Santa Clara Valley Water District

MID-COYOTE CREEK FLOOD PROTECTION PROJECT

BASELINE FISHERIES MONITORING REPORT YEAR 1 (2007)

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Introduction

Project Goals

As part of the Mid-Coyote Creek Flood Protection Project, the Santa Clara Valley Water District (District) is conducting a pre-project baseline fisheries investigation to inform the project team about the status of the current fishery within the project footprint. This baseline investigation will be conducted for three consecutive years (2007-2009). The information gathered in these investigations will be used to evaluate the project's potential impacts to the stream corridor as it relates to aquatic resources. This information will also be used to develop the appropriate mitigation for the chosen project alternative and identify enhancement opportunities for native fish in the project reach and the entire Coyote Creek watershed. All study conclusions, mitigation recommendations, and enhancement opportunities will be provided to the regulatory and resource agencies as well as other interested parties following the final year of the study in 2009.

Watershed Description

The Coyote Creek watershed is the largest watershed in Santa Clara County, encompassing over 320 square miles (Figure 1). The eastern and southern portions of the watershed drain most of the western face of the Diablo Mountain Range where the creek originates at elevations up to 3,650 feet. These upland areas remain undeveloped with little anthropogenic disturbance. The northern and western portions of the watershed are comprised of the Santa Clara County valley floor. Portions of the valley floor are extensively urbanized with patches of undeveloped parks and open agricultural lands. Coyote Creek has 29 tributaries and flows northwest through the valley, approximately 42 miles from the headwaters, where it enters the southern extent of the San Francisco Bay.

The Mid-Coyote Project is located on the valley floor of the Coyote Watershed on the mainstem of Coyote Creek. The project reach extends approximately 6.1 miles between Montague Expressway and Interstate 280, all within the City of San Jose.

Historic Distribution of Fish in Coyote Creek

In waterways that have little to no anthropogenic disturbance, natural variations in fish assemblages are a common occurrence. The valley floor of the Coyote Creek watershed has changed dramatically over the last one hundred years due to extensive modifications to the drainage basin. As a result, the fish communities that were uniquely adapted to the oscillating environmental conditions in Coyote Creek have also changed. To understand current fish assemblages, it is necessary to examine fish communities that occurred historically in Coyote Creek.

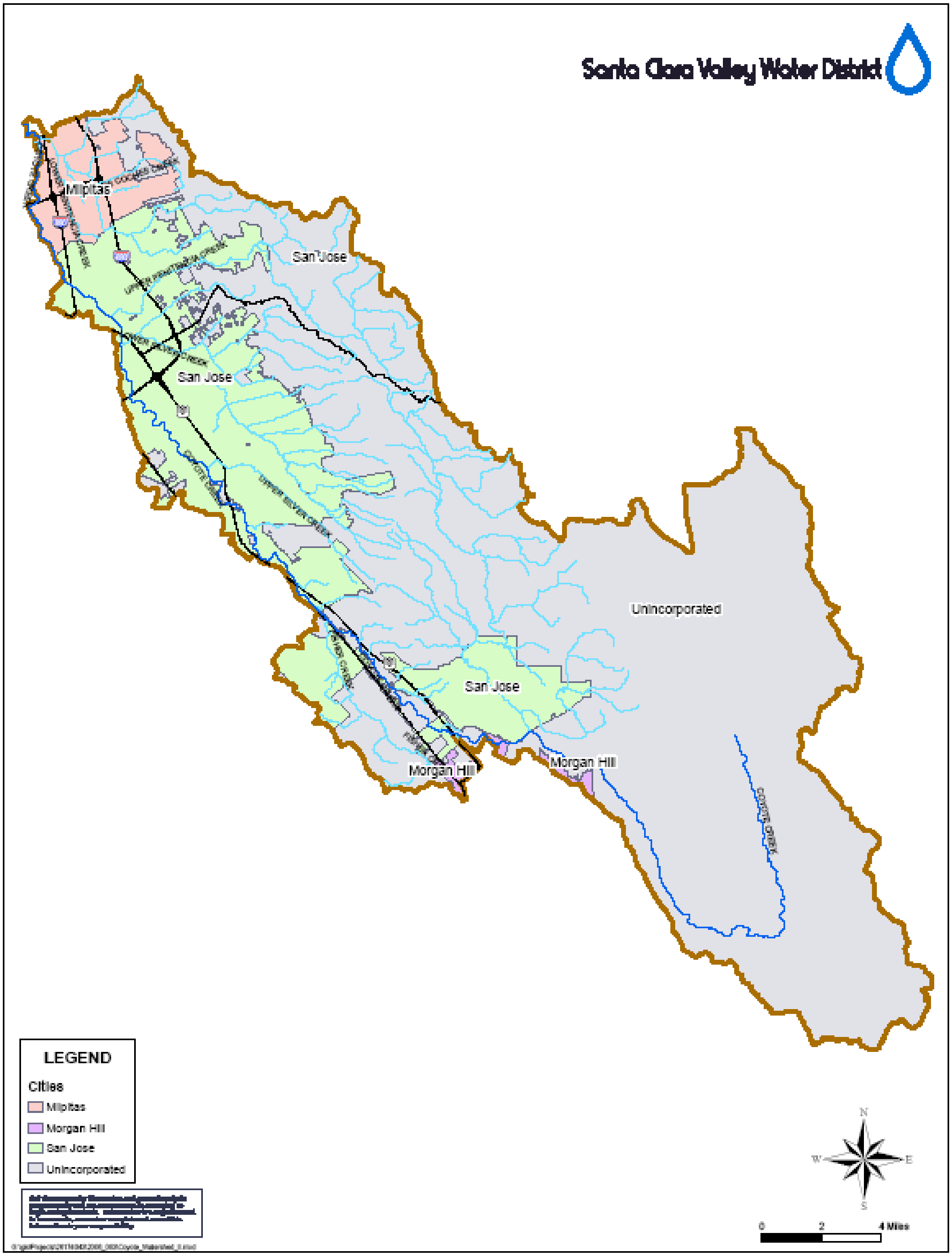


Figure 1. The Coyote Creek watershed in Santa Clara County.

The fish in Coyote Creek are characterized as part of the larger Sacramento-San Joaquin ichthyological province which historically was the center for fish speciation in California. The fish communities in the Coyote watershed are further broken down into the Monterey Bay subprovince. This subprovince is primarily comprised of three large streams, the San Lorenzo, Pajaro, and Salinas Rivers, which flow into Monterey Bay. The distribution of freshwater dispersants helps to explain the cataloging of Coyote Creek into this subprovince (Snyder, 1913) (Moyle, 2002). Geologic evidence presented by Dr. J.C. Branner in 1907 points to intercalated watersheds of Coyote and Llagas Creek (Pajaro watershed) in the headwaters. Branner and earlier California geologists describe the San Francisco Bay as being a freshwater system which connected to the Sacramento-San Joaquin Rivers and flowed toward the ocean at Monterey Bay during the middle to late Pleistocene period. During this time, freshwater dispersants from the larger Sacramento-San Joaquin basin colonized Coyote Creek and subsequently the Pajaro Watershed through the headwater connection (Branner, 1907).

J.O. Snyder, Assistant Professor of Zoology at Stanford University, was the first to record fish assemblages present in Coyote Creek. In 1904 he documented thirteen species of fish in eleven tributaries of the San Francisco Bay. Coyote Creek was the only creek he sampled that contained the full assemblage of all thirteen species (Table 1). Snyder's fish sampling took place at two locations in Coyote Creek. All thirteen species of fish were captured at the first location which was documented as being near the mouth of Coyote Creek. The second sampling location was referred to as 'near San Jose,' which is presumed to be the city's center in 1904 at Santa Clara Street. At this location, Snyder observed eight of the thirteen species (Snyder, 1904).

Table 1. Report to the Bureau of Fisheries. Fish species documented by J.O Snyder in Coyote Creek (1904)

Occurrence of fish species documented by Snyder for Coyote Creek (1904)	Common name
Entosphenus tridentatus	Pacific lamprey
*Catostomus occidentalis**	Sacramento sucker
*Orthodon microlepidotus**	Sacramento blackfish
*Lavinia exilicauda**	Hitch
Pogonichthys macrolepidotus	Sacramento splittail
*Ptychocheilus grandis**	Sacramento pikeminnow
Leucicorus crassicauda	Thicktailed chub
*Rutilus symmetricus**	California roach
Agosia nubile carringtoni	Sacramento speckled dace
*Salmo irideus**	Rainbow trout
Gasterostues cataphractus	Threespine stickleback
*Hysterocarpus traski**	Tule perch
*Cottus asper**	Prickly sculpin

* Fish captured at the second location (near San Jose) in Coyote Creek

During these initial collections, Snyder did not record the presence of Sacramento perch (*Archoplites interruptus*) or Western brook lamprey (*Lampetra richardsoni*). A researcher for the University of Michigan, Carl L. Hubbs, documented the presence of both of these species during his study in Coyote Creek in May of 1922 researching the life cycle of Lampreys (Hubbs, 1925). W. Follett with the California Academy of Sciences also found Sacramento perch in the watershed in 1932. Riffle sculpin (*Cottus gulosus*) were not recorded in Coyote Creek until 1953 by Terrence J. Merkel of the University of California Berkley. However, it is possible they were incorrectly identified by earlier collectors owing to the high variability in morphological features of the Cottidae family (CDFG, 1976). Staghorn sculpins (*Leptocottus armatus*) are not recorded in the historic record however they are known to occur in lower Coyote Creek and other streams tributary to the San Francisco Bay (David Salsbery, SCVWD, pers comm., 2006) (Moyle, 2002).

The sixteen native fish that were documented in the Coyote basin gave the creek the distinction of having the greatest diversity of fish species in the South San Francisco Bay (HRG, 1995). This distinct assemblage of fish in Santa Clara Valley persisted until the turn of the century and was the result of the mosaic of habitats available to the fauna prior to extensive modifications to the hydrology and geomorphic features of the watershed. Freshwater wetlands, lagunas, willow groves, a well entrenched, ephemeral, broad, braided channel with open riparian woodland and savanna were characteristics of the basin that was rapidly modified as agriculture and urban sprawl began to dominate the valley bottom (SFEI, 2006).

