 feet (min)	60 cfs
Juvenile and Smolt Emigration	0.4 feet	25% of channel	56 cfs
Juvenile and Smolt Emigration	0.4 feet	8 feet (min)	50 cfs

Flow criteria for downstream migration of post-spawning adults and immature fish have not been widely developed. However, it was assumed by MCWRA (2001) that post-spawning adult steelhead and emigrating juvenile steelhead can migrate downstream over riffle areas at shallower depths than those needed by adults migrating upstream. If a depth criterion of 0.4 feet is substituted in the analysis of passage transects in the Salinas River the resulting minimum passage flow estimates for downstream migration of post-spawning adults and smolts would be 112 cfs upstream of Spreckels and 56 cfs downstream of Spreckels (MCWRA 2001). If it is also assumed that the 0.4 foot depth criteria were achieved over a continuous 8 foot channel width rather than 10% of the channel width, the minimum passage flow estimate would be further reduced to 59 cfs upstream of Spreckels and 50 cfs downstream of Spreckels (MCWRA 2001).

In addition to flow considerations provided by MCWRA (2001), NMFS (2007) set up guidelines regarding steelhead upstream and downstream migration as permit conditions associated with operating the Salinas River Diversion Facility (SRDF). Adult steelhead upstream migration triggers will be in effect from February 1 through March 31 (NMFS 2007). When flow triggers occur, flows of 260 cfs at the USGS gage near Chualar (USGS gage 11152300) will be provided to facilitate adult steelhead upstream migration of adult steelhead. To insure this minimum flow and duration, MCWRA will provide reservoir releases when necessary to augment natural flows. The number of passage days targeted for dry-normal, normal-normal, and wet-normal years are 16, 47, and 73 days, respectively (NMFS 2007).

Based on specific flow triggers that consider reservoir storage, flow, and hydrologic conditions NMFS (2007) further recommended flows to facilitate the downstream migration of smolts and

rearing juvenile steelhead in the Salinas River. In some years, flow releases for smolt migration may not occur because triggers for those releases are not met. However, in those years, NMFS (2007) required MCWRA to provide reservoir releases and SRDF bypass flows to enhance migration opportunities for juvenile steelhead and post-spawn adult steelhead (kelts) (NMFS 2007).

In April 2010 the MCWRA began operation of the SRDF as part of the Salinas Valley Water Project (SVWP) (MCWRA 2011). Operation of the SRDF involves release of water from Nacimiento Reservoir to the Salinas River throughout the irrigation season with impoundment and diversion at the SRDF located at about river mile 4.8 near the upper part of the Salinas River Lagoon (MCWRA 2011). The SRDF operates seasonally between April 1 and October 31. Beginning April 1, MCWRA provides bypass flows to the lagoon under the following circumstances. For dry year-types, MCWRA provides 2 cfs to the lagoon when the SRDF is operating or during aquifer conservation releases. For non-dry year-types, and if the combined reservoir storage is 220,000 AF or more, MCWRA provides additional supplemental bypass flows (MCWRA 2011). If the lagoon is open to the ocean, then MCWRA provides 45 cfs to the lagoon for 10 days or until the lagoon closes to the ocean, whichever occurs first, then 15 cfs to the lagoon through June 30th, then 2 cfs as long as the SRDF is operating or during aquifer conservation releases (MCWRA 2011). If the lagoon is not open to the ocean, then MCWRA will provide 15 cfs to the lagoon through June 30th, then 2 cfs as long as the SRDF is operating or during aquifer conservation releases. These bypass flows influence water quality conditions in the lagoon during the dry season. Previous to implementation of the SVWP there was no requirement for provision of flow to the lagoon and there was generally no flow to the lagoon after storm flows ceased in the spring. This was likely consistent with natural river flow patterns before development of the Salinas Valley for agriculture (MCWRA 2011).

### *Temperature Considerations*

Water temperature is measured at two locations in the Salinas River, at the Blanco Road Bridge, three miles upstream of the SRDF, and at the SRDF. Data collected during 2011 indicate that the general trend within the monitoring period showed increasing water temperatures from spring to summer and decreasing temperatures from summer to fall. Sullivan et al. (2000) was reported in RWQCB (2008) as stating that for the protection of steelhead, the maximum weekly average temperatures are 67 °F. Temperatures recorded at the Spreckels Gage range from 50 to 82 °F, with an average of 63 °F (RWQCB 2008).

Water temperatures in this stream are highly variable and dependent on reservoir releases, air temperature, and reservoir storage. In general, water released through the reservoir outlet is at a relatively constant temperature of 52°F to 54°F (NMFS 2001). The water warms rapidly as it moves downstream, generally in proportion to fluctuation in daily air temperature. At minimum release levels (25 to 30 cfs), water temperature can increase to as much as 73°F within 5 miles of the Nacimiento dam, and 75°F within 10 miles of the dam. During the summer conservation release period (with flows of 300 cfs or more), water temperature is generally maintained at less than 64°F within 5 miles of the dam, and 68°F or less within 10 miles of the dam (MCWRA 2001).

In addition, diurnal water temperature fluctuations are common. Data collected at the Chualar gage indicate an average difference of 4.5°F and a maximum difference of 8°F between maximum and minimum daily temperature in April (MCWRA 2001). In May there is as much as a 22°F daily swing in temperature and the average change is 16°F (MCWRA 2001).

### ***City of Salinas Wastewater Facility***

Three miles southwest of the City of Salinas, the Salinas Industrial Wastewater Treatment Facility (Salinas Treatment Facility) is located on the bank of the Salinas River. The City of Salinas owns and operates the plant to treat and dispose of water used to wash and prepare vegetable crops at 24 industrial food processing facilities in Salinas. The Salinas Treatment Facility consists of an aeration pond for treatment of incoming water and three large percolation ponds that dispose of water by percolation and evaporation. Additional disposal capacity during the high-inflow season (May-October) is provided by drying beds and by temporary Rapid Infiltration Basins (RIBs) between the main ponds and the adjacent Salinas River channel.

Water that percolates from the ponds either flows a short distance through the subsurface and emerges as seepage into the Salinas River or accrues to the regionally extensive shallow aquifer. The shallow aquifer is not used directly as a source of water supply, but downward percolation from the shallow aquifer is a source of recharge to the 180-Foot aquifer, which is used for water supply in the agricultural area surrounding the Salinas Treatment Facility.

#### ***3.0.1.2 Salinas River Lagoon***

The mouth of the river is a seasonal lagoon controlled by the presence of a sandbar that forms in response to changes in outflow and tidal cycles. Lagoons form in response to seasonal rainfall and water patterns, and tidal influences, with sandbar closure during dry periods (spring and summer) and breaching during wet periods (fall and winter). During wet months, high energy waves erode and breach sandbars, while high stream flows widen and deepen the estuary mouth (Capelli 1997, Smith 1990 in MCWRA 2013b). In dry months, low energy waves deposit sand and build up sandbars. After sandbar formation, water surface elevation rises as the impounded lagoon fills with freshwater streamflow. The fresh water interacts with already present salt water, occasional surf wash, and salt water that has percolated through the sandbar to create a brackish environment or even a freshwater environment if inflow is sufficient (Capelli 1997, Smith 1990 in MCWRA 2013b). Sandbars generally breach at the onset of fall and winter storms, converting the estuaries to freshwater during high flows and brackish estuaries during low inflows if there is still a substantial area of impounded water despite removal of all or most of the sandbar. In the Salinas River flooding of agricultural lands can precede the natural breaching (MCWRA 2013b).

In general, estuaries provide important habitat for juvenile steelhead and are used for rearing/feeding, freshwater to saltwater acclimation, and migration (Simenstad et al. 1982). Similarly, lagoons located at the interface of river mouths and the ocean may be a valuable habitat component for juvenile steelhead, providing abundant feeding opportunities for rearing fish and saltwater transition zones for outmigrating smolts. Preferred rearing conditions in lagoons exist when sandbars cut off ocean access which reduces salinity and promotes mixing

of the lagoon water (Smith 1990), which prevents water stratification and high temperatures, thus supporting food production and appropriate dissolved oxygen concentrations.

Historical information (i.e., late 1800s) reported by the Habitat Restoration Group et al. (1992 in NMFS 2007) indicates that the floodplain adjacent to the Salinas River and the lagoon appeared to support extensive areas of wetland-type vegetation, with riparian woodland vegetation bordering the channel in the vicinity of the present river mouth. This freshwater marsh ecosystem, including the lower Salinas River was likely an integral component of a larger wetland complex that included Elkhorn Slough and the Pajaro River mouth (NMFS 2007). Currently, the Salinas Lagoon is around 2 miles long and located in low-lying, open agriculture setting (Casagrande et al. 2003). The banks are defined leading to a stable surface area during the summer months. The northern bank is vegetated with riparian and phreatophytic vegetation with large woody debris scattered around the lagoon (Casagrande et al. 2003). A seasonal sandbar forms in the lagoon in response to the changes in outflow and tidal cycles (MCWRA 2011) and currently is reported to be utilized primarily as a migration corridor by adult and juvenile steelhead (MCWRA 2013b).

The lagoon supports a mixture of marine and freshwater fishes. Over 24 species (**Table 2**) were observed during lagoon fishery surveys conducted during the past 12 years (2002-2013). Some species appear to occur in the lagoon year round while others are seasonally present. (HES 2012, MCWRA 2013a). Steelhead and tidewater goby have been rarely observed in the lagoon surveys. Only three steelhead were observed: two in 2011 and one in 2013. Tidewater goby were recently observed for the first time during the 12 years of the lagoon survey and for the first time since 1951, when two gobies were observed during fall 2013 surveys. The tidewater goby was presumed lost from the lagoon due to levee construction and channelization (USFWS 2013). It is likely that the gobies observed in 2013 had dispersed from nearby Bennett Slough or Moro Cojo Slough (MCWRA 2013b).

**Table 2. Fish species observed in Salinas River Lagoon during lagoon fishery surveys conducted during spring, summer and fall (2002-2013)**

Species	Scientific name	Season observed		
		Spring	Summer	Fall
Arrow goby	<i>Clevelandia ios</i>	No	No	Yes
Carp	<i>Cyprinus carpio</i>	No	Yes	Yes
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>	No	No	Yes
Hitch	<i>Lavinia exilicauda</i>	No	Yes	x
Largemouth bass	<i>Micropterus salmoides</i>	No	Yes	Yes
Mosquitofish	<i>Gambusia affinis</i>	No	Yes	Yes
Pacific herring	<i>Clupea pallasii</i>	No	Yes	Yes
Pacific lamprey	<i>Lampetra tridentata</i>	Yes	No	Yes
Pacific sardine	<i>Sardinops sagax</i>	No	Yes	No
Pacific staghorn sculpin	<i>Leptocottus armatus</i>	Yes	Yes	Yes
Prickly sculpin	<i>Cottus asper</i>	Yes	Yes	Yes
Rockfish	<i>Sebastes spp</i>	No	Yes	No

Sacramento blackfish	<i>Orthodon microlepidotus</i>	Yes	Yes	Yes
Sacramento pikeminnow	<i>Ptychocheilus grandis</i>	Yes	Yes	Yes
Sacramento sucker	<i>Catostomus occidentalis</i>	Yes	Yes	Yes
Shiner surfperch	<i>Cymatogaster aggregata</i>	Yes	Yes	Yes
Starry flounder	<i>Platichthys stellatus</i>	Yes	Yes	Yes
Steelhead	<i>Oncorhynchus mykiss</i>	Yes	Yes	Yes
Striped bass	<i>Morone saxatilis</i>	Yes	Yes	Yes
Threadfin shad	<i>Dorosoma patenense</i>	Yes	No	Yes
Threespine stickleback	<i>Gasterosteus aculeatus</i>	Yes	Yes	Yes
Tidewater goby	<i>Eucyclogobius newberryi</i>	No	No	Yes
Topsmelt	<i>Atherinops affinis</i>	No	Yes	Yes
Yellowfin goby	<i>Acanthogobius flavimanus</i>	Yes	Yes	No

The lagoon is brackish in the fall due to the freshwater from the inflowing river and salt water from the high ocean waves (Casagrande et al. 2003). During major runoff events, water elevations in the lagoons rise and breaching events occur. During breaching events, which can be natural or artificial, anadromous fish such as steelhead and Pacific lamprey are able to migrate into the river (Casagrande et al. 2003). The Monterey County Water Resources Agency intervenes in the breaching of Salinas Lagoon each year by using equipment to either cause or assist the breach (Casagrande et al. 2003). The MCWRA also manages the lagoon water levels as part of flood control activities (MCWRA 2011).

Monterey County Water Resources Agency intermittently evaluates water quality of the lagoons and analyzes fish population and response to any changing conditions. Since 2002 MCWRA has conducted the Lagoon Monitoring Program, which in 2010 was modified to be consistent with the NMFS 2009 Biological Opinion for sandbar management at the mouth of the Salinas River. Fall sampling was expanded to include spring and summer surveys.

### ***Flow Considerations***

Water levels in the lagoon are monitored by a county gage and staff plate located at the Old Salinas River outlet gate, which is located in the northwestern corner of the lagoon (Casagrande et al. 2003). During non-event periods the majority of fresh or brackish water entering the lagoon comes from the Blanco Drain, located 8 km upstream from the lagoon, which is an agricultural runoff canal (Casagrande et al. 2003). There are also a number of small agricultural tile drainage systems discharging directly into the lagoon. The flow at which the Salinas River lagoon will remain open to the ocean is expected to generally range from 80 to 150 cfs (MCWRA 2005).

#### ***3.0.1.3 Arroyo Seco River***

The Arroyo Seco River enters the Salinas River at RM 50, and drains a watershed area of 303 mi<sup>2</sup>. The river extends approximately 37 miles from its headwaters within forest and wilderness area to its confluence with the Salinas River. The river is unregulated with surface flow interrupted during dry summer months as it flows across the Salinas Valley en route to the Salinas River. The Arroyo Seco River contains a majority of the steelhead spawning habitat and

half the steelhead rearing habitat within the Salinas River basin. It is the closest major tributary to the Pacific Ocean, which increases the likelihood of steelhead utilization over upstream tributaries (MCWRA 2013b).

#### 3.0.1.4 *San Antonio River*

The San Antonio River enters the Salinas River at RM 105 and drains 344 mi<sup>2</sup>. The river flows 58 miles from its headwaters in the Los Padres National Forest to the Salinas River. The San Antonio River is regulated by the San Antonio Dam (RM 5), which impounds 350,000 acre-feet. The dam was constructed in 1965 and is used for flood protection, aquifer recharge, and recreation. Prior to construction of San Antonio Dam, the San Antonio River normally did not reach the Salinas River in late summer (Monterey County Flood and Water Conservation District, 1989, as cited in MCWRA 2001). Flow prescriptions are used to maintain steelhead rearing habitat on the San Antonio River below the dam. Prior to construction of the San Antonio Dam, the San Antonio River normally did not reach the Salinas River in late summer. Aquatic habitat below the dam consists primarily of shallow-run habitat, and lesser amounts of pool and riffle habitat. The channel substrate is primarily composed of equal parts of sand and gravel with lesser amounts of cobble and silt (Nacitone Watersheds Steering Committee and Central Coast Salmon Enhancement, Inc., 2008).