Current Distribution of Fish in Coyote Creek

Modifications to the watershed coincide with the local extirpation and extinction of native fauna and the introduction of alien species (CDFG, 1976) (HRG, 1995). The groundwater levels were already compromised by 1913 due to extensive pumping from the underground basins (SCVWD, 2005). Dams were constructed on lower Coyote Creek to prevent salt water intrusion from destroying neighboring crops (Figure 2) and the first of two reservoirs, Coyote Reservoir, was constructed to regulate runoff to the creek. Coyote reservoir was constructed in 1936 and has a drainage area of 119 square miles and a storage capacity of 22,925 acre feet (SCVWD, 2005). Instream percolation facilities were constructed to replenish the groundwater basins and sand and gravel mines were constructed on or adjacent to the mainstem of the creek (State Dept. of Public Works, 1937). The second and largest reservoir in the watershed, Anderson Reservoir, was constructed approximately 2 miles downstream of Coyote Reservoir. Anderson Reservoir, built in 1950, has a drainage area of 193 square miles and an 89,073 acre foot capacity.

Thicktailed chub and Sacramento splittail were first and last reported in Coyote Creek by Snyder in 1904 (CDFG, 1976). Thicktailed chub are extinct with the last recorded specimen being caught in the Sacramento River near Rio Vista in 1957 (Moyle, 2002). It is possible that Sacramento splittail were already declining when Snyder recorded their presence in 1904. The construction of levees and modification of the lands in lower Coyote Creek was well underway by the time Snyder recorded his first collections. The levees would have isolated the creek from the lakes, sloughs and overflow channels which characterized the area prior to settlement and would have provided appropriate hydraulic conditions for propagation of the splittail (SFEI, 2006).

Figure 2. Photograph from May 18, 1932 depicting the original Standish Dam which was constructed as an earthen, wood barrier to prevent salt water intrusion to crops. (SCVWD, 2003).

The last recorded occurrence for Sacramento perch in Coyote Creek was 1959. Tule perch and western brook lamprey were last recorded in the Coyote basin by Hubbs in 1922 (CDFG, 1976) (Leidy, 1984). A single tule perch was found on the mainstem of Coyote Creek in 1999 (SCVURPPP, 2001). The District confirmed different year classes of tule perch in the Ogier ponds in June 2003. The tule perch may have been locally extirpated after 1922 and reintroduced back to Coyote Creek during pipeline water transfers from the Central Valley. Alternatively, it is also possible that the numbers were so depressed in years subsequent to the first observation that other researchers did not observe the fish.

The last recorded observation of speckled dace in Coyote Creek occurred in 1977 (HRG, 1995). Moyle reports that speckled dace have limited distributions in some watersheds which can make them prone to local extirpation (Moyle, 2002). This may have been the case with the Coyote Creek population however little is know about the historic distribution of this fish in the Coyote Watershed.

Riffle sculpin and pikeminnow have not been observed below the reservoirs on the valley floor for many years however they still persist upstream of the reservoirs and in tributaries of less disturbed habitats (Leidy, 2007). Sacramento blackfish, Pacific lamprey, California roach, hitch, rainbow trout, prickly sculpin, Sacramento sucker and the threespine stickleback still exist on the mainstem of the valley floor. Degraded habitat, poor water quality and the presence of introduced fauna has reduced the quality and quantity of habitat for these native fish. The District's biological staff has observed the presence of 23 introduced fish in the watershed during field surveys from 1995-2007 (Table 2). Currently, the population status and structure of the remaining native fish fauna in Coyote Creek is unknown.

Table 2. Introduced fish species found in Coyote Creek from 1995-2007 by District fisheries staff. These fish were documented during various field activities (i.e. trapping and electrofishing surveys)

Occurrence of introduced fish species documented by SCVWD for Coyote Creek (1995-2007)	Common Name
Acanthogobius flavimanus	Yellowfin gobi
Ameiurus melas	Black bullhead
Ameiurus melas	Brown bullhead
Carassius auratus	Goldfish
Cyprinus carpio	Common carp
Dorosoma petenense	Threadfin shad
Gambusia affinis	Mosquitofish
Ictalurus punctatus	Channel catfish
Lepomis cyanellas	Green sunfish
Lepomis gibbosus	Pumpkinseed
Lepomis macrochirus	Bluegill
Lepomis microlophus	Redear sunfish
Lucania parva	Rainwater killifish
Menidia beryllina	Inland silverside
Micropterus salmoides	Largemouth bass
Morone saxitalis	Striped bass
Notemigonus crysoleucus	Golden shiner
Percina macrolepida	Bigscale logperch
Pimephales promelas	Fathead minnow
Pomoxis annularis	White crappie
Pomoxis nigromaculatus	Black crappie
*Oncorhynchus tshawytscha**	Chinook salmon
*Thaleichthys pacificus**	Eulachon

*These fish are native to California but not the Coyote Creek Watershed.

Baseline Fisheries Survey

The proposed flood protection project encompasses a 6.1 mile stretch of the mainstem of Coyote Creek between Montague Expressway and Highway 280. In order to characterize the aquatic habitat conditions within the project limits and serve as a basis for the fisheries monitoring, a comprehensive habitat survey was conducted between July 31 and August 11, 2006 for the entire length of the project reach.

The baseline fisheries study focuses mainly on the project reach for impact analysis, however, Upper Penitencia and Lower Silver Creek were also included since they have confluence points within the project footprint. In addition, to reference conditions upstream of the project site, four additional monitoring sites were established upstream of the project limits on the mainstem of Coyote Creek. The four sampling locations upstream of the project footprint were chosen to correspond with the previous work of Pitt and Bozemen fish sampling in 1977-1979 and the Santa Clara Valley Urban Runoff Pollution Prevention Plan (SCVURPPP) fish sampling in 1999 (Pitt et al., 1982) (SCVURPPP, 2001). This approach will allow a comparison between the various studies and provide fish assemblage data from years where there was variability in the natural hydrologic conditions.

As a first step in understanding the fisheries resources in Coyote Creek this study aims to collect and compile basic information regarding population status and structure. Various metrics were chosen to evaluate fish community composition. The objectives of this investigation is to determine the existing conditions for native fish in the project reach; determine community assemblage, taxonomic composition and spatial distribution of fishes; determine the abundance, density, age and size structure of native fish; determine the proportion of exotic taxa utilizing the project reach; and evaluate temporal, partial or total barriers to anadromous fish migration through the project reach and into Upper Penitencia Creek.

Hydrological Conditions

The hydrology and geomorphology of the valley floor has been extensively modified and the current conditions of the project reach reflect those modifications. Approximately 75 percent of runoff for the watershed occurs above Coyote and Anderson Reservoirs (Iwamura, 1999). By changing the natural downstream hydrograph, sediment, nutrients, energy and fauna have been altered in the alluvial valley.

Anderson Reservoir serves as part of the District's linked system of reservoirs for groundwater recharge and as a source of drinking water for Santa Clara County. Water is released from the reservoir during the dry summer months to replenish groundwater basins while the winter peak discharges are attenuated by reservoir operations. Anderson Reservoir has a 49 inch diameter welded steel pipe with a maximum release capacity of 550 cfs. When the reservoir spills, flows exceed 550 cfs in the creek (SCVWD, 2005). The largest documented flow on record for Coyote Creek is 25,000 cfs in 1911. After construction of Coyote and Anderson Reservoirs the largest estimated flow in the creek was 7,500 cfs in 1997 (SCVWD, 2006).

Due to the upstream dams, the reduction in peak flows on the valley floor inhibits water from entering the floodplain and stabilizes the channel. Lack of lateral migration of Coyote Creek is further exacerbated by extensive urbanization within the floodplain. The wide, irregular creek with alternating bars and islands, coarse alluvial gravels, and widely spaced riparian trees is now a simplified single thread channel through much of the middle and lower reaches (SFEI, 2006). The channel simplification is possibly the result of the creek not actively cutting into the banks and terraces therefore eliminating the course sediment which historically formed the channel bars and islands. Reduction of peak flows has also allowed encroachment of a dense vegetated canopy which is currently found within the project reach.

In addition to the reduction of peak flows, dams capture and interrupt the downstream transport of sediment. The result is a channel with lowered bed elevation and armoring of the surface layer of in channel stream deposits downstream of the reservoir (Williams et al., 1984). Additionally, there are other complex interactions influencing the hydrology and geomorphology of the valley floor. These factors include groundwater management, water diversions, historic gravel mining, ground subsidence, increased impervious surfaces and outfall pumping.

As a result of these hydrologic changes to the watershed, the habitat available for fish has also changed. The heterogeneous value of the pool-riffle reaches, commonly associated with alluvial valleys of low to moderate gradients, are now irregularly spaced and infrequent. Artificial hydrologic function can have considerable influence on biological communities and in California, non-native fish are most abundant in aquatic habitats that have been modified by human activity (Moyle, 2002).

Altered flow regimes downstream of reservoirs have profound effects on the ecology of streams. This baseline investigation incorporated rainfall data, reservoir releases and surface water monitoring data at three gauge locations on the mainstem of Coyote Creek. In addition, flow was calculated manually at each sampling station. This data will be used to help determine how hydrologic variability between sampling years effects native/introduced fish assemblages.

Methods

Site Selection

Thirteen fish sampling stations were established for a total of 2751 linear feet within the 6.1 mile project limit (Appendix A, Maps 1-4). All sampling sites were a minimum of 200 linear feet in length or greater depending on blocknet placement to adequately isolate the sampling area. The sampling stations were randomly selected in each of the designated project reaches. Project reaches were divided into 200 foot segments and the sampling site was selected based on randomly generated numbers. Private property access prohibited sampling at the randomly selected station in Reach 13. This Reach is comprised entirely of mid-channel pool; therefore, the first site with access to the creek upstream of the private property with similar habitat was selected. This site is reported as sampling site 12 located at William Street Park (Appendix A, Map 4).

The project limits were habitat typed prior to fish sampling in summer of 2006 (Entrix 2006). During the baseline fisheries investigation, the principle investigator verified the habitat types by measuring the linear distance of each habitat unit with a hip chain. Maximum pool depths and widths were also verified with a stadia rod and hip chain.

Physical habitat measurements (i.e. mean depth, width and length), instream cover (amount and complexity), canopy cover, and substrate characteristics are detailed in the Baseline Fisheries Habitat Study Report (Entrix, 2006) and are not summarized in this document. That data and future collection of these variables will be included in the final report in 2009.

Four additional sampling sites, for a total of 812 linear feet, were established upstream of the project limits on the mainstem of Coyote Creek to reference conditions outside of the project boundaries on the valley floor (Appendix A, Map 5). All sites were measured in linear feet and habitat typed using the same methodology described in the Entrix 2006 report. These sites were not randomly selected but chosen to correspond with sites sampled by Pitt and Bozeman (1982) and SCVURPPP (2001).

The SCVURPPP report identified sites on the mainstem of Coyote Creek that fell into three classifications based on land use composition within the drainage area. Urban sites had the highest percent impervious services within the drainage area and were the most impacted. Transition sites had been recently transformed (1979) from rural to urban based on previously collected data examined by the SCVURPP researchers. Sites classified as rural were downstream of Anderson Reservoir and were considered the least impacted by surrounding land use. With regards to this study, Upper Coyote Creek site A falls within SCVURPPP's urban classification zone while site B falls within the transition zone. Sites C and D correspond to the rural zone of Coyote Creek downstream of Anderson Reservoir (SCVURPPP, 2001). Similar to the project reach locations, each site was a minimum of 200 linear feet.

Additional sampling sites were established on each of the tributaries that have confluence points within the project boundaries. All sites were measured in linear feet and habitat typed using the same methodology described in the Entrix 2006 report. The first site was located on Upper Penitencia Creek at the Noble Fish Ladder, Upper Penitencia Site B (Appendix A, Map 6). The second site was located on Lower Silver Creek upstream of the confluence point with Coyote

Creek, Lower Silver Creek Site A (Appendix A, Map 3), A third site was included in this report on Upper Penitencia Creek because sampling methods were identical. The District dewatered 500 linear feet of Upper Penitencia Creek upstream of Interstate 680 to repair an eroding stream bank under Stream Maintenance Program permits. Similar to the other six sites outside of the project reach, this site will be surveyed for the two remaining years of this baseline study. This site marker is identified as Upper Penitencia Creek Site A (Appendix A, Map 6).

Hydrological Conditions

To evaluate changes in flow regimes in the sampling area, total monthly precipitation, stream flow gauging data, and reservoir releases are graphed and reported in the results. Rainfall records are summarized for the last three water years prior to fisheries monitoring. However, it should be noted that base flows for 2006/07 water year were lower than average due to limited rainfall (Western Weather Group, 2007).

Stream flows within the project reach and the mainstem of Coyote Creek downstream of the reservoirs vary considerably. Flow was calculated prior to each sampling session using a width/depth transect, where current water velocity was measured from 60% of the stream depth with a handheld Marsh-McBirney Flowmate 2000® meter.

Daily discharge within the project reach is influenced by two tributaries, Upper Penitencia Creek and Lower Silver Creek. Upper Penitencia Creek drains an area of 24 square miles with seven tributaries draining to the mainstem. The creek is perennial in the headwaters with natural springs contributing to flow. Lower Silver Creek watershed is 43 square miles which includes 11 tributaries. Some of the tributaries are also perennial in the headwaters. In addition to the two tributaries contributing flow to the project reach, 44 outfalls drain directly to the creek within the project boundaries. Thirty of these outfalls are owned and operated by the City of San Jose and range in size from 18-72 inches in diameter with a combined drainage area of 3,341 acres (SCVWD, 2007). Mean daily discharge through the project reach from the confluence of Lower Silver downstream to Montague Expressway can best be represented by the USGS stream gauge located at Highway 237 in Milpitas. A hydrograph of the mean daily discharge at the location is reported in the results for water year 2006/07.

Base flows are lower upstream of the confluence point with Lower Silver and the closest representative stream gauge, located at Edenvale Road, is approximately 5.6 miles upstream of the project reach. This District owned stream gauge is located upstream of the Upper Silver Creek confluence point so the discharge from this watershed is unaccounted for. However, manual discharge measurements taken during each sampling session at the upstream sites (Sites 13, 14, and Upper Coyote Creek Sites A and B) proved to be similar to the mean daily discharge for the Edenvale Road gauge. A hydrograph of the mean daily discharge at the location is reported for water year 2006/07 in the results.

Upper Coyote Creek sampling sites C and D are best represented by District stream gauge 82 located approximately 1.5 miles downstream of Anderson Reservoir. A hydrograph of the mean daily discharge at this location is reported for water year 2006/07 in the results. Water releases from Anderson Reservoir affect the base flows at this site. Reservoir release data was obtained from District blend logs for daily water releases for water year 2006/07. The results are graphed and reported in the results for water year 2006/07. The Coyote Canal was not operated in water year 2006/07 and water was not diverted out of the main channel into this facility.

For Upper Penitencia Creek and Lower Silver Creek sampling sites, manual discharge data was taken prior to fish monitoring and is reported in the results.

Fish Sampling

Sites were quantitatively sampled using blocknets to isolate fish within the sampling limits. Two types of electrofishers were employed during the course of the survey. Site conditions were evaluated prior to commencement of field sampling to determine which electrofishing gear was site appropriate. A Smith-Root Inc. Streambank Generator Powered Pulsator (5.0) electrofishing system with a floating tote barge was utilized at the deeper, wider sites which required more than one anode pole to effectively fish. A Smith-Root Inc. battery operated backpack (12A) unit was used at sites were the stream width was less than 15 feet wide and could be effectively fished with one anode pole and two netters.

Prior to each electrofishing session, stream conductivity and temperature measurements were taken and the electrofisher unit settings were adjusted accordingly to minimize damage or mortality to fish encountered. Other water quality parameters measured prior to sampling included ph, turbidity, and dissolved oxygen. A mutli-parameter U-10 Horiba® water quality meter was used for all the measurements and was calibrated daily before use.

Multipass electrofishing removal methods were utilized with equal effort applied to each sampling pass. Electrofishing was conducted in an upstream manner at each site. Electrofishing time was quantified in seconds for each pass through the sampling unit. Each pass represented a sampling period. Fish captured during each sampling period were relocated outside of the isolated sampling area to avoid recapture. Three passes were made at each site except during two sampling sessions: failed block nets at one site and zero captures at the other site. At the conclusion of each pass, captured fish were identified, measured and each fish was checked for abnormalities (i.e. lesions, deformities).

Percent Native Fish

A metric chosen to include in the annual report is the percentage of native/introduced fish at each of the sampling sites. Because introduced fish in California are predominately found in highly disturbed streams with altered flow regimes, this metric was chosen to measure the biotic integrity between sampling sites. Each sampling site was characterized based on the percentage of native and nonnative fish caught during each sampling session.

The project reach is dominated by mid-channel pools which comprise 77.4 percent of the total length (Entrix, 2006). Six of the thirteen sites (Sites 1, 8, 9, 10, 11, 12) randomly selected within the project limits are comprised entirely of mid-channel pool habitat. The remaining seven sites (Sites 2, 3, 4, 5, 6, 7, and 13) include a mixture of habitat units including lateral scour pools, runs and riffles. To determine if the mixed habitat sampling units have a higher percentage of native fish than the mid-channel pool sites, a t-test for independent groups was preformed. Results of the analysis are used to determine if there is a significant difference between the homogenized sites verses (i.e. mid-channel pool) versus the sites with more complexity (i.e. run, lateral scour pool, riffle etc).

Population Estimates

Population estimates were calculated for fish within each sampling unit using multipass depletion methods (Lockwood, 2000). Capture data at each sampling site was entered in Microfish 3.0, a program designed for use with depletion data to give maximum likelihood population estimates (Van Deventer and Platts, 1985). The program estimates density, standard error and degree of fit to the model (i.e. catch efficiency or capture probability). This parameter corresponds to the probability that a member of the population will be captured.

Fish that were difficult to capture and had poor depletion numbers, (i.e. *Lampetra tridentata* and *Gasterosteus aculeatus*) were not included in the analysis but are reported as total catch per sampling unit.

Fish sampling commenced May 1 and ended June 3, 2007. A summary of dates sampled, location, and the length of each unit sampled are presented in Table 3.

Table 3. Site identification number, location, date sampled and length of each sampling unit.

Sampling Site ID	Location	Date Sampled	Length of Sampling Unit (ft)
#1	Upstream Montague Expressway	May 1, 2007	200
#2	Downstream Charcot Avenue	May 2, 2007	215
#3	Upstream Charcot Avenue	May 3, 2007	218
#4	Upstream Interstate 880	May 14, 2007	214
#5	Downstream Old Oakland Road	May 7, 2007	212
#6	Upstream Old Oakland Road	May 9, 2007	252
#7	Downstream Berryessa Road	May 10, 2007	209
#8	Downstream Mabury Road	May 23, 2007	206
#9	Upstream Mabury Road	May 21, 2007	208
#10	Upstream of Highway 101	May 17, 2007	203
#11	Downstream E. Santa Clara Street	May 24, 2007	211
#12	Upstream E. William Street	June 3, 2007	203
#13	Downstream Interstate 280	May 8, 2007	200
Upper Coyote Creek Site A	Upstream Interstate 280	May 30, 2007	200
Upper Coyote Creek Site B	Upstream Ford Road	May 22, 2007	200

Sampling Site ID	Location	Date Sampled	Length of Sampling Unit (ft)
Upper Coyote Creek Site C	Upstream Ogier Ponds	May 31, 2007	209
Upper Coyote Creek Site D	Downstream Anderson Reservoir	May 15,2007	203
Upper Penitencia Site A	Upstream Intestate 680	July 23, 2007	500
Upper Penitencia Site B	Noble Fish Ladder	May 16, 2007	200
Lower Silver Site A	Downstream Highway 101	May 11, 2007	200

The population results are summarized in this annual report but no further analysis will occur with this data until year three of the sampling is complete. After year three, the population data and habitat variables collected (i.e. discharge, water temperature, conductivity, percent cover etc.) at each of the sites will be incorporated into a statistical analysis to investigate weather there is an association between fish assemblages and environmental variables within the study area. This analysis will help determine what habitat variables favor native versus introduced fish assemblages and determine what effects the annual fluctuations of flow have on native fish communities.

Length Frequency Histograms

Length-frequency histograms were graphed to assist in determining age and size structure of native fish within the project footprint. Catch rates were frequently low and the histograms were unimodal distribution which made it difficult to determine year class structure. Scale analysis will be incorporated in future sampling efforts for this program to elucidate age structure.
The width of the length groups for the histograms is based on the maximum fish length. A 1.0 cm interval was used for species that reach 30 cm. A 2.0 cm interval was used for species that reach 50 cm.