#### 3.0.1.5 *Nacimiento River*

The Nacimiento River enters the Salinas River at RM 108 and drains 362 mi<sup>2</sup>. The river flows 53 miles from its headwaters in the Santa Lucia Mountains within the Los Padres National Forest to the confluence with the Salinas River. Under natural conditions, flow in the river is intermittent, drying during the summer months. The river is regulated by the Nacimiento Dam, located 10 miles upstream from the confluence with the Salinas River. The dam, constructed in 1957 impounds 350,000 acre-feet, and provides flood protection and aquifer recharge to the Salinas Valley (MCWRA 2001). Before Nacimiento Reservoir was constructed, the Nacimiento River regularly experienced levels of little or no flow in the reach currently inundated by the reservoir and in the section of river downstream of the dam (MCWRA 2001). The dam also blocks passage of steelhead to the upper portion of the basin. Dam operation and flow releases on the Nacimiento River are managed to facilitate and enhance passage for upstream migrating adult steelhead on the Salinas River, to facilitate and enhance passage for downstream migrating steelhead smolts and juveniles on the Salinas River, to maintain the Salinas River Lagoon, to provide water for Salinas River Diversion Facility (RM 4.8) and to maintain steelhead rearing habitat below the dam (MCWRA 2005). Below the dam, the Nacimiento River is characterized by a low gradient and long, wide sections with sparse riparian vegetation. Typical substrate consists of gravel with lesser amounts of sand and cobble. Water temperatures below the dam generally range from 64-69 °F, but can reach as high as 73-75°F (MCWRA 2013b).

#### 3.0.1.6 *Salinas Valley Water Project*

The Salinas Valley Water Project (SVWP) was completed in 2010 with the goals to halt seawater intrusion to aquifers, to provide water for current and future needs, and to improve the hydrologic balance of groundwater within the basin. Groundwater is the source for most urban

and agricultural water needs in the Salinas River Valley (NMFS 2007). A long-known and continual imbalance between groundwater withdrawal and recharge caused overdraft conditions and seawater intrusion into the aquifer. To address (in part) overdraft in the basin, the San Antonio and Nacimiento reservoirs were constructed in 1965 and 1957, (NMFS 2007).

The SVWP is a combination of structural and operational changes to provide surface water deliveries and aquifer replenishment. The project includes the Salinas River Diversion Facility (SRDF) located at RM 4.8 on the Salinas River, which consists of a bladder dam to impound spring, summer and early-fall reservoir releases, and a pump station to deliver surface water and reduce the need for groundwater pumping. The SVWP also includes re-operation of the San Antonio and Nacimiento dam releases as the source of surface water. The project does not provide new water sources for the basin, rather more water is released from the San Antonio and Nacimiento dams in the spring, summer, and early-fall for diversion by the SRDF to offset groundwater pumping (NMFS 2007).

As part of the SVWP goals and to minimize impacts to federally threatened S-CCC steelhead and its Critical Habitat, the MCWRA developed flow prescriptions to facilitate and enhance adult steelhead upstream migration, downstream migration of juveniles, smolts, and kelts (post-spawn adult steelhead), and spawning and rearing habitat within the San Antonio and Nacimiento rivers below the dams (MCWRA 2005). Additionally, MCWRA releases lagoon maintenance flows in conjunction with lagoon opening and closure, juvenile passage flows released from the San Antonio and Nacimiento dams, and passage conditions within the Arroyo Seco River (MCWRA 2005). The flow prescriptions and timing are tied to the S-CCC steelhead life cycle within the Salinas River (MCWRA 2005).

### **3.0.2 Species Evaluated**

#### **3.0.2.1 Native Species**

Snyder (1913) described 12 fish species within the Salinas River basin including steelhead, Pacific lamprey (*Lampetra tridentata*, new *Entosphenus tridentatus*), threespine stickleback (*Gasterosteus aculeatus*), coast range sculpin (*Cottus aleuticus*), hitch (*Lavinia exilicauda*), Sacramento pikeminnow (*Ptychocheilus grandis*), prickly sculpin (*Cottus asper*), riffle sculpin (*Cottus gulosus*), Sacramento sucker (*Catostomus occidentalis*), Monterey roach (*Hesperoleucus symmetricus*, new *Lavinia symmetricus subditus*), tule perch (*Hysterocarpus traski*), and speckled dace (*Rhinichthys osculus*). MCWRA (2001) reported that 8 of the species recorded by Snyder (1913), including tule perch, riffle sculpin, and coast range sculpin, were not collected. Moyle (2002) believes that the riffle sculpin may have been misidentified and that the roach collected is a Monterey Roach subspecies (*Lavinia symmetricus subditus*).

Casagrande et al. (2003) described the Sucker-Hardhead-Pikeminnow Assemblage as occurring in large rivers, reservoirs, with warm temperatures, and along sand or bedrock substrate, such as occurs in the lower Salinas River. Hitch, Monterey roach, and non-native species including redear sunfish and green sunfish, bluegill and black bass can also be found within this assemblage (Casagrande et al. 2003). This fish assemblage occurs in the low-elevation reaches of the western and north Salinas River watershed, including the Salinas River main-stem, the lower reaches of the Arroyo Seco River and lower Gabilan Creek (MCWRA 2013a). The Roach

assemblage is associated with small tributary streams with low to moderate gradients and rocky substrate, and the Rainbow Trout-Speckled Dace Assemblage, which typically occurs in cool headwater streams are also represented within the Salinas River watershed. The most abundant native fishes observed in the Salinas River watershed during recent years include hitch, Sacramento blackfish, speckled dace, starry flounder, and threespine stickleback (MCWRA 2011). FISHBIO (2011). **Table 3** lists native fish species known to occur in the Salinas River watershed.

**Table 3. Native Fish Species Known to Occur in the Salinas River Watershed (Source MCWRA 2013b)**

Common name	Scientific name	Special Status	Distribution
Hitch	<i>Lavinia exilicauda</i>	None	Mainstem Salinas
Monterey roach	<i>Lavinia symmetricus subditus</i>	California Species of Special Concern	Mainstem Salinas tributaries
Pacific herring	<i>Clupea pallasii</i>	None	Salinas Lagoon
Pacific lamprey	<i>Entosphenus tridentatus</i>	None	Mainstem Salinas tributaries
Prickly sculpin	<i>Cottus asper</i>	None	Mainstem Salinas, tributaries
Sacramento blackfish	<i>Orthodon microlepidotus</i>	None	Mainstem Salinas
Sacramento pikeminnow	<i>Ptychocheilus grandis</i>	None	Mainstem Salinas
Sacramento sucker	<i>Catostomus occidentalis</i>	None	Mainstem, Salinas/Reservoir
Shiner surfperch	<i>Cymatogaster aggregata</i>	None	Salinas Lagoon
Speckled dace	<i>Rhinichthys osculus</i>	None	Upper tributaries
Staghorn sculpin	<i>Leptocottus armatus</i>	None	Salinas Lagoon
Starry flounder	<i>Platichthys stellatus</i>	None	Salinas Lagoon
South Central California Coast steelhead	<i>Oncorhynchus mykiss</i>	Federally-listed Threatened	Mainstem Salinas tributaries
threespine stickleback	<i>Gasterosteus aculeatus</i>	None	Mainstem Salinas tributaries
Tidewater Goby	<i>Eucyclogobius newberryi</i>	Federally Endangered.	Salinas Lagoon
topsmelt	<i>Atherinops affinis</i>	None	Salinas Lagoon

### 3.0.2.2 Special Status Species

**Table 3** also lists the special status species in the Salinas River and Salinas Lagoon. Of the species identified as occurring within the Salinas River and could be affected by ongoing operations and subject to regulation by NMFS or USFWS, SCCC steelhead and tidewater goby were identified as occurring in the Salinas River and are the only listed species addressed in this Analysis. Monterey roach is a special status species identified by CDFW as a Species of Special Concern and is also addressed in this Analysis.

### 3.0.3 Species Considered and Eliminated from the Analysis

In 2011, Skiles et al. (2013) reported pink salmon (*O. gorbuscha*) in the Salinas River. Although pink salmon were historically distributed in coastal streams, the Puget Sound region is regarded as the southernmost extent of recent spawning habitat. Pink Salmon have been known to occur within California (Jordan and Evermann 1896, Moyle 2002, Moyle et al. 2008) and have even



been reported south of the San Francisco Bay in the San Lorenzo River (Scofield 1916). However, the four pink salmon do not suggest a population within Salinas River (Skiles et al. 2013). Therefore, the species is not considered further in this analysis.

### **3.0.4 Special Species Status Species**

#### **3.0.4.1 South-Central California Coastal Steelhead Distinct Population Segment**

##### ***ESA Listing Status***

In 1996, NMFS and USFWS adopted a joint policy for recognizing Distinct Population Segments (DPS) under the Endangered Species Act (ESA) (DPS Policy; 61 FR 4722; February 7, 1996). On August 9, 1996, NMFS identified 15 Evolutionarily Significant Units (ESU), with the South-Central California Coast (SCCC) steelhead ESU listed as a threatened species (62 FR 43937). During 2006 the SCCC steelhead status as Threatened was re-affirmed (71 FR 834).

The SCCC DPS includes all naturally spawned anadromous populations of *O. mykiss* in coastal river basins from the Pajaro River in Monterey County southward to but not including the Santa Maria River in San Luis Obispo County (65 FR 36074, 71 FR 834).

The ESA requires that NMFS review the status of listed species under its authority at least every five years and determine whether any species should be removed from the list or have its listing status changed. In September 2012, NMFS completed a 5-year status review of the SCCC steelhead DPS. Based upon a review of available information, NMFS (2012) recommended that the SCCC steelhead DPS remain classified as a threatened species.

Although *O. mykiss* exhibits both resident and anadromous life history characteristics, the SCCC steelhead DPS includes only the anadromous life form of *O. mykiss*.

##### ***Critical Habitat Designation***

Critical Habitat for SCCC steelhead was designated in February 2000 (65 FR 7764) and was reaffirmed in 2005 (70 FR 52488). Section 3 of the ESA (16 U.S.C. 1532(5)) defines critical habitat as “(i) the specific areas within the geographical area occupied by the species, at the time it is listed on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed”. The freshwater primary constituent elements of critical habitat include: 1) spawning habitat, including spawning substrate, and adequate water quantity and quality; 2) freshwater rearing habitat including floodplain connectivity, and natural escape and velocity cover; and 3) freshwater migration corridors free of obstructions, with water quantity and quality conditions that allow movement (NMFS 2005, MCWRA 2013b).

Critical Habitat on the Salinas River watershed is designated from the mouth upstream to 7.5 miles below the Santa Margarita Lake, Arroyo Seco River, Nacimiento River (below the dam), San Antonio River (below the dam), and the upper Salinas River tributaries (NMFS 2005, MCWRA 2013b). The primary constituent element of critical habitat that could potentially be affected by the Proposed Project includes migration habitat in the Salinas River.

## ***Taxonomy***

The taxonomic history and nomenclature of steelhead is complex and difficult to reconcile. The species has been described with at least 22 scientific names in five genera and is known by many common or colloquial names (Scott and Crossman 1973; Healey and Jordan 1982). Until 1989, the primary scientific name used for steelhead from western North America was *Salmo gairdneri*. However, Smith and Stearley (1989) presented evidence that *Salmo gairdneri* was the same species as the previously described *Salmo mykiss*, and was more similar to Pacific salmon (*Oncorhynchus*) than to Atlantic salmon (*Salmo*). Thus, the scientific name *Oncorhynchus mykiss* was adopted for steelhead and rainbow trout in 1989.

Based on genetic and distributional information, Boughton et al. (2006) identified 41 historically independent populations of SCC steelhead in the DPS, including three populations in the Salinas River (Moyle 2008). Three populations are recognized in the Salinas River due to its large size, which likely allows sufficient geographic isolation to maintain multiple populations (Boughton et al. 2006). These 41 populations are divided into four biogeographical regions including (from north to south): Interior coast range, Carmel Basin, Big Sur Coast, and San Luis Obispo Terrace (Boughton et al. 2007 as cited in Moyle 2008). The Salinas River occurs within the Interior Coast Range Biogeographic Population Group (BPG; NMFS 2012 in MCWRA 2013).

## ***Population Trends***

The limited documentation on current abundance suggests the overall population in the SCCC steelhead DPS is extremely small. Estimating the magnitude of the departure of the population from historical conditions is further hampered because the run size for most watersheds continues to be poorly characterized and major impacts leading to subsequent declines occurred prior to most modern fish investigations in the SCCC steelhead DPS. The sporadic presence of steelhead in many watersheds in the SCCC steelhead DPS further confounds assessment efforts. Nonetheless, investigations conducted since 1996 (Busby et al. 1996, Boughton et al. 2006) indicate that of the 39 watersheds that historically supported anadromous runs, virtually all continue to be occupied by native *O. mykiss*, though most of the populations are at historically low levels (NMFS 2013).

Recent status reviews conducted by Busby (1996), Good et al. (2005), and Williams et al. (2011) indicated that steelhead populations in the region declined dramatically from the 27,000 estimated at the turn of the century.

## ***Life History Overview***

Much of the following discussion is derived from MCWRA 2013b.

Steelhead are a form of rainbow trout that migrate to the ocean as juveniles and return to inland waters as adults to spawn in a process known as anadromy. All steelhead within the SCCC steelhead DPS are considered “winter steelhead” based on their migratory timing and behavior; ascending streams during the winter when winter rainfall results in suitable flow and temperature (Busby 1996, Moyle 2002). SCCC steelhead require pools with low velocities in association with instream and near stream cover such as large woody debris, undercut banks, or submerged or overhanging vegetation, can provide desirable resting areas for migrating adult

steelhead. The migration of adult SCCC steelhead is strongly associated with high winter and spring flows that provide a continuous hydrological connection between the ocean and upstream habitat (NMFS 2012). The pulse of upstream migration is believed to coincide during storm runoff conditions when flows are elevated. Adult upstream migration times vary according to life history type (e.g., winter run versus spring-run) and climatic conditions (i.e., the timing of higher winter and spring flows) (MCWRA 2013b).

Winter steelhead fish are reported to enter freshwater to spawn between November 1 and April 30 (Barnhart 1986), with peak numbers occurring in January and February (Moyle 2002). NMFS (2007) states that SCCC steelhead primarily migrate from December through April in the Salinas Region. Steelhead spawn in cool, clear, well-oxygenated streams with suitable depth, current velocity, and gravel size (Reiser and Bjornn 1979, Barnhart 1986). Steelhead typically select spawning areas at the downstream end of pools, in gravels ranging from approximately 0.5 to 4.5 inches in diameter (Pauley et al. 1986). Once they reach their spawning grounds, females use their caudal fin to excavate a nest (redd) in streambed gravels where they deposit their eggs. Steelhead are unique among Pacific salmonids in that they can be iteroparous (may be able to return the ocean and then spawn again in one or more subsequent years). Eggs incubate for 25–30 days, depending on water temperatures (warmer temperature will decrease incubation time, which is reported to occur in the Salinas River watershed), then hatch into alevins (larval stage). The alevins remain in the gravel for an additional 2–5 weeks after hatching, depending on temperature, before emerging in spring or early summer as fry (Shapovalov and Taft 1954, Barnhart 1986). Following emergence, steelhead juveniles (fry) feed in shallow, low-velocity areas such as stream margins and low-gradient riffles, then move to faster, deeper water as they increase in size (Bjorkstedt et al. 2005). In the summer and late-fall, as flows lessen and riffle area decreases, juvenile steelhead may move into pools (Barnhart 1986). During winter as water temperatures decrease and flows increase, juveniles seek hydraulic refuge within pools, interstitial spaces in cobble and boulder substrates, or near large woody debris (MCWRA 2013b).