Fish Passage Evaluation

Identification of temporal, partial or total barriers to upstream/downstream fish migration for juvenile and adult anadromous fish was also investigated as part of this study. To utilize a consistent method for collection and analysis of andromous fish passage data, the protocol designed by the California Department of Fish and Game for Fish Passage Evaluation at Stream Crossings was used in conjunction with FishXing® software (CDFG, 2003) (Love, 1999).The first potential passage impediment analyzed is a culvert pipe on Upper Penitencia Creek approximately 85 feet upstream of the confluence with Coyote Creek (Figure 3). The site was chosen primarily because it is a stream crossing that constricts the natural channel width.

Figure 3. Entrance to the culvert located upstream of the confluence Coyote Creek in Upper Penitencia Creek .

A topographic survey of the 45-foot long by 5-foot wide circular culvert located on Upper Penitencia Creek was performed in January 2008. Elevation and horizontal data measured (to within two hundredths of a foot) included the culvert's upstream and downstream invert and diameter, the roadway deck, and channel cross sections taken just upstream and downstream from the culvert. The inlet headwall configuration, depth and type of sediment within the culvert, and outlet pool dimensions were also measured to provide inlet losses, hydraulic roughness, and tailwater control information respectively.

The physical data described above and additional fish-specific information for *L. tridentata* and *O. mykiss* including mean discharge values during migration, minimum water depth requirements, and swimming abilities was entered into the FishXing® software to determine the culvert's impact to anadromous fish passage. Flow data was evaluated from 1-500 cfs and a passable flow range was established based on pipe dimensions and species specific swimming capabilities.

A biological criterion for adult *O. mykiss* was referenced from the CDFG Fish Passage Evaluation at Stream Crossings Manual (2003). Fish length for adult *O. mykiss* was based on the fork length of the adult fish captured at the Upper Penitencia Creek Sampling Site B. Out-migrant *O. mykiss* length was based on the average fork length of fish captured during out-migrant trapping operations on Coyote Creek (SCVWD, 2002). A low passage design flow of 1.0 cfs was chosen to evaluate fish passage during low flows because during migration seasons the creek typically will have a minimum of 1.0 cfs passing through the culvert. A high passage design flow of 500 cfs was chosen because that is the maximum capacity of the creek from King Road down to the confluence with Coyote Creek (SCVWD, 1988).

Fish passage at the culvert was also evaluated for of adult *L. tridentata*. The size of adult L *tridentata* was based on the average size of the adults captured during the baseline fisheries monitoring. Swimming performance criteria for adult *L. tridentata* was taken from Mesa et al. 2003. Due to the role that attachment of the suctorial disc plays in upstream movement of *L.*

tridentata, minimum depth requirement data was difficult to obtain. For the purposes of this analysis, a depth requirement of 0.3 ft was chosen as minimum for upstream movement.

Temperature Monitoring

Onset Computer Corporation Optic Stowaway® Temperature Monitors were deployed at half mile increments throughout the project reach. Fourteen temperature monitoring stations were established in 2005 (Table 4) (Appendix A, Map 7). The temperature loggers were programmed to record water temperature every hour to capture the range of daily temperature fluctuations within the stream. Two temperature loggers were deployed at each station in the event of monitor failure. The temperature loggers were placed in protective casings and secured to the bank with cable. The loggers were allowed to sink to the bottom of the creek away from direct solar radiation which could artificially influence the temperature reading. A summary of deployment/retrieval dates and results from each the monitoring location for 2005-2007 are presented in appendix B. No further analysis will occur with this data until year three of the sampling is complete.

Table 4. Summary of temperature recorder station identification numbers with location and project reach number.

Temperature Logger Station ID	Location	Project Reach Number
1	Downstream Montague Expressway	4a
2	Downstream Charcot Avenue	4b
3	Downstream O' Toole	5
4	Upstream Ridder Park Drive	7
5	Upstream Old Oakland Road	8a
6	Downstream Berryessa Road	8b
7	Upstream Berryessa Road	9
8	Upstream Mabury Road	10
9	Downstream East Julian Street	11
10	Downstream East Santa Clara Street	12
11	Downstream East San Antonio Street	13
12	Upstream East William Street	14
13	Upstream Interstate 280	n/a
14	Lower Silver Creek upstream of confluence with Coyote Creek	n/a

Results

A total of twenty sites were sampled within the Coyote Creek watershed. The total number of fish captured at each site ranged from 5 at sampling site 12 to 538 at Upper Penitencia Creek Site A. Overall, nineteen species of fish was captured within the study area. Eight of the nineteen species were native to the watershed while the remaining eleven were introduced (Table 5).

Table 5. Species identification, common and scientific names of fishes collected in the Coyote Creek watershed during the 2007 fisheries study.

Species ID*	Species	Common Name	Origin
SSKR	*Catostomus occidentalis*	Sacramento sucker	N
SHRT	*Oncorhynchus mykiss*	Steelhead/rainbow trout	N
RCH	*Lavinia symmetricus*	California Roach	N
PSCP	*Cottus asper*	Prickly sculpin	N
TP	*Hysterocarpus traski*	Tule perch	N
STK	*Gasterosteus aculeatus*	Threespine stickleback	N
H	*Lavinia exilicauda*	Hitch	N
PL	*Lampetra tridentata*	Pacific Lamprey	N
RS	*Cyprinella lutrensis*	Red shiner	I
FHM	*Pimephales promelas*	Fathead minnow	I
CP	*Cyprinus carpio*	Common carp	I
LMB	*Micropterus salmoides*	Largemouth bass	I
BG	*Lepomis macrochirus*	Bluegill	I
GSH	*Notomigonus chrysoleucas*	Golden shiner	I
PSD	*Lepomis gibbosus*	Pumpkinseed	I
GF	*Carassius auratus*	Goldfish	I
WCR	*Pomoxis annularis*	White crappie	I
MOS	*Gambusia affinis*	Mosquitofish	I
IS	*Menidia berylina*	Inland silverside	I

Note: Origin codes: N = native, I = introduced.
*Species codes were used to simplify tables and graphs for the results section.

Rainfall totals when the fish sampling began in May was 9.46 inches for the year which was 65% of average for this location. Monthly precipitation totals are shown in Figure 4 for the three water years prior to the onset of this study.

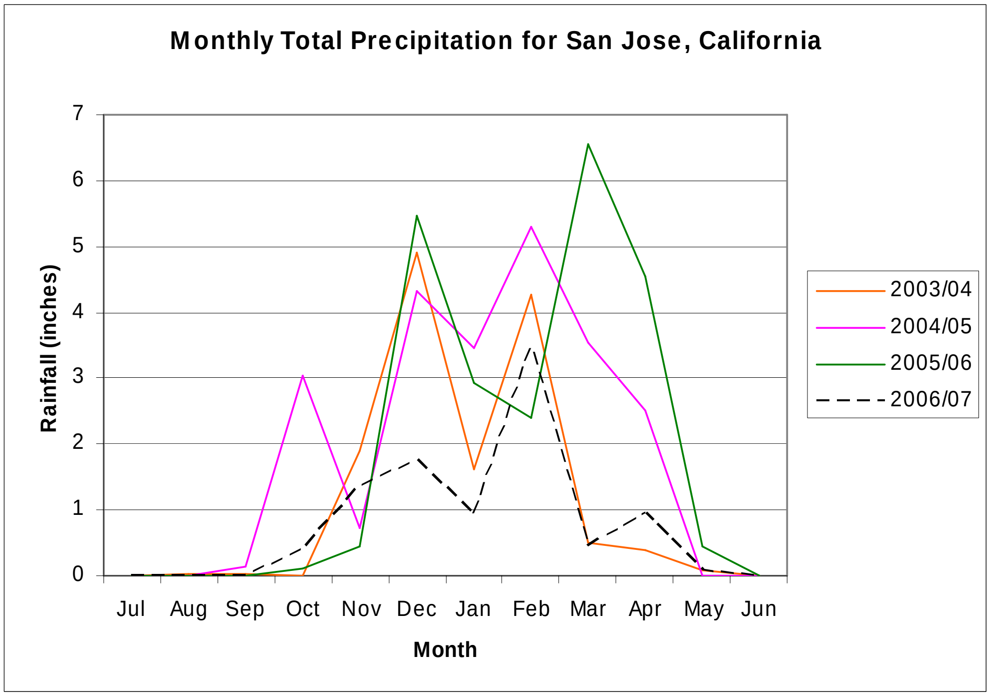


Figure 4. Monthly total precipitation for San Jose, California for water year 2003 -2007.

The fish sampling results are summarized below in three sections based on their location within the study area. Section 1 displays the results within the flood protection project limits from Montague Expressway to Interstate 280 (sites # 1-13). Information in this section includes: hydrographs for stream gauges which influence the project area; types of habitat units sampled; total number of each species captured; population estimates for each sampling site; water quality results at each sampling station; and percent native/introduced fish captured at each sampling location. In addition, the results of the independent t-test analysis are reported for sampling units comprised of more than one habitat type versus homogenized sampling sites.

Section 2 provides results for the four reference sites selected upstream of the project reach, Upper Coyote Creek (UCC) sites A-D. Hydrographs, habitat type's sampled, total number of each fish species captured, water quality results at each sampling unit, and population estimates for each sampling site are reported.

Section 3 provides results for the two tributaries, Upper Penitencia Creek (sites A and B) and Lower Silver Creek (site A). Linear feet of each habitat unit surveyed, number of each fish species captured and water quality results are reported for each site. In addition, the results of the fish passage analysis for the culvert on Upper Penitencia Creek are reported for adult and juvenile *O. mykiss* and adult *L. tridentata*.

The results of the temperature monitoring stations are reported in Appendix B. These results will be analyzed along with year two and three findings of the study and summarized in the final report in 2009.

Section 1-Flood Protection Project Area (Sampling Sites 1-13)

Hydrographs

Mean daily discharge for sampling sites 1-11, from Montague Expressway to the confluence with Lower Silver, are depicted in Figure 5. Mean daily discharge for sampling sites 12 and 13, Coyote Creek upstream of the confluence with Lower Silver to Interstate 280, are depicted in Figure 6. Manual discharge measurements taken at each sampling site are reported in Table 6. The base flow is considerably lower at the Edenvale gauge and consequently the last two fish sampling stations within the flood protection project limits.

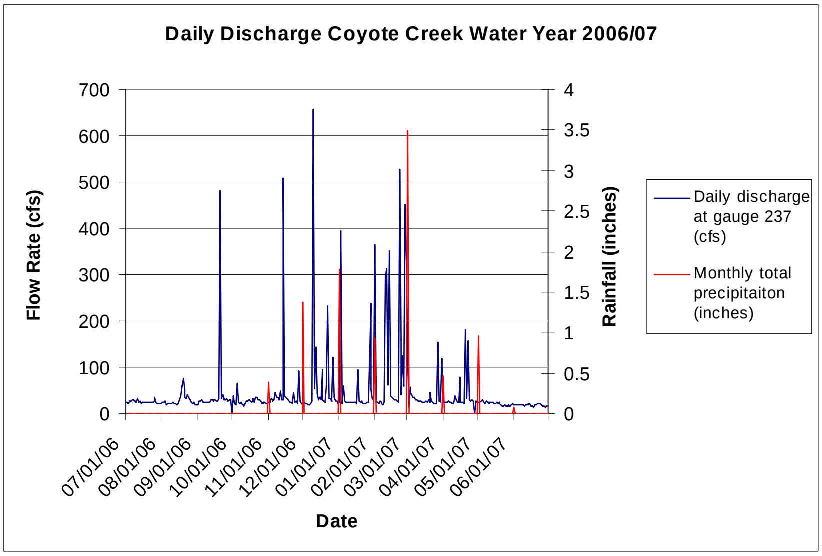


Figure 5. Mean daily discharge for water year 2006/07 measured at USGS gauge at Highway 237 in Milpitas.

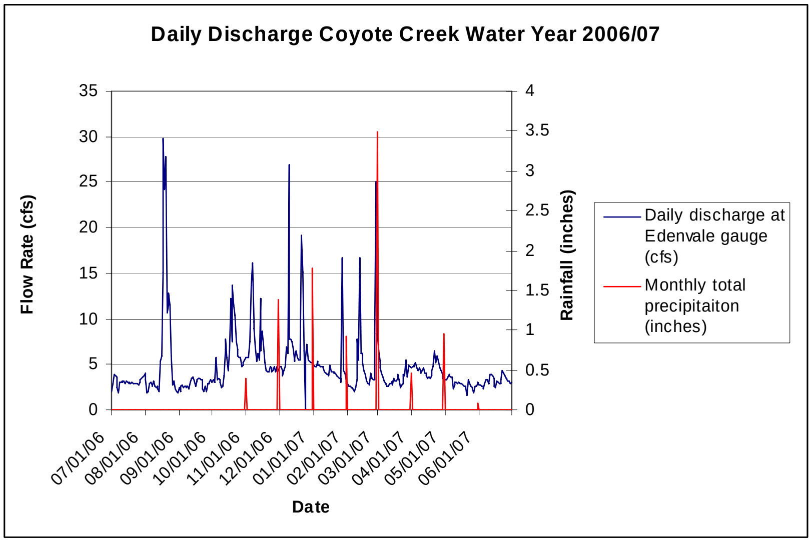


Figure 6. Mean daily discharge for water year 2006/07 measured at Edenvale gauge on Coyote Creek.

Table 6. Manual discharge at sampling sites 1-13.

Site ID	Date	Discharge (cubic feet per second)
1	May 1, 2007	21.8
2	May 2, 2007	25.1
3	May 3, 2007	26.6
4	May 14, 2007	18.3
5	May 7, 2007	22.7
6	May 9, 2007	24.8
7	May 10, 2007	16.8
8	May 23, 2007	15.8
9	May 21, 2007	19.4
10	May 17, 2007	24.8
11	May 24, 2007	18.6
12	June 3, 2007	13.4
13	May 8, 2007	4.2

Habitat Types

The flood control project limits are dominated by pools, particularly mid-channel pools which make up 77.4 % of the total 6.1 miles. Runs, including pool tailouts, are the second most abundant habitat type comprising 15.1 % of the overall project area. Riffles only make up 1.1 % of the flood control project area.

A total of 2751 linear feet of stream reach was sampled within the flood protection project area during the 2007 sampling season. This equates to an 8.5% sampling effort. Of the 2751 linear feet sampled, 72.8% were pools (mid-channel and lateral scour), 23.5% were runs and 3.7% were riffles (Figure 7). This combination of habitat types provides a representative sample of the larger flood protection project area.

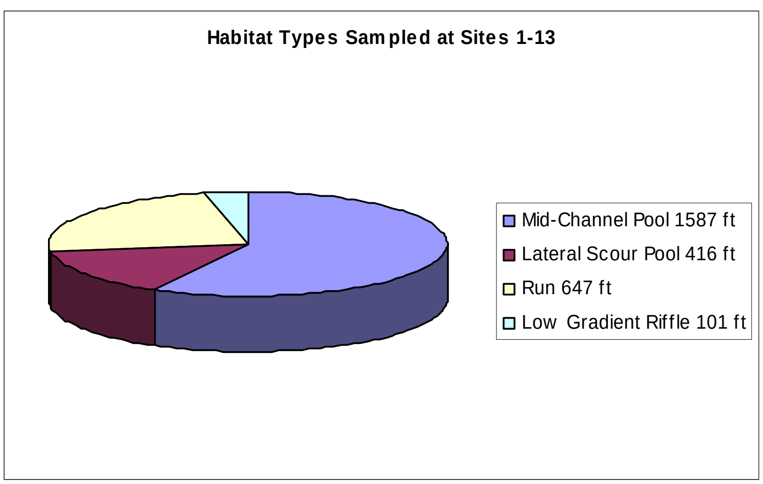


Figure 7. Total linear feet of each habitat type sampled during May 2007 from Montague Expressway to Interstate 280 on Coyote Creek

Seventeen species of fish, representing eight families were captured within the thirteen sampling sites within the flood protection project area (Figure 8). Six of the seventeen species captured are native to the Coyote watershed with two of the six being found in the greatest abundance, *C. occidentalis* and *L. symmetricus.* Results of the length frequency histograms for *L. symmetricus* and *C. occidentalis* make it difficult to elucidate year class however it is evident that multiple year classes are present for both species (Figures 9 and 10). *C. occidentalis* was captured at all sites except two, sites 9 and 11. *L symmetricus* was captured at all sites except four: sites 1, 8, 9, and 10. *L. symmetricus* and *L. exilicauda* are known to hybridize in Coyote Creek and although anal fin ray counts were performed in the field, hybrids may have been classified erroneously as *L. symmetricus* (Moyle, 2002). Over 50% of the total number of L. *exilicauda* was captured at site 7. *L. tridentata* was the third most abundant native fish found within the project limits. They were captured primarily at three locations, sites 5, 7, and 8 with the greatest number captured at site 7. All captured *L. tridentata* were ammocetes with the exception of four adults, ranging in total length from 433-590 mm (Figure 11). Three redds for *L. tridentata* were observed upstream of sampling site 6, Reach 8a of the flood protection project.

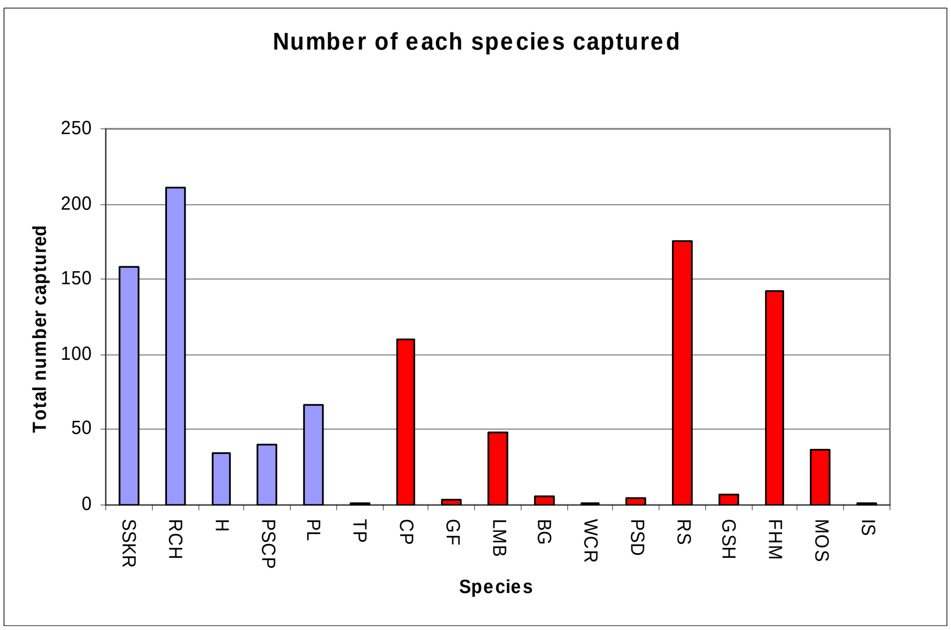


Figure 8. Total number of each species captured from Montague Expressway to Interstate 280. (Native fish are depicted in blue and introduced fish in red)

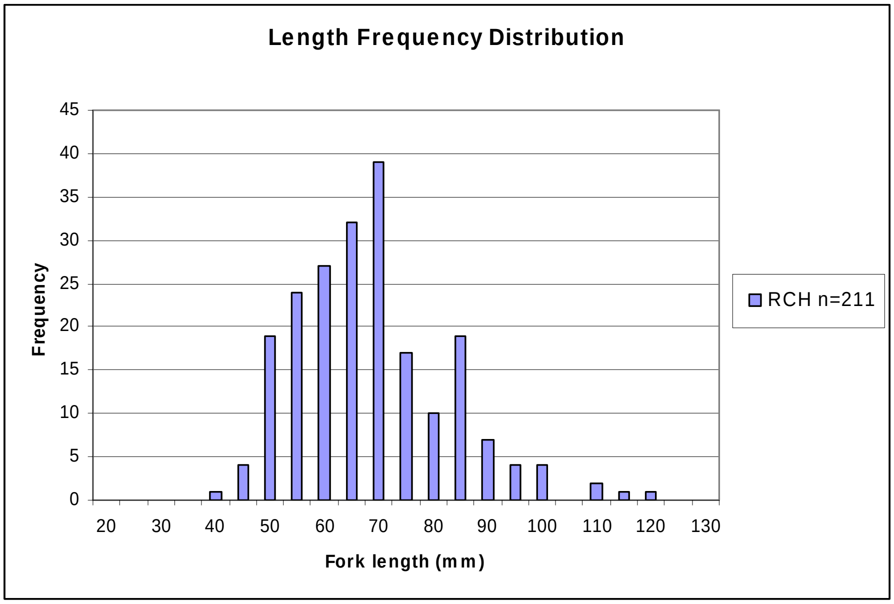


Figure 9. Length frequency histogram for *Lavinia symmetricus* captured within the flood protection project area.