As fry grow they develop marks on their sides and become known as “parr”, which is the juvenile life stage (Moyle, 2002). After 1 to 3 years of rearing in freshwater, most juvenile steelhead begin the process of smoltification and proceed to migrate downstream toward the ocean. Young steelhead feed on a wide variety of aquatic and terrestrial insects, and emerging fry are sometimes preyed upon by older juveniles (NMFS 2007). Steelhead smolts may immigrate to the ocean from January through June on the receding limb of the winter hydrograph. NMFS (2012) states that outmigration usually occurs in the late winter and spring. These fish may reside in the ocean for between 2 and 4 years (Barnhart 1986; Moyle 2002) prior to returning to spawn. Habitat needs in the Salinas River for emigrating steelhead (smolts) likely are similar to those for rearing juvenile steelhead. Migrating smolts are particularly vulnerable to predation, and physical structure and cover (refugia) are important for survival of this life stage. Similar to rearing juveniles, outmigrants rely on the presence of adequate food and suitable resting pools. Lagoons and estuaries at the river mouth are often very important for the rearing of larger juveniles and may provide essential feeding opportunities for smolts prior to entering the ocean (Smith 1990, MCWRA 2013b).

Densities of juvenile steelhead in streams are greatest where in-stream cover and their invertebrate food source are diverse and abundant. The distribution and abundance of rearing juveniles is influenced by food availability, predation and competition, and the quantity and quality of suitable habitat (Bjornn and Reiser 1991). Temperature is also an important factor for juvenile rearing conditions. In general, water temperatures less than 59°F are suitable for summer rearing of juvenile steelhead, while temperatures greater than 77°F are potentially lethal, and temperatures above 72°F may affect feeding and fitness (Bjornn and Reiser 1991, NMFS 2011, MCWRA 2013b).

Downstream migrating steelhead exhibit three possible life history strategies based upon usage of lagoon and stream rearing habitat: stream rearing, lagoon rearing, and combination stream and lagoon rearing (Hayes et al 2008). Stream-reared steelhead spend one–three years in the stream, and then migrate to the ocean with minimal lagoon residence. Lagoon-reared steelhead spend only a few months in the stream before migrating to the lagoon where they will rear for typically one year. The combination stream and lagoon strategy will rear for 1–2 years in the stream and 1–10 months in the lagoon before immigrating to the ocean. Conditions for growth can be very good in lagoons relative to stream habitat, and thus fish in lagoons tend to achieve a larger size-at-age than their stream-reared counterparts (Smith 1990, Hayes et al. 2008). Since larger smolts tend to have higher ocean survival, growth during lagoon rearing may increase ocean survival of steelhead smolts (MCWRA 2013b).

### ***Steelhead Habitat in the Salinas River***

Much of the following discussion is derived from MCWRA 2013b.

The mainstem Salinas River is a migration corridor for adult steelhead migrating from the ocean to spawn in tributaries (NMFS 2007). Kelts, smolts, and juveniles use the river to migrate downstream to the ocean or lagoon. The lower Salinas River has a sandy substrate with a broad channel with no spawning or rearing habitat present, (NMFS 2003). Most spawning and rearing that does occur in the Salinas River Basin occurs in tributary streams (NMFS 2003, NMFS 2007). The Salinas River between the confluence with the Pacific Ocean and below the upstream dams is characteristic of a depositional environment where transverse, lateral, and point bars form the predominant channel pattern. The substrate is primarily sand throughout, and coarser gravel is only a minor component, primarily upstream of King City. Before Nacimiento and San Antonio Reservoirs were constructed, the Salinas River had little or no summertime flow in most years due to groundwater pumping (NMFS 2003). Even with present operations and release of cooler water from the reservoirs throughout the summer, water temperatures are too high for rearing juveniles (MCWRA 2001 Appendix C). As such, steelhead use of upper Salinas River tributaries depends upon maintaining a migration corridor in the mainstem Salinas River. The current migration corridor of the lower Salinas River is limited by the availability of adequate flows to provide passage over long distances to suitable spawning and rearing habitat (NMFS 2007). Adequate migration flows are highly annually variable. Groundwater pumping has also affected these flows, and levees, channel maintenance, road crossings, and removal of riparian vegetation have reduced the availability and quality of migration habitat for steelhead (NMFS 2007, MCWRA 2013b).

### ***Steelhead in the Salinas River Lagoon***

Habitat conditions in the Salinas River Lagoon are generally not suitable for steelhead spawning or egg incubation, but could potentially support rearing. When the river mouth is open, the lagoon is tidally influenced and sustains saltwater conditions. When the river mouth is closed, the lagoon is typically fresh with good water quality conditions, specifically when Salinas River inflow is adequate and no saltwater intrusions occur. The transition period between saltwater and freshwater conditions may result in salinity stratification that can contribute to elevated temperatures and low dissolved oxygen levels, conditions not suitable for rearing juveniles. Thus, the lagoon is believed to be utilized primarily as a migration corridor by adult and juvenile steelhead.

### ***Current and Ongoing Studies in the Salinas River Watershed***

MCWRA has conducted fisheries studies on the Salinas River Watershed including the Nacimiento, Arroyo Seco, and Salinas Rivers and the Salinas River Lagoon (MCWRA 2011, 2012, 2013a). Studies focused primarily on these tributaries to the Salinas River because the tributaries historically provided the best spawning and rearing habitats in the watershed. Additionally, MCWRA (2011, 2012) measured conductivity, dissolved oxygen, and water temperature on the Salinas River and Lagoon and conducted an impoundment survey at the SRDF.

During 2010 MCWRA developed and implemented a Juvenile Outmigration Monitoring Program to: (1) determine the abundance of downstream migrating steelhead smolts in the Salinas River Basin; (2) determine the relative contribution of the tributaries on smolt abundances to the overall Salinas River Basin abundance; (3) characterize the migration timing of steelhead smolts; and (4) evaluate potential relationships to environmental factors. A set of three rotary screw traps (RST) was installed and operated in the Salinas River Watershed at three locations, one each on the Arroyo Seco River, Nacimiento River and Salinas River. Sampling was conducted from March 12 through May 28 during 2010 (MCWRA 2011) and during the same time period in 2011 (MCWRA 2012).

During the November 16, 2010 impoundment survey, no *O. mykiss* were observed (MCWRA 2011). However, electrofishing and seining surveys conducted on the Nacimiento and Arroyo Seco rivers during 2010 resulted in capture of *O. mykiss* on the Arroyo Seco River (MCWRA 2011). During the 2010 juvenile outmigration survey period, a total of 140 *O. mykiss* were captured in the Arroyo Seco River, which led to an abundance estimate of 480 juvenile *O. mykiss*. No *O. mykiss* were captured in the Nacimiento River and only two *O. mykiss* were captured on the Salinas River, so no abundance estimates could be generated (MCWRA 2011).

The impoundment survey was also conducted during 2011, but was not completed due to unforeseen environmental conditions not allowing efficient sampling to occur (MCWRA 2012). Electrofishing and seining was also conducted during 2011 in the Nacimiento and Arroyo Seco rivers. Twenty eight *O. mykiss* were captured in the Arroyo Seco River and no *O. mykiss* were captured in the Nacimiento River. The Salinas Basin Juvenile *O. mykiss* Outmigration Monitoring report published in September 2011 (Appendix A of MCWRA 2012) documented the second year of outmigration monitoring in the Salinas River watershed. A total of 64 *O.*

*mykiss* were captured in the Arroyo Seco River, resulting in an abundance estimate of 332 *O. mykiss* for the sampling season. No *O. mykiss* were captured in the Nacimiento River and only two *O. mykiss* were captured on the Salinas River, so no abundance estimates could be generated (MCWRA 2012).

The 2011 study concluded that similar to 2010 there were no apparent overall relationships between downstream migration timing, water temperature, or dissolved oxygen (MCWRA 2012). The report further suggested that that migration timing may be affected by turbidity, with small peaks in migration occurring during small changes in turbidity. However, because turbidity and flow covary, it is difficult to identify the influences of turbidity and flow independently (MCWRA 2012).

Non-salmonid species captured during the 2010 and 2011 surveys conducted by MCWRA (2011, 2012) are presented in those reports.

MCWRA conducts sandbar management at the mouth of the Salinas River as part of its flood control activity (MCWRA 2013a). The Lagoon Monitoring Program, conducted by MCWRA since 2002 was altered in 2010 to be consistent with the NMFS 2009 Biological Opinion for sandbar management at the mouth of the Salinas River (MCWRA 2011). The Biological Opinion (NMFS 2009) calls for fish population sampling in the Salinas River Lagoon during spring (April/May), summer (June-August), and fall (October or early November) (MCWRA 2013a). Sampling is focused on capturing rearing juvenile steelhead that may be present in the lagoon (MCWRA 2013a). The objective of the sampling is to determine whether steelhead are present, and evaluate steelhead distribution, relative abundance (catch per unit effort), and condition (MCWRA 2013a). Sampling is conducted at accessible and appropriate stations from the mouth upstream past Highway 1 to approximately river mile 3. Fish are captured using large beach seines (MCWRA 2013a).

The lagoon monitoring in 2011 began in April with high flows from the Salinas River and an open lagoon (MCWRA 2012). The lagoon was closed for the October sampling. The fish population sampling was conducted May10-11, August 23-24, and October 25-26, with sampling occurring at standard locations. Fish sampling occurred using large beach seines. For the first time since 2002, juvenile steelhead were captured during each of the three sampling periods (MCWRA 2012). However, only one individual was captured during each of the three surveys. The winter conditions of 2010-2011 led to good migration conditions and the flow at Spreckles remaining high through late-May, led to conditions at Arroyo Seco that would support adult steelhead migration (MCWRA 2012), which is in agreement with the smolt trapping conducted during 2011 that documented migration of juvenile steelhead from the Arroyo Seco River with the majority of migrating juveniles being smolts and silvery parr. Smolts would pass quickly through the estuary while parr and young-of-year may spend time rearing in the estuary (MCWRA 2012). The low number of parr and young-of-year migrating from the Arroyo Seco River is consistent with the lack of observed steelhead rearing in the Salinas River lagoon (MCWRA 2012).

The water conditions in 2012 were dry and resulted in low flows during migration periods for adult steelhead in the Salinas River system, but adequate flows for migrating smolts (MCWRA

2012). The late season rain in March and April also led to high flows likely beneficial for smolts (MCWRA 2013a). In 2012, the diversion gates were raised on April 2, 2012 and lowered on April 14, 2012 (due to lack of demand) then raised on May 1, 2012 for the rest of the season (MCWRA 2013a). With a full impoundment behind the inflatable dam, a minimum of 2 cfs was bypassed to the Salinas River Lagoon for 27 days (October 20th thru November 15th) (MCWRA 2013a). Impoundment of water at the SRDF ended on November 15, 2012 and the gates were completely lowered (MCWRA 2013a). During the irrigation season flows were bypassed through the fish ladder and the regulating weir at the SRDF (MCWRA 2013a). Bypass flows averaged 10-22 cfs throughout the season (MCWRA 2013a).

The 2007 NMFS Biological Opinion stated that one of the terms and conditions of the Biological Opinion requested that adult steelhead escapement monitoring be conducted using a Dual Frequency Identification Sonar (DIDSON; Lake Forest Park, Washington, USA). The escapement-monitoring program was to be conducted for a minimum of 10 years, unless NMFS and MCWRA agree to an alternative timeframe. In 2011 an adult steelhead escapement Monitoring program was set up with a combined resistance board weir and VAKI Riverwatcher fish counting system, when the weir became inoperable, a Dual Frequency Identification Sonar was installed and used (MCWRA 2012). Due to multiple factors, monitoring was not conducted during the entire timeframe outlined in the Biological Opinion (December 1 to March 31) (MCWRA 2012). Between January 19, 2011 and February 17, 2011, 23 steelhead passage events were detected by the VAKI Riverwatcher system at the Salinas River Weir, 18 upstream passages, and 5 downstream passages, with a total of 13 adult steelhead documented (MCWRA 2012). Although steelhead cannot be distinguishable from salmon with silhouettes alone, based on passage timings and the fact that the Salinas is not known to support any salmon species, the assumption was made that silhouettes observed were steelhead (Cassagrande et al. 2003, MCWRA 2011).

During the 2012 period monitoring protocols were amended regarding the weir and flow events. Unlike the previous season, the weir was operated during the entire monitoring period (December 1 through March 31) established by the Biological Opinion (NMFS 2007). Weir monitoring was initiated on November 30, 2011 and terminated on April 2, 2012.

From November 30, 2011, through April 2, 2012, the Riverwatcher system recorded a net upstream passage of 17 adult steelhead (19 recorded passing upstream and 2 recorded passing downstream), which was an increase of four adult steelhead net upstream passages during the previous monitoring season (MCWRA 2013a). No apparent relationships between migration timing, flow, water temperature, turbidity, and dissolved oxygen were identified during the 2012 migratory period for steelhead. However, failure to detect such trends and relationship is (at least partially) attributable to a very small population size of steelhead in the Salinas basin (MCWRA 2012). Furthermore, the 2011/2012 winter was relatively “dry” that resulted in only two very small peaks in flow at the weir (MCWRA 2013a). Future monitoring efforts may yield additional information and elucidate relationships between upstream migration of steelhead and environmental variables.

### 3.0.4.2 Tidewater Goby

#### **Status and Distribution**

The tidewater goby (*Eucyclogobius newberryi*) is listed as threatened. It is a small fish that inhabits coastal brackish water habitats entirely within California, ranging from Tillas Slough (mouth of the Smith River, Del Norte County) near the Oregon border south to Agua Hedionda Lagoon (northern San Diego County). The tidewater goby is known to have formerly inhabited at least 134 localities, including the Salinas River. Presently 23 (17 percent) of the 134 documented localities are considered extirpated and 55 to 70 (41 to 52 percent) of the localities are naturally so small or have been degraded over time that long-term persistence is uncertain.

This species was listed by the U.S. Fish & Wildlife Service (USFWS) as endangered in 1994 (USFWS 1994). The 5-year review conducted in 2007 recommended down-listing to threatened status (USFWS 2007). The USFWS has determined that reclassifying the tidewater goby as threatened is warranted, and, has proposed to reclassify tidewater goby as threatened (Federal Register: March 13, 2014; Volume 79, Number 49).

Snyder (1913) did not find tidewater goby in his survey of the Salinas River; however, Hubbs (1947) collected tidewater goby in low to moderate abundance at three locations in the Salinas River Lagoon in August 1946. Tidewater gobies were recently collected again in the Salinas Lagoon in 2013 (HES 2014). Tidewater goby have also been found in Bennett Slough (northern end of Elkhorn Slough) (USFWS 2005). The critical habitat designation for tidewater goby includes Bennett Slough (north of the project area) and the Salinas River (USFWS 2013). The Salinas River however, does not include any special management considerations or protection of the essential physical or biological features, which include water diversions, alterations of water flows, and groundwater overdrafting because location is outside the geographical area occupied by the species at the time of listing.

The following life history and habitat discussion are primarily summarized from the Tidewater Goby Recovery Plan (USFWS 2005) and HES (2014).

#### **Life History**

Tidewater goby generally live for only 1 year, with few individuals living longer than a year. Reproduction occurs at all times of the year. Spawning activity peaks twice, once during the spring and again in the late-summer. Fluctuations in reproduction are probably due to death of breeding adults in early summer and colder temperatures or hydrologic disruptions in winter. Male tidewater gobies begin digging breeding burrows in relatively unconsolidated, clean, coarse sand, in April or May after lagoons close to the ocean. After hatching, the larval tidewater gobies emerge from the burrow and swim upward to feed on plankton. Juvenile tidewater gobies become benthic dwellers at 16 to 18 mm SL. Tidewater gobies are known to be preyed upon by native species such as small steelhead, prickly sculpin, and staghorn sculpin.