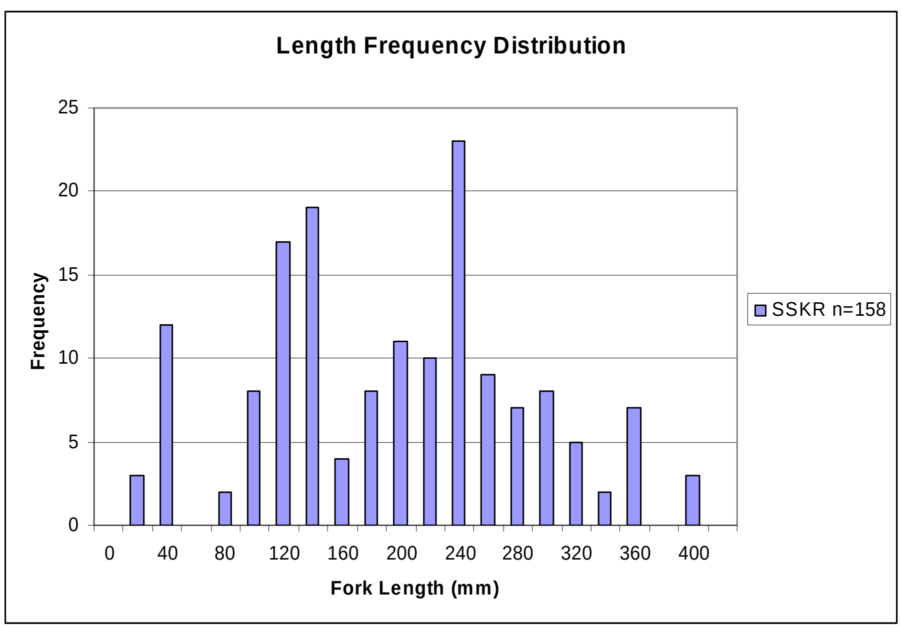


Figure 10. Length frequency histogram for *Catostomus occidentalis* captured within the flood protection project area.

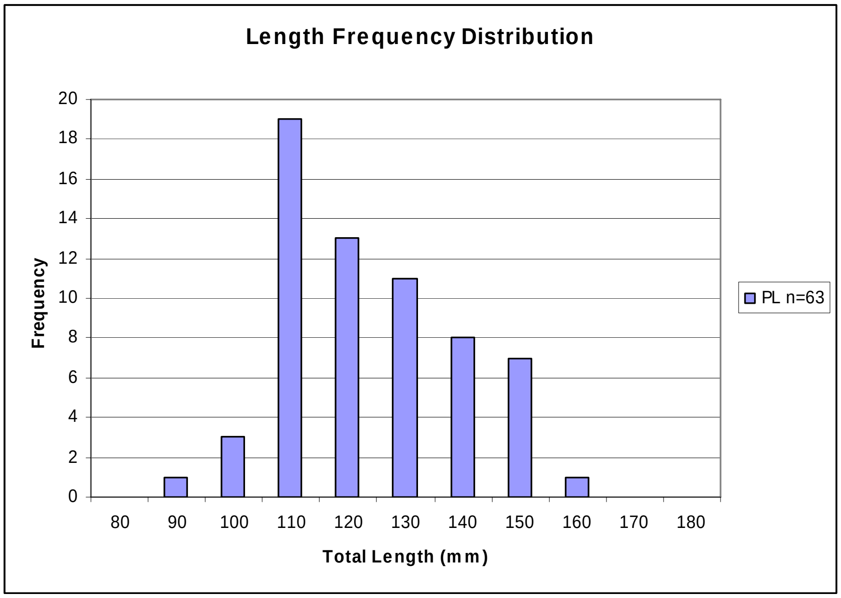


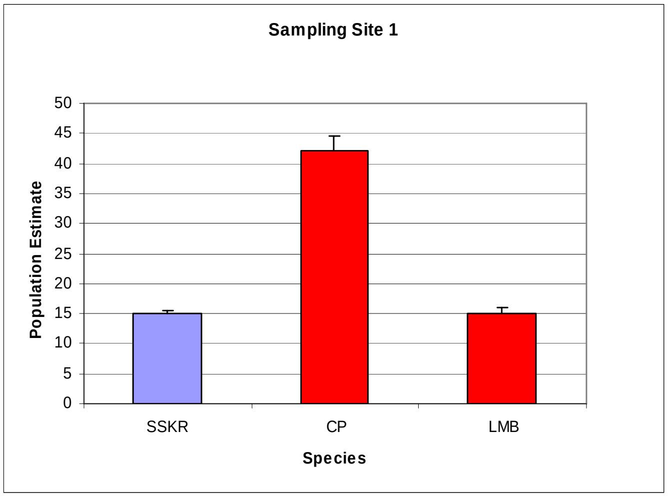
Figure 11. Length frequency histogram for *Lampetra tridentata* ammocetes captured within the flood protection project area.

Population Estimates

Maximum likelihood population estimates were calculated based on the multipass depletion method with capture data at each sampling site. Each fish captured was partitioned during sampling by species and size group. Size group estimates and their variances are summed to provide total population estimates. Population estimate standard error is denoted on the graphs by error bars. The upper and lower confidence interval is also provided for each species.

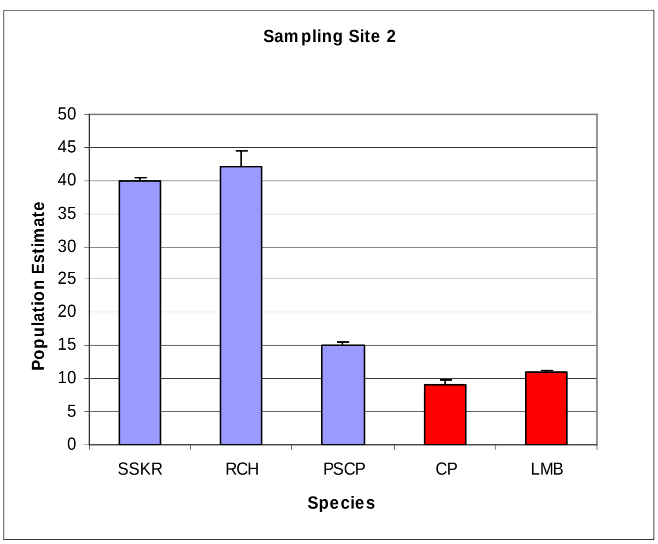
This method requires that an adequate number of fish be removed on each sampling pass so that measurably fewer fish are available for capture and removal on a subsequent pass. Population estimates were not calculated for fish with poor depletion numbers (i.e. *L. tridentata, G. aculeatus*).

The greatest number of fish was captured at Site 11 (240) while the fewest fish were captured at Site 12 (5). No population estimates were calculated for Site 12 because of the low number of captures. Native fish are depicted in blue on all graphs; introduced fish are depicted in red.



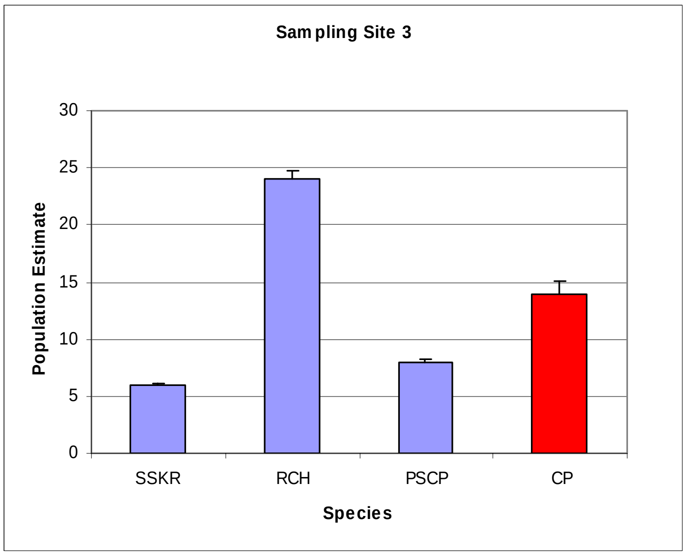
Species	Lower confidence interval	Upper confidence interval
SSKR	14	16
CP	37	47
LMB	13	17

Figure 12. Results of population estimates for fish captured from Site 1.



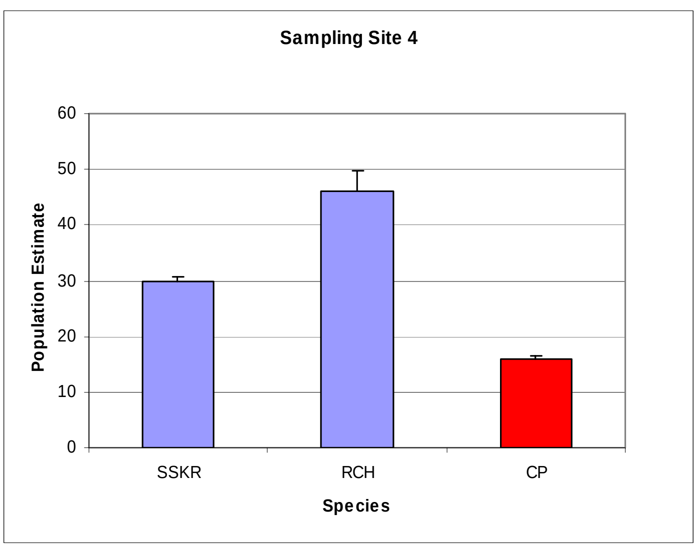
Species	Lower confidence interval	Upper confidence interval
SSKR	39	41
RCH	37	47
PSCP	14	16
CP	7	11
LMB	11	12

Figure 13. Results of population estimates from fish captured from Site 2.



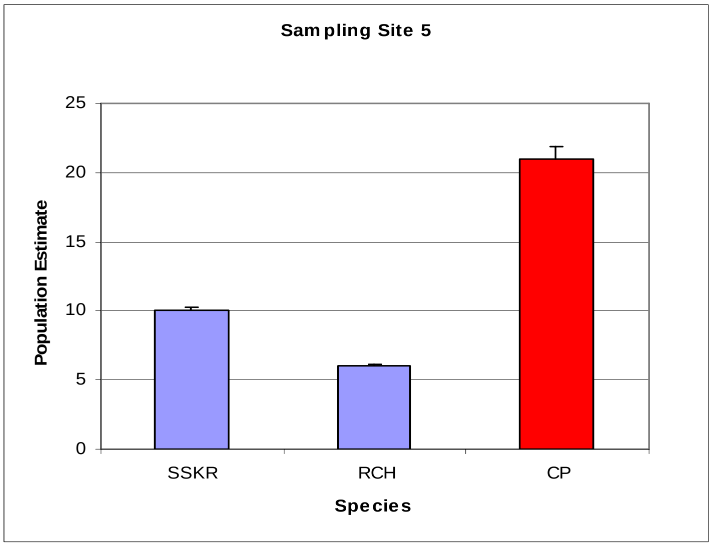
Species	Lower confidence interval	Upper confidence interval
SSKR	6	7
RCH	22	26
PSCP	7	9
CP	12	16

Figure 14. Results of population estimates from fish captured from Site 3.



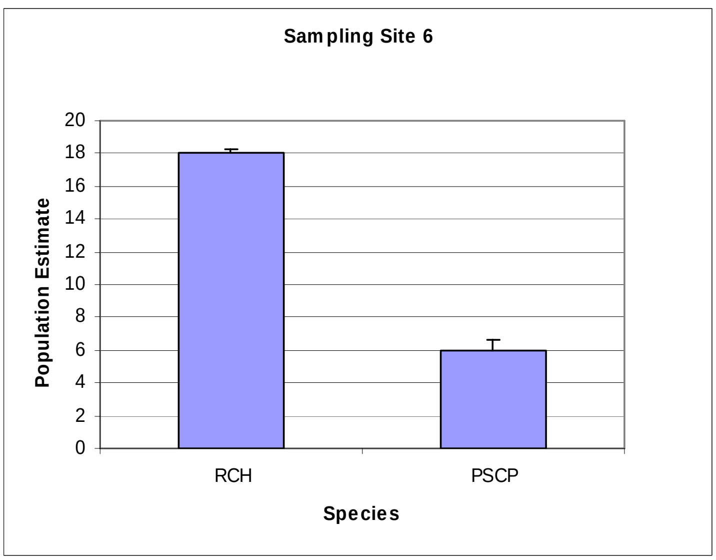
Species	Lower confidence interval	Upper confidence interval
SSKR	29	31
RCH	38	54
CP	15	17

Figure 15. Results of population estimates from fish captured from Site 4.



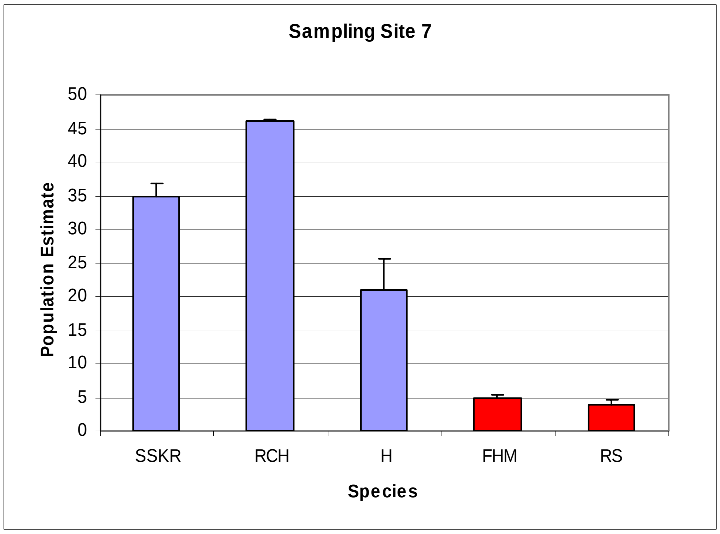
Species	Lower confidence interval	Upper confidence interval
SSKR	9	11
RCH	5	6
CP	19	23

Figure 16. Results of population estimates from fish captured from Site 5.



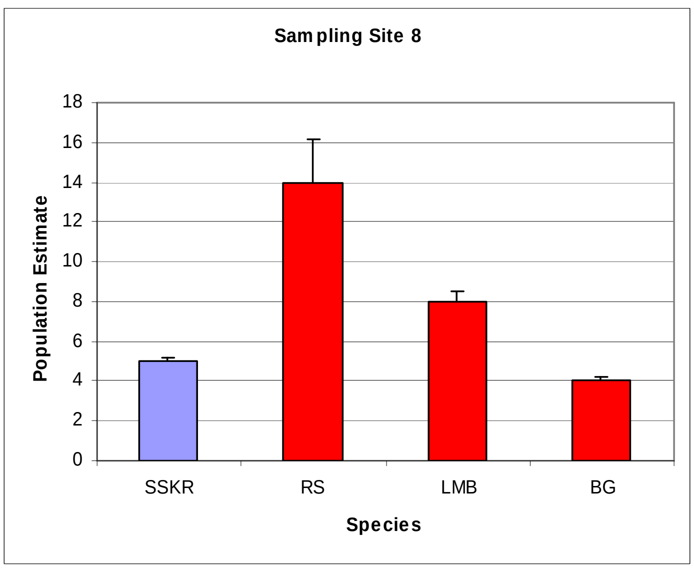
Species	Lower confidence interval	Upper confidence interval
RCH	17	19
PSCP	4	7

Figure 17. Results of population estimates from fish captured from Site 6.



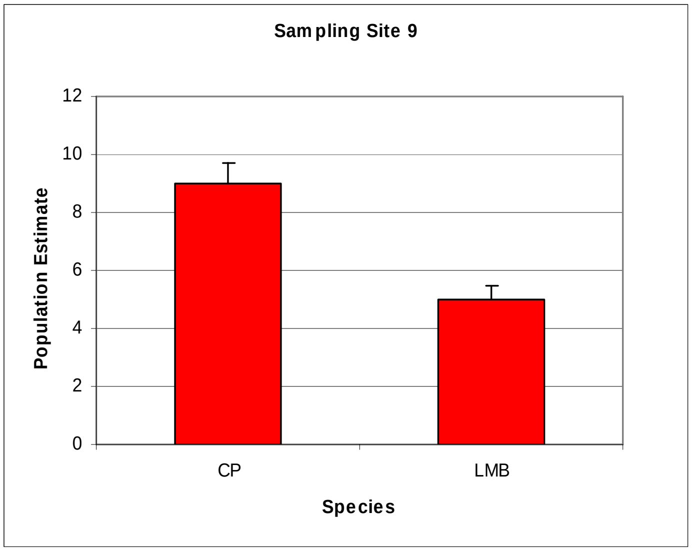
Species	Lower confidence interval	Upper confidence interval
SSKR	31	39
RCH	45	47
H	12	30
FHM	4	6
RS	2	5

Figure 18. Results of population estimates from fish captured from Site 7.



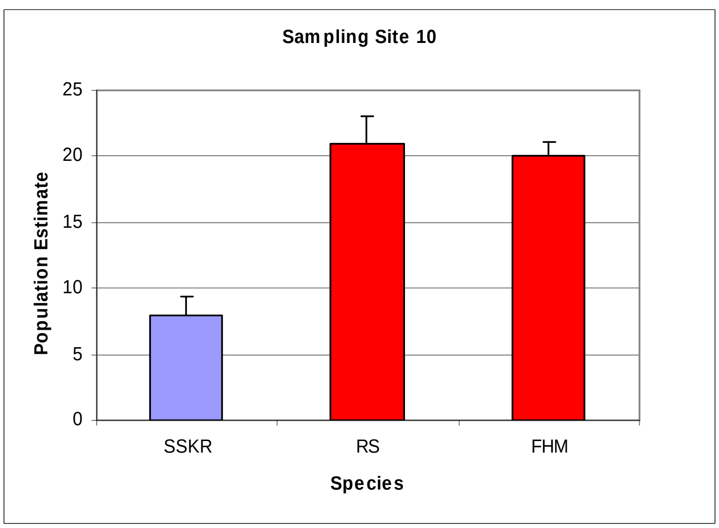
Species	Lower confidence interval	Upper confidence interval
SSKR	4	5
RS	9	19
LMB	7	9
BG	3	5

Figure 19. Results of population estimates from fish captured from Site 8.



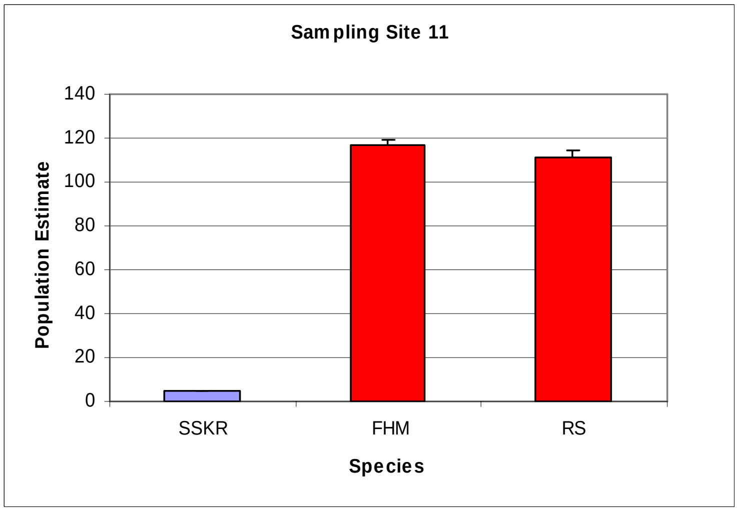
Species	Lower confidence interval	Upper confidence interval
CP	7	11
LMB	4	6

Figure 20. Results of population estimates from fish captured from Site 9.



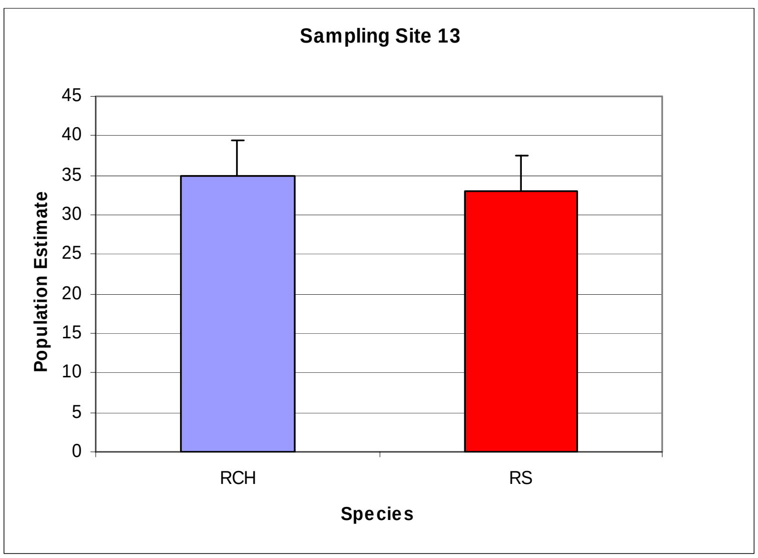
Species	Lower confidence interval	Upper confidence interval
SSKR	5	11
RS	17	25
FHM	18	22

Figure 21. . Results of population estimates from fish captured from Site 10.