The USFWS characterizes tidewater goby populations (i.e., localities) along the California coast as metapopulations (a group of distinct populations that are genetically interconnected through occasional exchange of animals) (USFWS 2007). While individual populations may be periodically extirpated under natural conditions, a metapopulation is likely to persist through colonization or re-colonization events that establish new populations (USFWS 2007). Local



populations of tidewater gobies occupy coastal lagoons and estuaries that, in most cases, are separated from each other by the open ocean. Very few tidewater gobies have ever been captured in the marine environment (Swift et al. 1989), which suggests this species rarely occurs in the open ocean (USFWS 2007). Some tidewater goby populations persist on a consistent basis (potential sources of individuals for re-colonization), while other tidewater goby populations appear to experience intermittent extirpations. Local extirpations may result from one or a series of factors, such as the drying up of some small streams during prolonged droughts, water diversions, and estuarine habitat modifications (USFWS 2007). Some localities where tidewater gobies have been extirpated apparently have been re-colonized when extant populations were present within a relatively short distance of the extirpated population (i.e., less than 6 miles (10 kilometers)). More recently, another tidewater goby researcher has suggested that re-colonizations have typically been between populations separated by no more than 10 miles (16 kilometers). Flooding during winter rains can contribute to re-colonization of estuarine habitats where tidewater goby populations have previously been extirpated. The closest known populations that could recolonize the Salinas River Lagoon is in the Elkhorn Slough. The mouth of Elkhorn Slough is connected to the Salinas River Lagoon through the Old Salinas River. The mouth of Elkhorn Slough is about 7 miles (11 kilometers) north of the Salinas River Lagoon.

### *Habitat Characteristics*

The tidewater goby favors the calm conditions that prevail when the lagoons are cut off from the ocean by beach sandbars. They are bottom dwellers and are typically found at water depths of less than 3 feet. Tidewater gobies typically inhabit areas of slow-moving water, avoiding strong wave action or currents. Particularly important to the persistence of the species in lagoons is the presence of backwater, marshy habitats, which provide refuge habitat during winter flood flows. Optimal lagoon habitats are shallow, sandy-bottomed areas, surrounded by beds of emergent vegetation. Open areas are critical for breeding, while vegetation is critical for overwintering survival (providing refuge from high flows) and probably for feeding.

USFWS (2005) identify several criteria for lagoon conditions that favor tidewater gobies. These include: little or no channelization; allowing closure to the ocean for much of the year so that tidal fluctuation is absent or minimal; fresh unconsolidated sand is optimal for reproduction; high quality of inflowing water to increase habitable area of a lagoon in summer. Nutrient enrichment can stimulate algal blooms, deplete oxygen, and lead to hydrogen sulfide formation. Most fish species are intolerant of low dissolved oxygen and high hydrogen sulfide concentrations. Non-native predatory fish should be excluded. Centrarchid fish (sunfish and bass) and tidewater gobies are not usually found together and may not be able to coexist.

Gobies may move upstream during winter rains and high flows of inlet streams as well as during the summer when algal blooms and hydrogen sulfide forms in the substrate and enters the water column. During this period most fish are found at the upper end of lagoons where freshwater inflow occurs or at the seaward end where occasional waves wash into the lagoon.

### 3.0.4.3 *Monterey Roach*

#### *General Information on the Monterey Roach (Lavinia symmetricus subditus)*

Monterey Roach (*Lavinia symmetricus subditus*) is designated as a California Species of Special Concern (CSC), which is a designation conferred by the CDFW for those species that are considered to be indicators of regional habitat changes or are considered to be potential future protected species. Species of special concern are not necessarily afforded protection under the Fish and Game Code unless they are also identified in the code as California Fully Protected Species. The CSC designation is intended by the CDFW for use as a management tool to take these species into special consideration when decisions are made concerning the development of natural lands.

The Monterey form of California Roach formerly were widely distributed throughout streams in the Monterey Bay drainage, however, they are currently less widely distributed due to habitat loss and interspecific competition (Moyle 2002, MCWRA 2013b). They tend to be most abundant when found by themselves or with just one or two other species (Moyle 2002, MCWRA 2013b). In the absence of predatory fish species, roach will utilize the open waters of pools; otherwise they often stay within pool margins and amongst shallow water areas. Roach are omnivorous, mainly feeding on the bottom, but they can also feed on drift organisms such as terrestrial insects (Moyle 2002, MCWRA 2013b).

Little is known regarding the current status and distribution of Monterey roach in the Salinas River watershed. Monterey roach were collected on the Salinas River at RM 109 during recent rotary screw trap surveys (MCWRA 2013a). However, roach have not been reported to occur in the lower Salinas River, downstream of the Project. Roach have been reported to occur in the warmwater reaches of neighboring watersheds, including lower Natividad Creek/Laurel Pond, the lower Santa Rita Creek drainage, the Reclamation Ditch, Tembladero Slough, and the Old Salinas River.

## 4 IMPACT ANALYSIS METHODS

### 4.0.1 Impact Analysis Approach

The impact assessment addresses impacts on SCCC steelhead, tidewater goby and Monterey roach in the Salinas River by considering the proposed project long-term hydrologic changes associated with each of three diversion scenarios associated with the Groundwater Replenishment Project.

Each scenario is evaluated relative to a baseline condition that is defined as historic flow in the Salinas River near Spreckels plus the Salinas Industrial Wastewater Treatment Facility (Salinas Treatment Facility) outflow plus Salinas stormwater outfall. The baseline condition is also referred to as the Existing Condition scenario. The diversion scenarios are broadly defined as follows:

- Scenario A includes diverting Salinas stormwater outfall and Salinas Treatment Facility outflow, with no diversions from Blanco Drain
- Scenario B includes diverting Salinas stormwater outfall and Salinas Treatment Facility outflow, in addition to 2.99 cfs from Blanco Drain
- Scenario C includes diverting Salinas stormwater outfall and Salinas Treatment Facility outflow, in addition to up to 6 cfs (typically only up to 4.6 cfs) from Blanco Drain

Detailed assumptions associated with each of these scenarios are provided by Schaaf and Wheeler (2014).

The requirements for conducting analyses under CEQA include utilizing the best available information to conduct impact assessments. In the absence of final design specifications associated with all of the project components, environmental documents often rely on the use of qualitative analyses, which rely on an understanding of potential impact mechanisms and understanding of species habitat utilization and life history characteristics. These analyses focus on the types of impacts that could occur on a species that could be present at a general location during a general time of year. For each of the scenarios identified above, the impact mechanism with the highest potential for affecting SCCC steelhead in the Salinas River is a reduction in flow during adult immigration and juvenile outmigration (including smolt outmigration).

Because the diversion scenarios may result in reductions in river flows, the impact assessment focuses on these and other habitat based elements (e.g., water quality). The analytical framework used to assess these potential impacts is described below.

#### 4.0.1.1 *Analytical Tools*

The SCCC steelhead impact assessment relies on historic hydrologic data obtained from the Spreckels gage that has been conditioned based on assumptions regarding stormwater outfall and Salinas Treatment Facility outflow. By conditioning the data based on these assumptions, the historical data effectively became a baseline hydrologic modeling output against which potential alterations in flow associated with implementation of each of the diversion scenarios could be compared. Specifically, the diversion assumptions are applied to the estimated

(modeled) baseline flows to obtain a specific set of estimated (modeled) flows associated with each of the diversion scenarios. These “modeled flows” provide a quantitative basis from which to assess the potential impacts of the three diversion scenarios on SCCC steelhead passage in the Salinas River at the Spreckels gage. Detailed discussion of development of the modeled flows is presented in Schaaf and Wheeler (2014).

#### **4.0.1.2 *Model Uncertainty***

The modeled flows used in these analyses, although mathematically precise, should be viewed as having inherent uncertainty. Nonetheless, for planning and impact assessment purposes this approach represents the best available information with which to conduct evaluations of proposed changes in flow diversion, and resulting Salinas River flows. Detailed discussion of specific assumptions used to develop the “modeled” flows is presented in Schaaf and Wheeler (2014).

### **4.0.2 Application of Model Output**

Modeled flow results are used for comparative purposes, rather than for absolute predictions, and the focus of the analysis is on differences in the results among comparative scenarios (e.g., a comparison of estimated conditions under Scenario A, relative to the Existing Condition scenario [estimated without-project conditions]). All of the assumptions (e.g., hydrologic conditions, climatic conditions, upstream storage conditions, Salinas Lagoon conditions, etc.) are the same for the baseline, or existing conditions scenario and the diversion scenarios flow estimates, except assumptions associated with the diversion scenario itself, and the focus of the analysis is based primarily on the differences in modeled flow conditions among the three scenarios and the existing condition scenarios.

Raw model output included estimated daily flow for an 82-year period of record, which were conditioned to aggregate data in meaningful ways for the SCCC steelhead evaluation. Daily estimated flow data were used to develop exceedance probability distributions (exceedance curves) by month. These exceedance probability distributions were developed from ranked and sorted data, and show the percentage of time (probability) that a given value is exceeded. These curves show the general long-term differences in flow between an evaluated diversion scenario and the baseline scenario.

### **4.0.3 Impact Indicators**

Impact indicators were developed to assess potential Project effects on steelhead life stages and related habitat conditions that are likely to be present in the affected reach of the Salinas River. Migration, both upstream for adults and downstream for adults and juveniles (smolts) are the potentially affected life stages. Potential project effects to these life stages are related to changes in flows. As such, impact indicators were developed as a means to assess potential effects on steelhead passage and migration resulting from each of the different Diversion Scenarios. Specifically, relative changes in modeled flow due to the Diversion Scenario and, predicted changes in frequency of the occurrence of migratory conditions, based on flow-based passage criteria, were used as quantitative indicators of potential effects to steelhead, as discussed in the following sections.

#### 4.0.3.1 *Stream Flow Changes*

Stream flow magnitude and timing are critical components of water supply, water quality, and the ecological integrity of river systems (Poff et al. 1997). Stream flow, which is strongly correlated with many critical physicochemical characteristics of rivers, can be considered a master variable that limits the distribution and abundance of riverine species (Power et al. 1995 and Resh et al. 1988 in Poff et al. 1997).

In order to identify potential effects of the Project's Diversion Scenarios on stream flow, a 10 percent decrease in flow relative to existing conditions was defined as the impact indicator. A decrease in monthly flow of 10 percent or greater has been previously identified by various environmental documents as an appropriate criterion to evaluate flow changes. For example, in the Trinity River Mainstem Fishery Restoration Draft EIS/EIR (USFWS et al. 1999), the USFWS identified reductions in flow of 10 percent or greater as changes that could be sufficient to reduce habitat quantity or quality to an extent that could significantly affect fish. The Trinity River EIS/EIR further states, "...[t]his assumption [is] very conservative...[i]t is likely that reductions in streamflows much greater than 10 percent would be necessary to significantly (and quantifiably) reduce habitat quality and quantity to an extent detrimental to fishery resources." Conversely, the Trinity River EIS/EIR considers increases in streamflow of 10 percent or greater, relative to the basis of comparison, to be "beneficial" to fish species.

In addition to the USFWS et al. (1999) criteria, the San Joaquin River Agreement EIS/EIR (USDOI et al. 1999) used USGS 1977 criteria thresholds, which were derived based on the ability to accurately measure stream flow discharges to  $\pm 10$  percent. The criterion used to determine impacts associated with implementation of the San Joaquin Agreement was based on average percentage changes to stream flow relative to the basis of comparison. The San Joaquin River Agreement EIS/EIR considered flow changes of less than  $\pm 10$  percent to be insignificant (USDOI et al. 1999).

The Freeport Regional Water Project Draft EIS/EIR (JSA 2003) used a similar rationale as the USGS documentation for selecting criteria to evaluate changes in flow. The Freeport EIS/EIR states: "Relative to the base case, a meaningful change in habitat is assumed to occur when the change in flow equals or exceeds approximately 10 percent. The 10 percent criterion is based on the assumption that changes in flow less than 10 percent are generally not within the accuracy of flow measurements, and will not result in measurable changes to fish habitat area."

Although the environmental documents listed above have been legally certified (i.e., Trinity River Mainstem Fishery Restoration Record of Decision December 19, 2000; San Joaquin River Agreement Record of Decision in March 1999; Freeport Regional Water Project Record of Decision January 4, 2005), biological justifications specific to using a 10 percent change as a criterion for a meaningful change in habitat affecting fisheries resources in a particular river have not been provided. Nevertheless, these documents apparently have resulted in consensus in the use of 10 percent when evaluating the potential effects of flow changes on fish and aquatic habitat.

Accordingly, this impact assessment relies on previously established information and, therefore, evaluates changes in monthly flow based on differences in frequency of daily flow changes of

10 percent or greater under the diversion versus baseline scenario. Specifically, a change of 10 percent or greater in long term flow, as expressed by flow exceedance probabilities is considered an indicator of potential impact on SCCC steelhead.

#### *4.0.3.2 Temporal Considerations*

As discussed below, duration and timing are important components of a flow regime (Poff et al. 1997). Therefore, simply evaluating quantitative changes in flow magnitude during an analytical period (i.e., migration periods) could artificially overstate or understate impacts. However, a paucity of information exists regarding site specific effects of changes in flow over specific durations. Thus, utilizing a change in flow that occurs 10% of the time during an analytical evaluation period was used as an indicator of a duration and timing of flow change that could result in an impact on migrating steelhead.

#### *4.0.3.3 Passage Thresholds*

In addition to the general assessment of the Diversion Scenario's potential effects on flow, specific, potential direct effects on upstream and downstream migration (passage impediments) were identified and evaluated. Specifically, flow levels that provide suitable conditions for upstream and downstream passage were established based on available literature and onsite evaluation at potential passage impediments. These flow values are treated as thresholds, below which passage is impaired, and serve as indicators of potential impact to passage for upstream migrating adults and downstream migrating juveniles and smolts. Specific passage thresholds are described below.

#### *4.0.3.4 Qualitative Environmental Considerations*

Conducting fully quantitative analyses of potential impacts on steelhead requires information more detailed than is currently available. As such, impact analyses included qualitative assessment of unquantified components of the flow regime that can be used to characterize the entire range of flows and specific hydrologic phenomena (e.g., floods and low flows) that are vital to the integrity of river ecosystems, thus fish species. These components of the flow regime include: (1) magnitude; (2) frequency; (3) duration; (4) timing; and (5) rate of change of hydrologic conditions (Poff et al. 1997). Furthermore, Poff et al. (1997) report that by defining flow regimes in these terms, the ecological consequences of particular human activities that modify one or more components of the flow regime can be considered explicitly. Therefore, while modeled flows are evaluated using specific values as impact indicators (changes in flow of 10% or more, specific flow thresholds); other flow conditions are considered qualitatively in conjunction with quantitative evaluations. That is, the relative changes in magnitude, timing, etc. that are not quantitatively assessed are surrogate for potential change in habitat that conditions, such as rearing and migration associated with flood or high flows.

The requirements for conducting analyses under CEQA include utilizing the best available information to conduct impact assessments. In the absence of final design specifications or other site-specific information (e.g., flow-habitat relationships) environmental documents often rely on the use of qualitative analyses, which rely on an understanding of potential impact mechanisms and a detailed understanding of species habitat utilization and life history

characteristics. Therefore, qualitative consideration of general habitat conditions in the potentially affected reaches also is included in the analyses of impacts on steelhead migration.

#### 4.0.3.5 Water Quality

The Central Coast Regional Water Quality Control Board (CCRWQCB) Water Quality Control Plan for the Central Coast Basin (Basin Plan) designates beneficial uses of the Salinas River below Spreckels as including municipal and domestic supply, agricultural supply, non-contact water recreation, wildlife habitat, warm and cold water fish habitat, freshwater replenishment (of the Salinas Lagoon) and commercial or sport fishing. The Salinas River is listed as an impaired water body pursuant to Section 303(d) of the Clean Water Act for chlorides, pesticides, *Escherichia coli*, fecal coliform, nitrate, total dissolved solids, turbidity and other factors. Diversion related impacts that could further degrade water quality conditions and impair associated beneficial uses would be considered an impact indicator.

#### 4.0.4 Species Specific Analytical Approach

The potential for changes in flows resulting from implementation of any of the three diversion scenarios to impact SCCC steelhead in the Salinas River is dependent on the ability of the species to use the affected reaches as a migratory corridor.

In addition to evaluating long-term flows, daily exceedance of specific flow thresholds identified in the literature as important for steelhead passage also was evaluated. The number of days when modeled flow in the Salinas River exceeds a specified flow threshold under the baseline scenario and does not exceed the same specified flow under a diversion scenario on the same day represents the number of days under each scenario when the diversion scenario caused modeled flows to be reduced below the threshold.

**Table 4** provides the timing of adult and juvenile presence in the Salinas River identified in various literature sources, as well as flow thresholds important for passage upstream (adults) and downstream (outmigrating juveniles and smolts).

**Table 4 – SCCC Steelhead life history periodicity and flow thresholds required for migratory passage in the Salinas River identified from various literature sources.**

Life stage	Time Period*	Flow (in cfs) Required Downstream of Spreckles Gage for Steelhead Migratory Passage	Source Document	Notes**
Smolt Outmigration	March through June	N/A	NMFS 2007, Page 23	In California, the outmigration of steelhead smolts typically begins in March and ends in late May or June (Titus <i>et al.</i> 2002).
	April through June	N/A	NMFS 2007, Page 23	Snider (1983) states that in the Carmel River, most juvenile steelhead migrate to the ocean between April and June.

	March through June	N/A	NMFS 2007, Page 74	However, to assist our assessment of the project's effects on flows for smolt outmigration, we have assumed that properly functioning habitat conditions for this phase of the steelhead life history include substantial sustained flows for several weeks during the period of migration (late March through early June).
	Year-Round with peak emigration from April through June	56	MCWRA 2001, Section 5.6	If a depth criteria of 0.4 feet is substituted in the analysis of passage transects in the Salinas River the resulting minimum passage flow estimates for downstream migration of post-spawning adults and smolts would be 112 cfs upstream of Spreckels and 56 cfs downstream of Spreckels.
		50		If it is also assumed that the 0.4 foot depth criteria were achieved over a continuous 8 foot channel width rather than 10% of the channel width, the minimum passage flow estimate would be further reduced to 59 cfs upstream of Spreckels and 50 cfs downstream of Spreckels.
	January through June	N/A	MCWRA 2013b, Page 3-118	Steelhead smolts may immigrate to the ocean from January through June on the receding limb of the winter hydrograph.
	December 15 through March 31	N/A	MCWRA 2013b, Page 3-119	Seaward migration of juveniles may end earlier as compared to the other coastal drainages, because a greater amount of flow is required to provide safe passage conditions in the broad, sandy Salinas riverbed and the migration from rearing habitat in the tributaries is greater than 50 miles. NMFS (2003, p. 24) noted December 15 to March 31 as the juvenile steelhead migration season, which likely considers the above factors.
	March through June	N/A	MCWRA 2013b, Page 3-128-129	... and steelhead smolt migration typically begins in March and ends in late-May or June, depending on flow and passage conditions.
	Jan 15 through May	N/A	MCWRA 2013b, Page 3-134	...and downstream juvenile/kelt migration (mid-January through the end of May).
<b>Adult Immigration</b>	December 1 through April 15	72	MCWRA 2001, Section 5.6	Based on the Thompson criteria, a flow of about 72 cfs would meet the minimum migration needs for steelhead in the Lower Salinas downstream of Spreckels and a flow of 154 cfs would meet the minimum migration criteria upstream of Spreckels. Less flow is required downstream of Spreckels since the channel is narrower and more confined in this reach.
		60		Using the less restrictive width criterion of 8 feet instead of 25%, minimum passage flow estimates for adult steelhead in the Salinas River would be 94 cfs upstream of Spreckels and 60 cfs downstream of Spreckels.
	January through May	N/A	Moyle 2008, Page 80	Adult steelhead return from the ocean to enter watersheds to spawn in SCC stream between January and May (Boughton et al. 2006)
	December	N/A	MCWRA 2013b,	NMFS indicates that adult steelhead in



	through April		Page 3-118	this region migrate upstream primarily from December to April (NMFS 2007)
	November through June	N/A	NMFS 2007, Page 23	Adult steelhead migrate to fresh water between November and June, peaking in March.
	December through April	N/A	NMFS 2007, Page 69 - 70	Although the exact timing of adult upstream migration in the Salinas River is not known, data from other Central California coastal streams indicate that adult steelhead in this area migrate upstream primarily from December through April (Figure 11)
* Time periods provided represent the widest range indicated by the source document. For example, if a source document indicates a time period beginning sometime in March and ending in late May or June, the time period selected includes March through June				
** Time periods are selected based on source documents evaluated (e.g., NMFS 2007, MCWRA 2013b), although the source documents may cite additional sources.				

#### 4.0.4.1 *Analytical Time Periods*

Based on information presented in Table 4 comparisons of modeled flows for the three diversion scenarios, relative to the baseline scenario (the Existing Condition scenario), are conducted for the following life stages and life history periodicities:

- Adult Immigration (December through April)
- Juvenile and Smolt Emigration (March through June)

These time periods were selected for evaluation in this analysis to evaluate the bulk of the upstream migration and downstream emigration periods. The evaluation is intended to encompass the majority of steelhead migration in the Salinas River, including the peak migration periods, without potentially overestimating impacts.

#### 4.0.4.2 *Analytical Passage Threshold Flow Indicator Values*

Two sets of passage flow indicator values were evaluated to assess passage potential of upstream migrating adult steelhead and downstream migrating juveniles. As described in MCWRA (2001), these thresholds were based on evaluation of stream conditions as part of the Salinas Valley Water Project Draft Master EIR. MCWRA estimated passage flow requirements using field measurement of channel and flow characteristics and the application of objective criteria for conditions suitable for adult steelhead upstream migration based on water depth transects at critical passage sites using a method developed by Thompson (1972). MCWRA (2001) further states that the minimum flow for steelhead adult immigration occurs when, at the shallowest cross-sections, there is a depth of at least 0.6 feet across 25% of the channel width and there is a continuous section this deep across at least 10% of the channel width. Based on these criteria, a flow of about 72 cfs would meet the minimum migration needs for steelhead in the Lower Salinas downstream of the Spreckels gage. However, MCWRA (2001) noted that under some situations the 0.6 foot depth over 25% channel width criteria have been considered to be overly restrictive and less conservative criteria have been applied. Using a less restrictive width criterion of 8 feet instead of 25%, minimum passage flow estimates for adult steelhead in the Salinas River would be 60 cfs downstream of Spreckels (RM 13.2).

Because juvenile passage criteria have not been widely developed, MCWRA (2001) modified the adult upstream passage criteria to accommodate downstream migrating juveniles based on the

assumption that emigrating juvenile steelhead can migrate downstream over riffle areas at shallower depths than those needed by adults migrating upstream. If a depth criterion of 0.4 feet is substituted in the analysis of passage transects in the Salinas River the resulting minimum passage flow estimates for downstream migration of smolts would be 56 cfs downstream of Spreckels. If it is also assumed that the 0.4 foot depth criteria were achieved over a continuous 8 foot channel width rather than 10% of the channel width, the minimum passage flow estimate would be further reduced to 50 cfs downstream of Spreckels (MCWRA 2001).

Therefore, the following passage flow indicator values were evaluated:

- Adult Immigration – 60 cfs and 72 cfs at Spreckels
- Juvenile and Smolt Emigration – 50 cfs and 56 cfs at Spreckels

#### **4.0.5 Evaluation Criteria and Significance Thresholds**

As described above, a 10 percent scenario-induced change in existing flow, as well as 10 percent scenario-induced changes in flows that occur 10 percent or more of the time, are used as impact indicators, but are not meant to serve as a significance thresholds for CEQA purposes. Instead, these impact indicators serve as mechanisms to compare a Diversion Scenario to a baseline condition. Additionally, site-specific flow thresholds and qualitative consideration of general habitat and flow conditions also are utilized in conducting the evaluation of flow-related impacts on steelhead. Impact determinations will be based on consideration of all evaluated impact indicators for all life stages for a particular species.

The California Environmental Quality Act (CEQA) Guidelines provide a discussion of significance criteria for evaluation of environmental effects of a project. Specifically, significance criteria represent the thresholds that were used to identify whether an impact would be considered significant under CEQA. However, these significance criteria do not provide quantitative thresholds against which simulated hydrologic data can be compared to identify potential impacts. Appendix G of the CEQA Guidelines suggests the following evaluation criteria for biological resources:

Would the project:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service;
- Conflict with any local policies or ordinances protecting fishery resources; or

- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Conservation Community Plan, or other approved local, regional, or state habitat conservation plan?

The evaluation criteria used for impact analysis represent a combination of the Appendix G criteria and professional judgment that considers current regulations, standards, and/or consultation with agencies, knowledge of the area, and consideration of the context and intensity of the environmental effects. Specifically, for the SCCC steelhead impact assessment, significance determinations are based on consideration of all evaluated impact indicators (e.g., 10 percent change in long-term flow, differences in exceedance of flow thresholds). An impact is considered significant if implementation of the Diversion Scenario would substantially adversely affect steelhead based on evaluation of the changes in flows. For the purposes of this analysis, the effect of a Diversion Scenario would be considered less than significant if it would result in any of the following:

- A change in average monthly stream flow of less than 10%.
- A change in flow of less than 10%, relative to specific flow thresholds during steelhead adult or smolt migration periods.
- Changes in flow that occur less than 10% of the time during the analytical period

Furthermore, for an impact to be considered less than significant, implementation of a Diversion Scenario will not cause creation of an obstacle or hazard to migrating steelhead (adults, juveniles or smolts).

Therefore, for the purposes of this analysis, a diversion Case scenario would result in a significant impact to aquatic biological resources if it would result in the following:

- A substantial adverse effect (directly, through habitat modifications, by interfering with the movement of native fish species, or by impeding the use of native fish nursery/rearing sites) on SCCC steelhead.

## 5 IMPACT ANALYSIS

The impact assessment of aquatic biological resources consisted of a comparative evaluation of hydrologic conditions (i.e., change in flow frequency, change in flow based habitat availability) between current conditions and each of the diversion scenarios.

The quantitative assessment of potential flow-related impacts included evaluation of: (1) changes in monthly long-term flows (exceedance probability distributions based on hydrologic record of 82 years) using occurrence (> 10 percent of the time) of a 10 percent or more reduction in simulated diversion scenario flow conditions, relative to a baseline condition as indicators of impact; and (2) differences in occurrence of suitable fish passage conditions using percent reduction in current daily flows from suitable to unsuitable relative to meeting specified passage thresholds (Table 4). Qualitative interpretation of flow changes, relative to general habitat conditions and water quality is also considered in the analysis.

Implication of effects on aquatic resources using an analysis of flow exceedance is complicated by the runoff patterns in coastal streams, like the Salinas River; coastal, rain dominated streams display substantial variation in flows during most months, as clearly depicted in the nearly vertical portion of the exceedance curves with the Y-axis scaled to 100 cfs (**Figure 1b**). These curves suggest that exceedance probability between 10 cfs and 100 cfs is typically less than 15 percent, which means that when flows reach 10 cfs they are likely to reach 100 cfs and that flows greater than 10 cfs are infrequent. Furthermore, evaluation of the exceedance probability distributions indicates that, while flows can get very high in any month, flows generally are substantially less than 80 percent of the maximum flow over 80 percent of the time. For example, during December the maximum modeled flow under the baseline condition (the Existing Condition scenario) is over 39,000 cfs. However, modeled flows are below approximately 55 cfs for 80 percent of the time and are below approximately 15 cfs for 50 percent of the time. Therefore, substantial flow reductions, as indicated by reductions of 10 percent or more, occur more frequently at lower flows simply because small reductions in flow represent a large percentage of the total flow. As such, evaluating only the percentage of time when flow reductions of 10 percent or more occur may be misleading when considered as an indicator of impacts on biological resources and their habitats because a 10 percent reduction in flow would not necessarily result in a substantial loss of migratory habitat or a substantial reduction in passage potential, as summarized below. In such cases, best professional judgment is used to determine whether impacts associated with these reductions would be considered substantial.

### 5.0.1 Scenario A Analysis

As described by Schaaf and Wheeler (2014), Scenario A reduces flow in the Salinas River by diverting City of Salinas stormwater (RM 11.2) and Salinas Treatment Facility inflow (RM 9.2-10.7). Scenario A does not include Blanco Drain diversions. The effect of Scenario A on Salinas River flow was analyzed at RM 4.7.

Overall, Scenario A diverts less than 1 percent of the baseline mean annual flow (Schaaf and Wheeler 2014). However, due to the flashy nature of runoff in the Salinas River, the majority of

flow occurs during a very brief period, which means that the likelihood of Scenario A (diversion rate of 3 cfs) to incur a 10 percent or greater reduction in flow (i.e., when flow is 30 cfs or less), is high. The probability of exceeding 30 cfs (i.e., exceedance probability) ranges from the highest probability of exceedance of 66 percent in February to less than 16 percent in June. As such, exceedance probability distributions of modeled daily flows aggregated by month from December through June (encompassing both the adult immigration and juvenile outmigration periods) indicate that flows under Scenario A are generally similar (slightly reduced), relative to the baseline scenario (the Existing Condition scenario) when flows are above 30 cfs during all months evaluated (**Figure 1**). However, flow reductions range from occurring approximately 34 percent of the time during February to approximately 84 percent of the time during June. **Table 5** displays the percentage of time when reductions in flow attributable to Scenario A diversion occur in the December through June period. Further, as flow decreases below 30 cfs, relatively small flow reductions resulting from increased diversions under Scenario A become proportionately greater, which occurs during all months evaluated. Therefore, reductions in flow of 10 percent or more occur during all months of the SCCC steelhead adult immigration and juvenile outmigration periods under Scenario A.

A more direct assessment of diversion effects on steelhead evaluates the reduction in suitable fish passage conditions under Scenario A. Therefore, each of the identified passage flow indicator values was evaluated. Specifically, the number and percentage of days in each month (over the entire 82-year period of record) was identified when Scenario A resulted in reducing flow from above to below a migratory flow threshold (**Table 6**). Suitable migration flows were reduced below each of the passage flow indicator values less than 1 percent of the time under Scenario A, relative to the Existing Condition scenario (Table 6).

Overall occurrence of suitable adult steelhead migration conditions (i.e., occurrence of threshold flows) were reduced about 1 percent for both the 60 cfs and 72 cfs thresholds (Table 6). The 60 cfs threshold was reduced a total of 58 days out of the 12,434 days modeled during the upstream migration period (December-April). In comparison to existing conditions, the percent occurrence of 60 cfs or greater flows during the upstream migration period was reduced 0.5 percent, from 46.5 to 46.0 percent. Percent reductions ranged from 0.1 percent in April to 0.7 percent in December and January. The net change in days meeting the 60 cfs threshold (i.e., reduction in days meeting the threshold under existing conditions) was 1 percent overall (58 out of 5,773 days). Net reduction ranged from 0.3 percent in April to 3.5 percent in December.

Similarly, the 72 cfs threshold was reduced 54 days out of the 12,434 days modeled during the upstream migration period (December-April). The percent occurrence of 72 cfs or greater flows during the upstream migration period was reduced 0.4 percent, from 45.0 to 44.6 percent. Percent reductions ranged from 0.3 percent in March to 0.6 percent in December. The net change in days meeting the 72 cfs threshold was less than 1 percent overall (54 out of 5,598 days). Net reduction ranged from 0.5 percent in April to 3.2 percent in December.

Overall occurrence of suitable juvenile steelhead migration conditions (i.e., occurrence of threshold flows) were reduced less than 1 percent for both the 50 cfs and the 56 cfs thresholds (Table 6). The 50 cfs threshold was reduced a total of 51 days out of the 10,004 days modeled during the downstream migration period (March-June). In comparison to existing conditions,

the percent occurrence of 50 cfs or greater flows during the upstream migration period was reduced 0.5 percent, from 37.8 to 37.3 percent. Percent reductions ranged from 0.2 percent in June to 0.9 percent in May. The net change in days meeting the 50 cfs threshold (i.e., reduction in days meeting the threshold under existing conditions) was 1.3 percent overall (51 out of 3,780 days). Net reduction ranged from 0.8 percent in March to 3.1 percent in May.

Similarly, the 56 cfs threshold was reduced 43 days out of the 10,004 days modeled. The percent occurrence of 56 cfs or greater flows during the upstream migration period was reduced 0.4 percent, from 37.0 to 36.6 percent. Percent reductions ranged from 0.2 percent in June to 0.6 percent in May. The net change in days meeting the 56 cfs threshold was 1.2 percent overall (43 out of 3,700 days). Net reduction ranged from 0.8 percent in March to 2.1 percent in May.

Schaff and Wheeler (2014) report that the stormwater runoff is generally of equal or better quality than the Salinas River, which receives it. Stormwater runoff meets the Central Coast RWQCB Basin Plan objectives in most categories. In the categories of turbidity and orthophosphate, it exceeds the basin plan objectives but is below the average concentration in the receiving stream. Diverting stormwater runoff to the Proposed Project should, therefore, have no appreciable effect on water quality within the Salinas River.

Effluent from the SIWTF is also generally of equal or better quality than the Salinas River. The exception in this case is Total Dissolved Solids (TDS), which exceeds both the Basin Plan objective and the quality of the receiving stream. Diverting Industrial Wastewater to the Proposed Project may result in reduced TDS levels in the river, particularly in summer months during low flow periods, outside the steelhead migration periods.

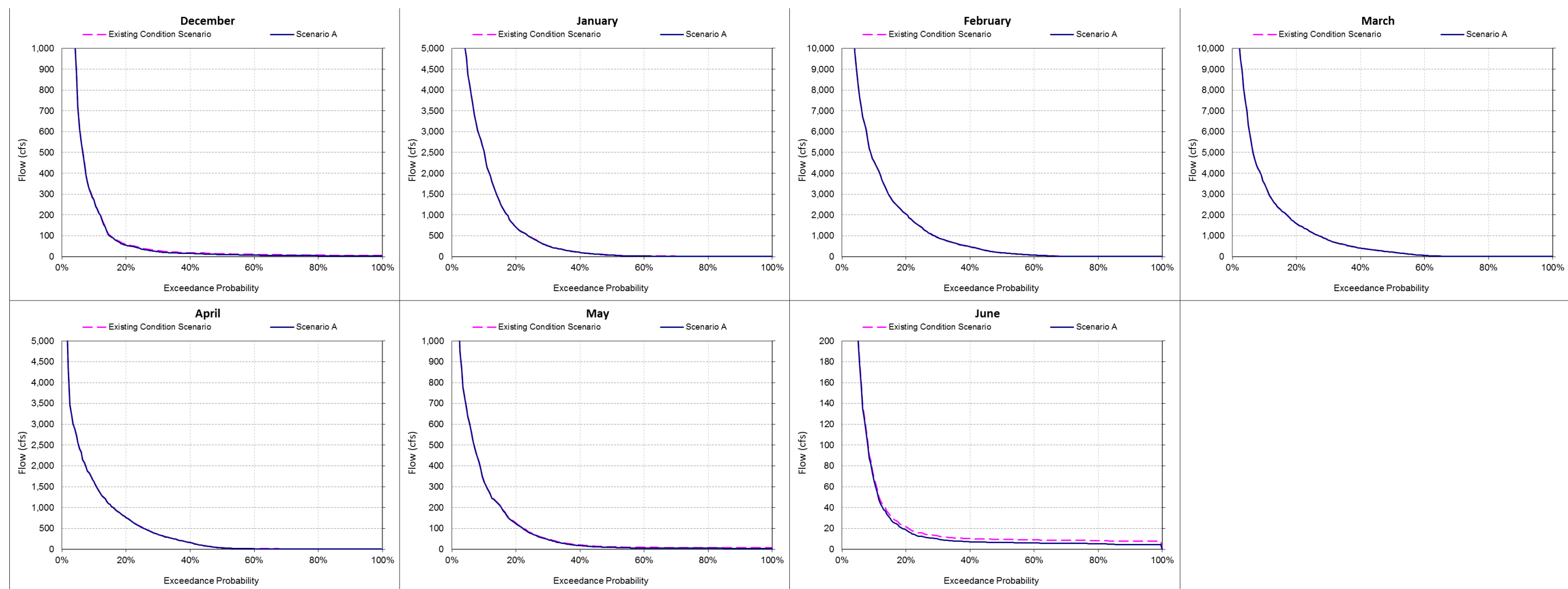
#### 5.0.1.1 *Scenario A Conclusion*

In general, modeled flows were reduced under Scenario A, relative to the Existing Condition scenario. Implementation of Scenario A is anticipated to reduce flows in the Salinas River during the SCCC steelhead adult immigration period by 1 percent and during the juvenile outmigration period by about 1.3 percent, relative to existing conditions. However, the effect of Scenario A on occurrence of suitable fish passage conditions (passage thresholds) is very infrequent (monthly reductions in flows meeting passage thresholds, relative to existing conditions occur from less than 1% of the time to no more than just over 3 percent of the time during juvenile and adult migration periods). Furthermore, flow reductions which seem disproportionately high during the lowest flow periods, are likely to have relatively little effect on steelhead migration. Implementation of Scenario A would not have an effect on the occurrence of high flows, flows greater than 100 cfs, which are more closely associated with steelhead migration than the threshold flows used in this evaluation, nor on availability of potential rearing habitat associated with side channel and flood plain inundation. Therefore, in consideration of the timing, frequency, magnitude, and duration of flow changes that could occur associated with implementing Scenario A, these flow changes are not considered to be substantial impacts on SCCC Steelhead.

There is a limited potential for tidewater goby and Monterey roach to occur downstream of the project site. Since these species prefer quiescent conditions, flow reductions would not be expected to have a detrimental effect on them, should they be present

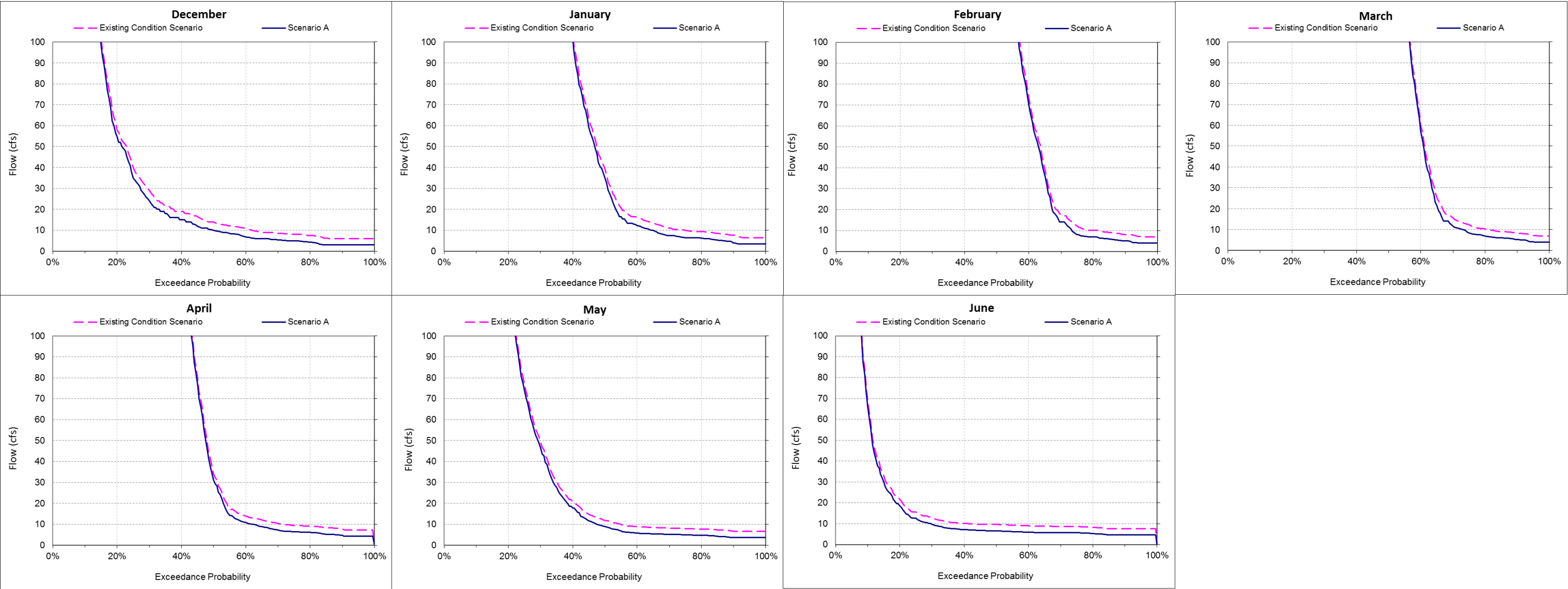
Additionally, removing stormwater runoff and Salinas Treatment Facility effluent should have no appreciable effect on water quality within the Salinas River.

Overall, flow reductions associated with implementation of Scenario A, relative to the Existing Condition is considered to be *Less than Significant* on SCCC Steelhead, Monterey roach, and tidewater goby.



**Figure 1a – Monthly exceedance probability distributions of modeled daily flows for Scenario A and the Existing Condition scenario.**





**Figure 1b – Monthly exceedance probability distributions of modeled daily flows for Scenario A and the Existing Condition scenario (y-axis scale restricted to 100 cfs).**

**Table 5 – Percentages of time that modeled flows under Scenario A are less than modeled flows under the baseline condition (the Existing Condition scenario) during both the SCCC steelhead adult immigration period (December through April) and juvenile outmigration period (March through June).**

<b>Analytical Scenario</b>	<b>December</b>	<b>January</b>	<b>February</b>	<b>March</b>	<b>April</b>	<b>May</b>	<b>June</b>
<b>Percent of time Scenario A has less flow than the Existing Condition Scenario</b>	100%	100%	100%	100%	100%	100%	100%
<b>Percent of time Scenario A has slightly less flow than the Existing Condition Scenario (1% &lt; X &lt;10%)</b>	16.6%	22.9%	22.3%	20.2%	20.2%	24.4%	12.3%
<b>Percent of time Scenario A has substantially less flow than the Existing Condition Scenario (X &gt; 10% )</b>	75.6%	50.2%	34.4%	37.3%	48.7%	64.9%	84.3%
<b>Total Days Modeled</b>	2,573	2,542	2,317	2,542	2,460	2,542	2,460

Table 6 – Model results estimates of the number of days and percentage of time represented by those days that diversions under Scenario A caused flows in the Salinas River to be reduced below the adult and juvenile passage thresholds relative to potential number of passage days and baseline conditions.

Life stage/ Period	Number of days meeting threshold		Percent of potential migration period meeting threshold		Change in percentage of potential migration period meeting threshold (%)	Reduction in number of days meeting threshold relative to baseline	Reduction in threshold occurrence relative to baseline (%)
	Baseline	Scenario A	Baseline	Scenario A			
Adult upstream Migration							
60 cfs threshold							
Dec	508	490	19.7	19.0	0.7	18	3.5
Jan	1,160	1,142	45.6	44.9	0.7	18	1.6
Feb	1,430	1,420	61.7	61.3	0.4	10	0.7
Mar	1,524	1,515	60.0	59.6	0.4	9	0.6
Apr	1,151	1,148	45.3	45.2	0.1	3	0.3
All	5,773	5,715	46.5	46.0	0.5	58	1.0
72 cfs threshold							
Dec	467	452	18.2	17.6	0.6	15	3.2
Jan	1,111	1,099	43.2	43.2	0.5	12	1.0
Feb	1,397	1,387	59.9	59.9	0.4	10	0.7
Mar	1,498	1,490	58.6	58.6	0.3	8	0.5
Apr	1,125	1,116	43.9	43.9	0.4	9	0.8
All	5,598	5,598	45.0	44.6	0.4	54	1.0
Juvenile Downstream Migration							
50 cfs threshold							
Mar	1,555	1,542	61.2	60.7	0.5	13	0.8
Apr	1,179	1,171	46.4	46.1	0.3	8	0.7
May	762	738	30.0	29.0	0.9	24	3.1
Jun	284	278	11.5	11.3	0.2	6	2.1
All	3,780	3,729	37.8	37.3	0.5	51	1.3
56 cfs threshold							
Mar	1,539	1,526	60.5	60.0	0.5	13	0.8
Apr	1,166	1,156	45.9	45.5	0.4	10	0.9
May	720	705	28.3	27.7	0.6	15	2.1
Jun	275	270	11.2	11.0	0.2	5	1.8
All	3,700	3,657	37.0	36.6	0.4	43	1.2

## 5.0.2 Scenario B Analysis

As described by Schaaf and Wheeler (2014), Scenario B reduces flow in the Salinas River by diverting City of Salinas stormwater (RM 11.2) and Salinas Treatment Facility inflow (RM 9.2-10.7) as well as 2.99 cfs from Blanco Drain (RM 5.1). The effect of Scenario B on Salinas River flow was analyzed at RM 4.7.

Overall, Scenario B diverts less than 1.5 percent of the baseline mean annual flow (Schaaf and Wheeler 2014). However, as discussed above, due to the flashy nature of runoff in the Salinas River, the majority of flow occurs during a very brief period, which means that the likelihood of Scenario B (diversion rate of 5.99 cfs) to incur a 10 percent or greater reduction in flow (i.e., when flow is 60 cfs or less), is high. The probability of exceeding 60 cfs ranges from the highest probability of exceedance of 62 percent in February to less than 11 percent in June. As such, exceedance probability distributions of modeled daily flows aggregated by month from December through June (encompassing both the adult immigration and juvenile outmigration periods) indicate that flows under Scenario B are generally similar (slightly reduced), relative to the baseline scenario (the Existing Condition scenario) when flows are above 60 cfs during all months evaluated (**Figure 2**). However, flow reductions range from occurring approximately 39 percent of the time during February to approximately 89 percent of the time during June. **Table 7** displays the percentage of time when reductions in flow attributable to Scenario B diversion occur in the December through June period. Further, as flow decreases below 60 cfs, relatively small flow reductions resulting from increased diversions under Scenario B become proportionately greater, which occurs during all months evaluated. Therefore, reductions in flow of 10 percent or more occur during all months of the SCCC steelhead adult immigration and juvenile outmigration periods under Scenario B.

However, as previously described for Scenario A, substantial flow reductions, as indicated by reductions of 10 percent or more, occur more frequently at lower flows simply because small reductions in flow represent a large percentage of the total flow when a 10 percent reduction in flow would not necessarily result in a substantial loss of migratory habitat or a substantial reduction in passage potential. Therefore, as discussed above, evaluating only the percentage of time when flow reductions of 10 percent or more occur may confound the analysis.

A more direct assessment of diversion effects on steelhead evaluates the reduction in suitable fish passage conditions due to Scenario B. Therefore, each of the identified passage flow indicator values was evaluated. Specifically, the number and percentage of days in each month (over the entire 82-year period of record) was identified when Scenario B resulted in reducing flow from above to below a migratory flow threshold (**Table 8**).

Overall occurrence of suitable adult steelhead migration conditions (i.e., occurrence of threshold flows) were reduced less than 2 percent for both the 60 cfs and 72 cfs thresholds (**Table 8**). The 60 cfs threshold was reduced a total of 104 days out of the 12,434 days modeled during the upstream migration period (December-April). In comparison to existing conditions, the percent occurrence of 60 cfs or greater flows during the upstream migration period was reduced 0.9 percent, from 46.5 to 45.6 percent. Percent reductions ranged from 0.4 percent in March and April to 1.2 percent in December. The net change in days meeting the 60 cfs threshold (i.e.,

reduction in days meeting the threshold under existing conditions) was 1.8 percent overall (104 out of 5,773 days). Net reduction ranged from 0.7 percent in March to 6.3 percent in December.

Similarly, the 72 cfs threshold was reduced 84 days out of the 12,434 days modeled during the upstream migration period (December-April). The percent occurrence of 72 cfs or greater flows during the upstream migration period was reduced 0.6 percent, from 45.0 to 44.4 percent. Percent reductions ranged from 0.4 percent in March to 0.9 percent in December. The net change in days meeting the 72 cfs threshold was 1.5 percent overall (104 out of 5,598 days). Net reduction ranged from 0.7 percent in March to 4.9 percent in December.

Overall occurrence of suitable juvenile steelhead migration conditions (i.e., occurrence of threshold flows) were reduced about 2 percent for both the 50 cfs and the 56 cfs thresholds (Table 8). The 50 cfs threshold was reduced a total of 80 days out of the 10,004 days modeled during the downstream migration period (March-June). In comparison to existing conditions, the percent occurrence of 50 cfs or greater flows during the upstream migration period was reduced 0.8 percent, from 37.8 to 37.0 percent. Percent reductions ranged from 0.4 percent in June to 1.7 percent in May. The net change in days meeting the 50 cfs threshold (i.e., reduction in days meeting the threshold under existing conditions) was 2.1 percent overall (80 out of 3,780 days). Net reduction ranged from 1.0 percent in March to 5.5 percent in May.

Similarly, the 56 cfs threshold was reduced 73 days out of the 10,004 days modeled. The percent occurrence of 56 cfs or greater flows during the upstream migration period was reduced 0.7 percent, from 37.0 to 36.3 percent. Percent reductions ranged from 0.6 percent in June to 0.9 percent in May. The net change in days meeting the 56 cfs threshold was 2.0 percent overall (73 out of 3,700 days). Net reduction ranged from 1.2 percent in March to 5.5 percent in May.

Effects on water quality are as described above, for Scenario A.

### **5.0.3 Scenario B Conclusion**

In general, modeled flows were reduced under Scenario B, relative to the Existing Condition scenario. Implementation of Scenario B is anticipated to reduce flows in the Salinas River during the SCCC steelhead adult immigration period by 1.8 percent and during the juvenile outmigration period by about 2.1 percent relative to existing conditions. However, the effect of Scenario B on occurrence of suitable fish passage conditions (passage thresholds) is very infrequent (monthly reductions in flows meeting passage thresholds relative to existing conditions occur from less than 1% of the time to no more than 5.5 percent of the time during juvenile and adult migration periods). Furthermore, flow reductions would be disproportionately high during the lowest flow periods. Implementation of Scenario B would not have an effect on the occurrence of high flows, flows greater than 100 cfs, which are more closely associated with steelhead migration than the threshold flows used in this evaluation, nor on availability of potential rearing habitat associated with side channel and flood plain inundation. Therefore, in consideration of the timing, frequency, magnitude, and duration of flow changes that could occur associated with implementing Scenario B, these flow changes are not considered to be substantial impacts on SCCC Steelhead.

There is a limited potential for tidewater goby and Monterey roach downstream of the project site. Since these species prefer quiescent conditions, flow reductions would not be expected to have a detrimental effect on them, should they be present

Additionally, removing stormwater runoff and Salinas Treatment Facility effluent should have no appreciable effect on water quality within the Salinas River.

Overall, flow reductions associated with implementation of Scenario B, relative to the Existing Condition is considered to be *Less than Significant* on SCCC Steelhead, Monterey roach, and tidewater goby.

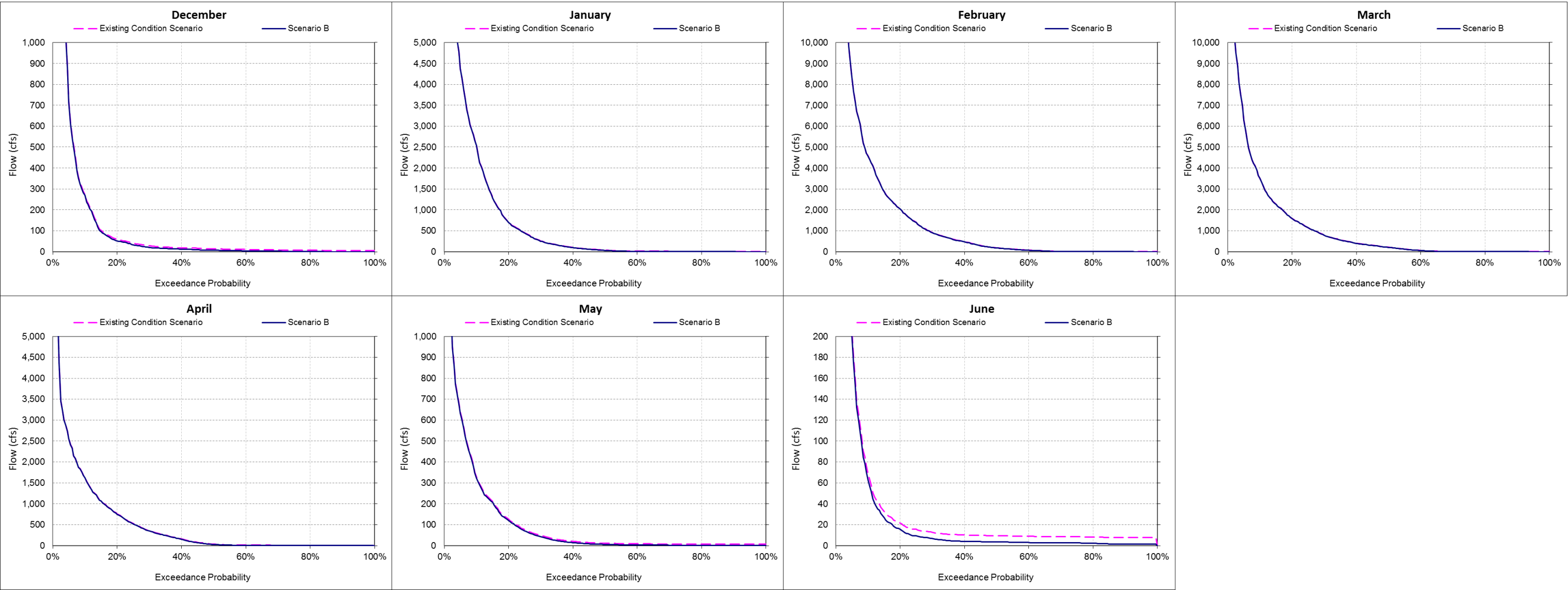
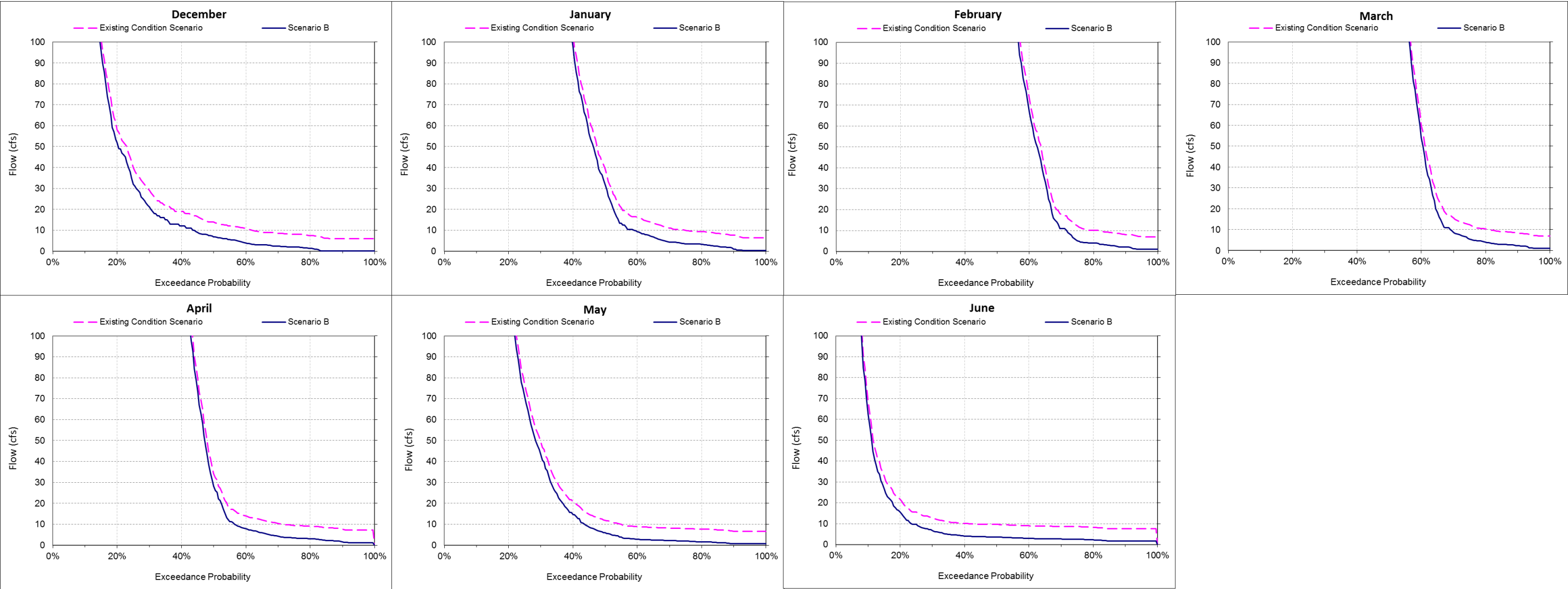


Figure 2a – Monthly exceedance probability distributions of modeled daily flows for Scenario B, relative to the Existing Condition scenario.



**Figure 2b – Monthly exceedance probability distributions of modeled daily flows for Scenario B, relative to the Existing Condition scenario (y-axis restricted to 100 cfs).**



**Table 7 – Percentages of time that modeled flows under Scenario B are less than modeled flows under the baseline condition (the Existing Condition scenario) during both the SCCC steelhead adult immigration period (December through April) and juvenile outmigration period (March through June).**

<b>Analytical Scenario</b>	<b>December</b>	<b>January</b>	<b>February</b>	<b>March</b>	<b>April</b>	<b>May</b>	<b>June</b>
<b>Percent of time Scenario B has less flow than the Existing Condition Scenario</b>	100%	100%	100%	100%	100%	100%	100%
<b>Percent of time Scenario B has slightly less flow than the Existing Condition Scenario (1% &lt; X &lt;10%)</b>	12.6%	24.0%	26.5%	27.2%	24.0%	22.0%	10.1%
<b>Percent of time Scenario B has substantially less flow than the Existing Condition Scenario (X &gt; 10% )</b>	82.2%	55.6%	38.5%	40.1%	53.4%	72.3%	89.2%
<b>Total Days Modeled</b>	2,573	2,542	2,317	2,542	2,460	2,542	2,460

Table 8 – Model results estimates of the number of days and percentage of time represented by those days that diversions under Scenario B caused flows in the Salinas River to be reduced below the adult and juvenile passage thresholds relative to potential number of passage days and baseline conditions.

Life stage/ Period	Number of days meeting threshold		Percent of potential migration period meeting threshold		Change in potential migration period meeting threshold (%)	Reduction in number of days meeting threshold relative to baseline	Reduction in threshold occurrence relative to baseline (%)
	Baseline	Scenario B	Baseline	Scenario B			
Adult upstream Migration							
60 cfs threshold							
Dec	508	476	19.7	18.5	1.2	32	6.3
Jan	1,160	1,133	45.6	44.6	1.1	27	2.3
Feb	1,430	1,407	61.7	60.7	1.0	23	1.6
Mar	1,524	1,513	60.0	59.5	0.4	11	0.7
Apr	1,151	1,140	46.8	46.3	0.4	11	1.0
All	5,773	5,669	46.5	45.6	0.9	104	1.8
72 cfs threshold							
Dec	467	444	18.2	17.3	0.9	23	4.9
Jan	1,111	1,099	43.7	43.2	0.5	12	1.1
Feb	1,397	1,376	60.3	59.4	0.9	21	1.5
Mar	1,498	1,487	58.9	58.5	0.4	11	0.7
Apr	1,125	1,108	45.7	45.0	0.7	17	1.5
All	5,598	5,514	45.0	44.4	0.6	84	1.5
Juvenile downstream migration							
50 cfs threshold							
Mar	1,555	1,540	61.2	60.6	0.6	15	1.0
Apr	1,179	1,165	47.9	47.4	0.6	14	1.2
May	762	720	30.0	28.3	1.7	42	5.5
Jun	284	275	11.5	11.2	0.4	9	3.2
All	3,780	3,700	37.8	37.0	0.8	80	2.1
56 cfs threshold							
Mar	1,539	1,520	60.5	59.8	0.7	19	1.2
Apr	1,166	1,150	47.4	46.7	0.7	16	1.4
May	720	697	28.3	27.4	0.9	23	3.2
Jun	275	260	11.2	10.6	0.6	15	5.5
All	3,700	3,627	37.0	36.3	0.7	73	2.0

#### 5.0.4 Scenario C Analysis

As described by Schaaf and Wheeler (2014), Scenario C, similar to Scenario B, reduces flow in the Salinas River by diverting City of Salinas stormwater (RM 11.2) and Salinas Treatment Facility inflow (RM 9.2-10.7) as well as from Blanco Drain (RM 5.1). Under Scenario C, diversion from Blanco Drain is 6 cfs (rather than 2.99 cfs under Scenario B). The effect of Scenario C on Salinas River flow was analyzed at RM 4.7.

Overall, Scenario C diverts less than 2 percent of the baseline mean annual flow (Schaaf and Wheeler 2014). However, as discussed above, due to the flashy nature of runoff in the Salinas River, the majority of flow occurs during a very brief period, which means that the likelihood of Scenario C (diversion rate of 8.99 cfs) to incur a 10 percent or greater reduction in flow (i.e., when flow is 90 cfs or less), is high. The probability of exceeding 90 cfs ranges from the highest probability of exceedance of 60 percent in February to less than 10 percent in June. As such, exceedance probability distributions of modeled daily flows aggregated by month from December through June (encompassing both the adult immigration and juvenile outmigration periods) indicate that flows under Scenario C are generally similar (slightly reduced), relative to the baseline scenario (the Existing Condition scenario) when flows are above 90 cfs during all months evaluated (**Figure 3**). However, flow reductions range from occurring approximately 40 percent of the time during February to approximately 90 percent of the time during June. **Table 9** displays the percentage of time when reductions in flow attributable to Scenario A diversion occur in the December through June period. Further, as flow decreases below 90 cfs, relatively small flow reductions resulting from increased diversions under Scenario C become proportionately greater, which occurs during all months evaluated. Therefore, reductions in flow of 10 percent or more occur during all months of the SCCC steelhead adult immigration and juvenile outmigration periods under Scenario C.

However, as previously described for Scenario A, substantial flow reductions, as indicated by reductions of 10 percent or more, occur more frequently at lower flows simply because small reductions in flow represent a large percentage of the total flow when a 10 percent reduction in flow would not necessarily result in a substantial loss of migratory habitat or a substantial reduction in passage potential. Therefore, as discussed above, evaluating only the percentage of time when flow reductions of 10 percent or more occur may confound the analysis.

A more direct assessment of diversion effects on steelhead evaluates the reduction in suitable fish passage conditions due to Scenario C. Therefore, each of the identified passage flow indicator values was evaluated. Specifically, the number and percentage of days in each month (over the entire 82-year period of record) was identified when Scenario C resulted in reducing flow from above to below a migratory flow threshold (**Table 10**). Suitable migration flows were reduced below each of the passage flow indicator values less than 2 percent of the time under Scenario C, relative to the Existing Condition scenario.

Overall occurrence of suitable adult steelhead migration conditions (i.e., occurrence of threshold flows) were reduced about 2 percent for both the 60 cfs and 72 cfs thresholds (**Table 10**). The 60 cfs threshold was reduced a total of 119 days out of the 12,434 days modeled during the upstream migration period (December-April). In comparison to existing conditions, the percent

occurrence of 60 cfs or greater flows during the upstream migration period was reduced 1.0 percent, from 46.5 to 45.5 percent. Percent reductions ranged from 0.5 percent in March to 1.3 percent in December. The net change in days meeting the 60 cfs threshold (i.e., reduction in days meeting the threshold under existing conditions) was 2.1 percent overall (119 out of 5,773 days). Net reduction ranged from 0.9 percent in March to 6.7 percent in December.

Similarly, the 72 cfs threshold was reduced 110 days out of the 12,434 days modeled during the upstream migration period (December-April). The percent occurrence of 72 cfs or greater flows during the upstream migration period was reduced 0.9 percent, from 45.0 to 44.1 percent. Percent reductions ranged from 0.6 percent in March to 1.1 percent in January. The net change in days meeting the 72 cfs threshold was 2.0 percent overall (110 out of 5,598 days). Net reduction ranged from 0.9 percent in March to 5.6 percent in December.

Overall occurrence of suitable juvenile steelhead migration conditions (i.e., occurrence of threshold flows) were reduced less than 3 percent for both the 50 cfs and the 56 cfs thresholds (Table 10). The 50 cfs threshold was reduced a total of 104 days out of the 10,004 days modeled during the downstream migration period (March-June). In comparison to existing conditions, the percent occurrence of 50 cfs or greater flows during the upstream migration period was reduced 1.0 percent, from 37.8 to 36.8 percent. Percent reductions ranged from 0.5 percent in June to 1.8 percent in May. The net change in days meeting the 50 cfs threshold (i.e., reduction in days meeting the threshold under existing conditions) was 2.8 percent overall (104 out of 3,780 days). Net reduction ranged from 1.6 percent in March to 6.0 percent in May.

Similarly, the 56 cfs threshold was reduced 96 days out of the 10,004 days modeled. The percent occurrence of 56 cfs or greater flows during the upstream migration period was reduced 1.0 percent, from 37.0 to 36.0 percent. Percent reductions ranged from 0.7 percent in June to 1.3 percent in May. The net change in days meeting the 56 cfs threshold was 2.6 percent overall (96 out of 3,700 days). Net reduction ranged from 1.6 percent in March to 6.5 percent in May.

Effects on water quality are as described above, for Scenario A.

### **5.0.5 Scenario C Conclusion**

In general, modeled flows were reduced under Scenario C, relative to the Existing Condition scenario. Implementation of Scenario C is anticipated to reduce flows in the Salinas River during the SCCC steelhead adult immigration period by up to 2.1 percent and during the juvenile outmigration period by up to 2.8 percent relative to existing conditions. However, the effect of Scenario C on occurrence of suitable fish passage conditions (passage thresholds) is very infrequent (monthly reductions in flows meeting passage thresholds relative to existing conditions occur from less than 1% of the time to no more than 5.5 percent of the time during juvenile and adult migration periods). Furthermore, flow reductions would be disproportionately high during the lowest flow periods. Implementation of Scenario B would not have an effect on the occurrence of high flows, flows greater than 100 cfs, which are more closely associated with steelhead migration than the threshold flows used in this evaluation, nor on availability of potential rearing habitat associated with side channel and flood plain inundation. Therefore, in consideration of the timing, frequency, magnitude, and duration of

flow changes that could occur associated with implementing Scenario C, these flow changes are not considered to be substantial impacts on SCCC Steelhead.

There is a limited potential for tidewater goby and Monterey roach downstream of the project site. Since these species prefer quiescent conditions, flow reductions would not be expected to have a detrimental effect on them, should they be present.

Additionally, removing stormwater runoff and Salinas Treatment Facility effluent should have no appreciable effect on water quality within the Salinas River.

Therefore, in consideration of the timing, frequency, magnitude, and duration of flow changes that could occur associated with implementing Scenario C, as well as improvements in water quality, implementation of Scenario C is considered to be *Less than Significant* on SCCC Steelhead, Monterey roach, and tidewater goby.

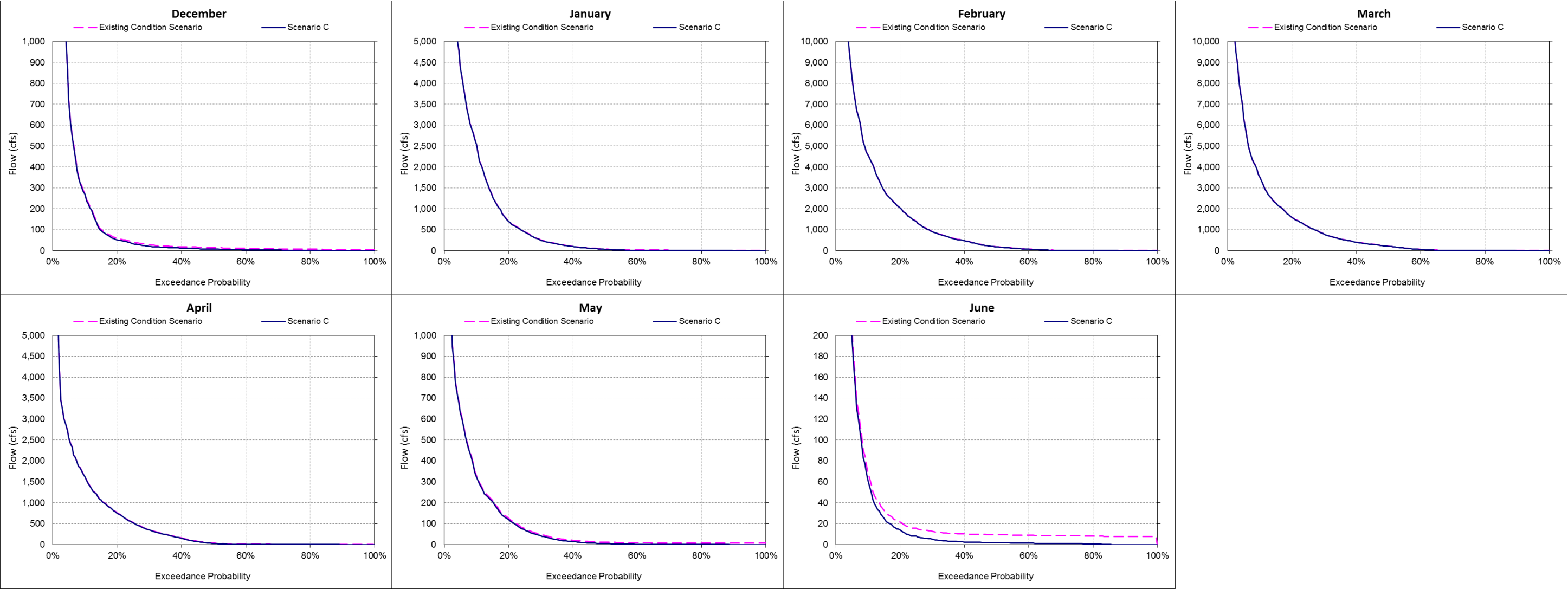


Figure 3a – Monthly exceedance probability distributions of modeled daily flows for Scenario C, relative to the Existing Condition scenario.

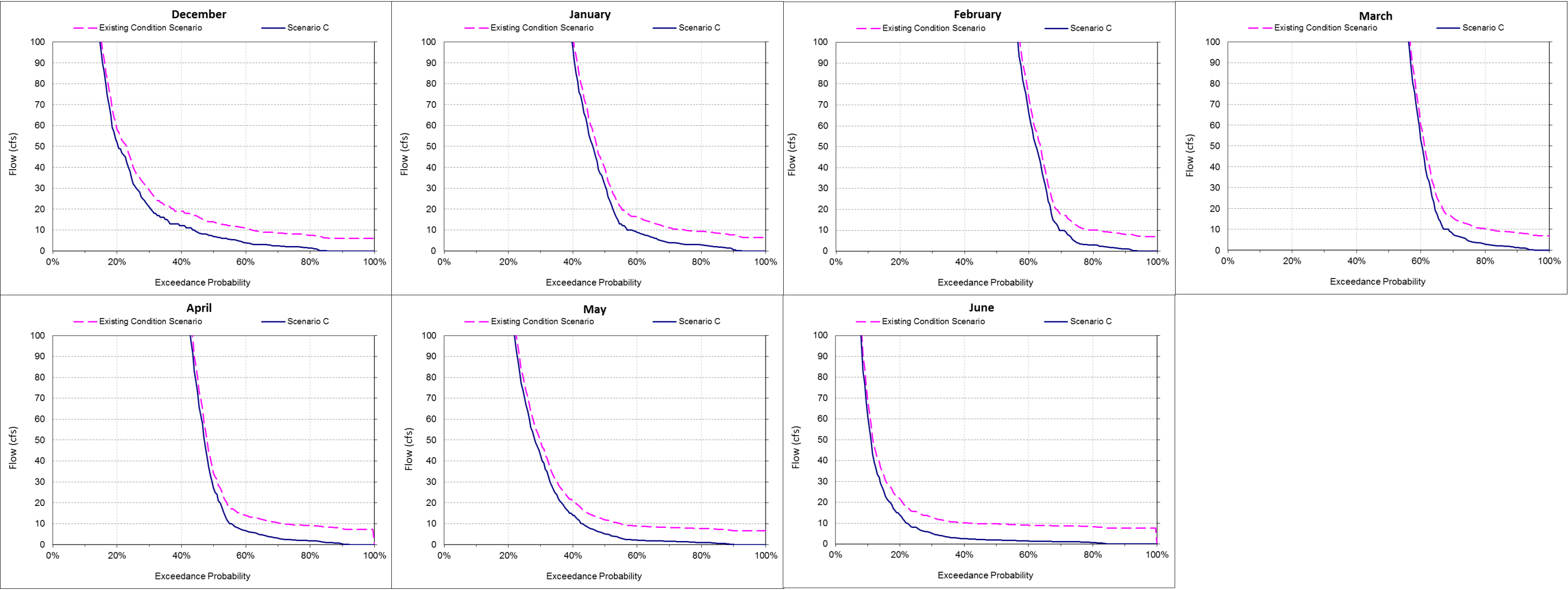


Figure 3b – Monthly exceedance probability distributions of modeled daily flows for Scenario C, relative to the Existing Condition scenario (y-axis restricted to 100 cfs)

**Table 9 – Percentages of time that modeled flows under Scenario C are less than modeled flows under the baseline condition (the Existing Condition scenario) during both the SCCC steelhead adult immigration period (December through April) and juvenile outmigration period (March through June).**

<b>Analytical Scenario</b>	<b>December</b>	<b>January</b>	<b>February</b>	<b>March</b>	<b>April</b>	<b>May</b>	<b>June</b>
<b>Percent of time Scenario C has less flow than the Existing Condition Scenario</b>	100%	100%	100%	100%	100%	100%	100%
<b>Percent of time Scenario C has slightly less flow than the Existing Condition Scenario (1% &lt; X &lt;10%)</b>	12.6%	24.2%	26.6%	28.8%	25.4%	21.7%	8.9%
<b>Percent of time Scenario C has substantially less flow than the Existing Condition Scenario (X &gt; 10% )</b>	82.3%	56.2%	40.4%	40.8%	54.5%	73.6%	90.4%
<b>Total Days Modeled</b>	2,573	2,542	2,317	2,542	2,460	2,542	2,460



**Table 10 – Model results estimates of the number of days and percentage of time represented by those days that diversions under Scenario C caused flows in the Salinas River to be reduced below the adult and juvenile passage thresholds relative to potential number of passage days and baseline conditions.**

Life stage/ Period	Number of days meeting threshold		Percent of potential migration period meeting threshold		Change in percentage of potential migration period meeting threshold (%)	Reduction in number of days meeting threshold relative to baseline	Reduction in threshold occurrence relative to baseline (%)
	Baseline	Scenario C	Baseline	Scenario C			
Adult upstream Migration							
60 cfs threshold							
Dec	508	474	19.7	18.4	1.3	34	6.7
Jan	1,160	1,130	45.6	44.5	1.2	30	2.6
Feb	1,430	1,402	61.7	60.5	1.2	28	2.0
Mar	1,524	1,511	60.0	59.4	0.5	13	0.9
Apr	1,151	1,137	46.8	46.2	0.6	14	1.2
All	5,773	5,654	46.4	45.5	1.0	119	2.1
72 cfs threshold							
Dec	467	441	18.2	17.1	1.0	26	5.6
Jan	1,111	1,083	43.7	42.6	1.1	28	2.5
Feb	1,397	1,373	60.3	59.3	1.0	24	1.7
Mar	1,498	1,484	58.9	58.4	0.6	14	0.9
Apr	1,125	1,107	45.7	45.0	0.7	18	1.6
All	5,598	5,488	45.0	44.1	0.9	110	2.0
Juvenile Downstream Migration							
50 cfs threshold							
Mar	1,555	1,530	61.2	60.2	1.0	25	1.6
Apr	1,179	1,158	47.9	47.0	0.9	21	1.8
May	762	716	30.0	28.2	1.8	46	6.0
Jun	284	272	11.5	11.0	0.5	12	4.2
All	3,780	3,676	37.8	36.8	1.0	104	2.8
56 cfs threshold							
Mar	1,539	1,515	60.5	59.6	0.9	24	1.6
Apr	1,166	1,145	47.4	46.5	0.9	21	1.8
May	720	687	28.3	27.0	1.3	33	4.6
Jun	275	257	11.2	10.5	0.7	18	6.5
All	3,700	3,604	37.0	36.0	1.0	96	2.6

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