Species	Lower confidence interval	Upper confidence interval
SSKR	4	6
FHM	112	122
RS	105	117

Figure 22. Results of population estimates from fish captured from Site 11.



Species	Lower confidence interval	Upper confidence interval
RCH	26	44
RS	24	42

Figure 23. Results of population estimates from fish captured from Site 13.

As represented in Figure 24, certain sites had a disproportionate amount of native versus introduced fish. Sites sampled which had only one habitat type present (i.e. mid-channel pool) within the sampling unit were statistically analyzed to see if there was a significant difference in the number of introduced fish at these sites verses the sites with more than one habitat type present (i.e. riffle, run , lateral scour pool) (Table 7).

Results of the independent t-test demonstrate that sites with only one habitat type present ($M=79.62$, $SD=17.31$) had a significantly higher percentage of introduced fish then those sites with mixed habitat units ($M=23.90$, $SD=18.10$), $t=5.64$, $p=<0.001$.

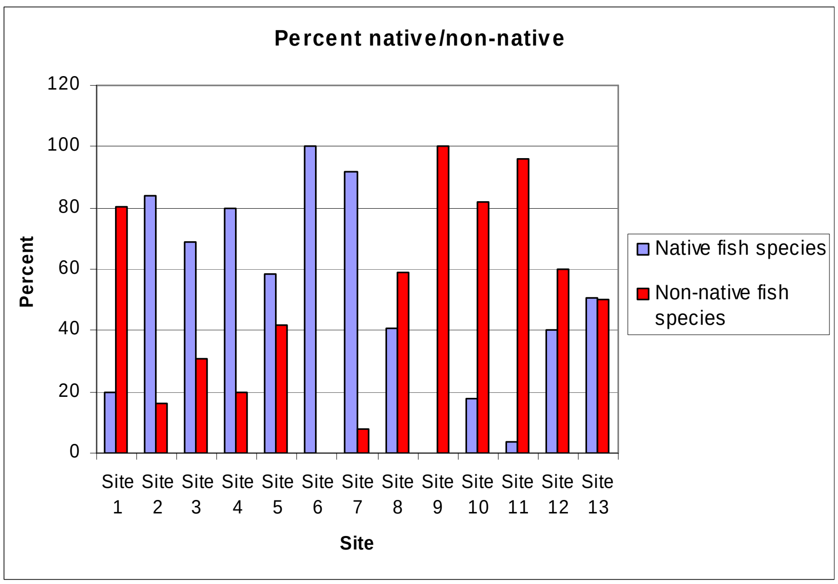


Figure 24. Percentage of native/introduced fish captured at each sampling location.

Table 7. Linear feet of habitat type at each sampling site.

Sampling Site ID	Linear Feet of Each Habitat Type Sampled	Total Linear Feet Sampled
#1	MCP (200)	200
#2	RUN (149), LSP (67)	216
#3	MCP (156), RUN (62)	218
#4	MCP (75), LSP (88), RUN (51)	214
#5	MCP (130), RUN(82)	212
#6	LSP (80), RUN (132), LGR (40)	252
#7	LSP (91), RUN (96), LGR (22)	209
#8	MCP (206)	206
#9	MCP (208)	208
#10	MCP (203)	203
#11	MCP (211)	211
#12	MCP (203)	203
#13	LSP (89), RUN (72), LGR (39)	200

Note: MCP=mid channel pool, LSP=lateral scour pool, LGR=low gradient riffle

Water Quality Sampling

Water quality parameters were recorded at each sampling site prior to electrofishing activities (Table 8). All sites had sufficient dissolved oxygen levels to support aquatic life. Diel fluctuations in water temperature are recorded by the temperature loggers however instantaneous water temperature was taken prior to sampling. Water temperatures ranged within the project limits from 15.0 °C to 20.3 °C. Turbidity was generally high, ranging from 8-35 NTUs. This study did not focus on the source of the turbidity at the sampling stations however it is noted that turbidity decreases substantially from the urban to rural fish sampling sites.

Table 8. Water quality results for fish sampling Sites 1-13.

Station ID/Time of measurement	Water Temperature (°C)	Dissolved Oxygen (mg/l)	pH	Turbidity (NTU)	Conductivity (mS/cm)
#1/10:03	17.8	7.8	8.05	19	1.09
#2/12:07	15.0	11.5	8.17	18	1.10
#3/11:35	19.5	9.6	8.29	18	1.09
#4/08:50	18.2	9.7	8.29	30	1.12
#5/08:48	19.1	9.4	8.26	19	1.10
#6/09:45	19.9	9.4	8.20	24	1.11
#7/13:50	20.3	9.7	8.18	25	1.12
#8/9:40	17.2	9.6	8.24	17	1.28
#9/08:55	18.5	8.4	8.31	35	1.11
#10/08:55	16.9	9.9	8.23	21	1.25
#11/09:15	17.9	10.1	8.15	26	1.10
#12/09:55	17.3	8.2	8.02	16	1.03
#13/10:00	18.2	9.6	8.07	8	0.92

Section 2-Upper Coyote Creek (Sampling Sites A-D)

Hydrographs

Mean daily discharge for Upper Coyote Creek sites A and B are depicted by the Edenvale gauge shown in Figure 6. Upper Coyote Creek Sites C and D are depicted by the Madrone gauge in Figure 25. Flows in this area of the creek are influenced by releases from Anderson Reservoir (Figure 26) as well as flow augmentation from a hydroelectric facility and San Felipe pipeline. Base flows at fish sampling sites C and D are significantly higher than the downstream sampling sites. Manual discharge measurements were taken at each of the sites and are shown in Table 9.

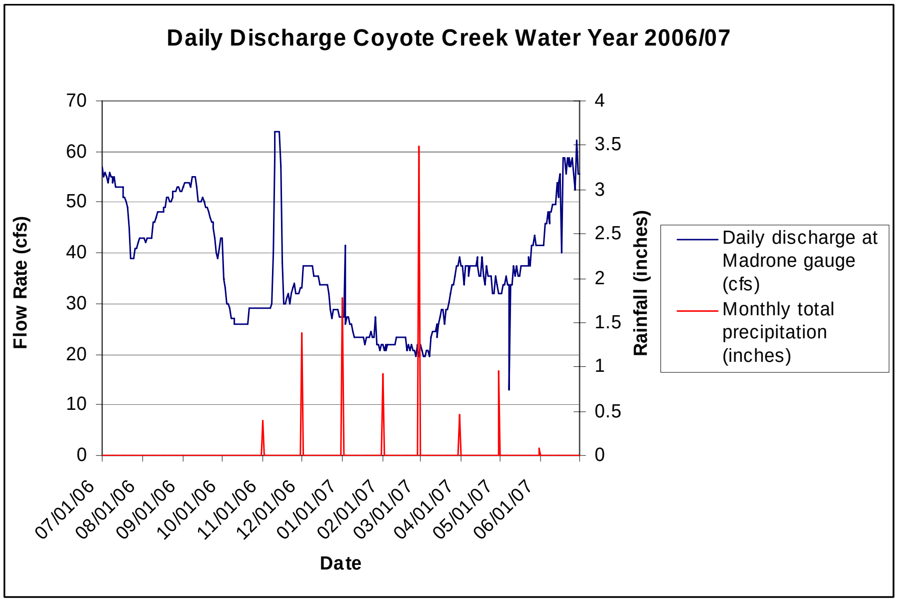


Figure 25. Mean daily discharge for water year 2006/07 measured at Madrone gauge on Coyote Creek.

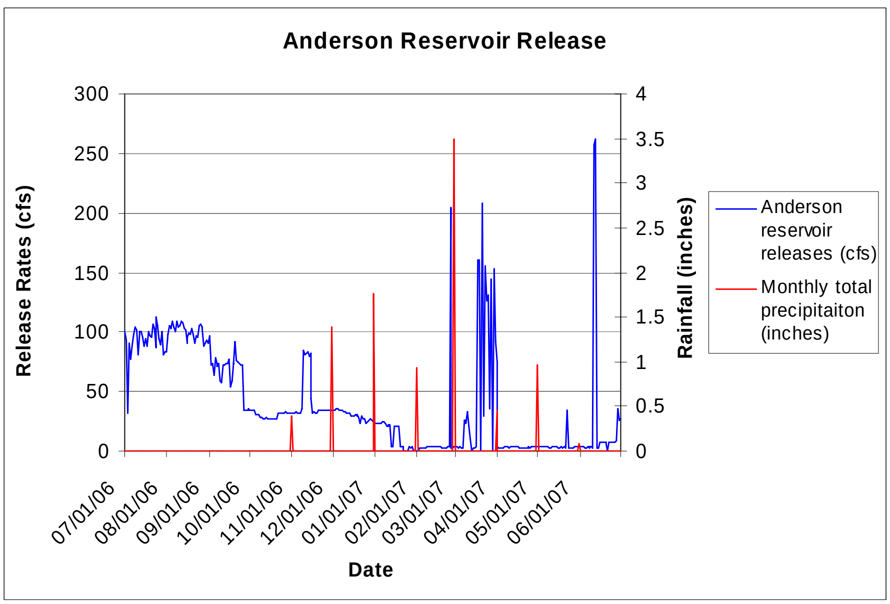


Figure 26. Water releases from Anderson Reservoir and monthly total precipitation on the valley floor for water year 2006/07.

Table 9. Manual discharge at Upper Coyote Creek Sites A-D.

Site ID	Date	Discharge (cubic feet per second)
Upper Coyote Creek Site A	May 30, 2007	3.8
Upper Coyote Creek Site B	May 22, 2007	4.2
Upper Coyote Creek Site C	May 31, 2007	41.6
Upper Coyote Creek Site D	May 15,2007	35.5

Habitat Types

A total of 812 linear feet of Coyote Creek was sampled upstream of the flood protection project limits (Figure 27). These four sites are reference sites for the baseline study and correspond with previous sites sampled by Pitt and Bozeman and SCVURPPP. Upper Coyote Creek Site A was within SCVURPPP's designated urban zone classification. This site was comprised of mid-channel pool (195 ft.) and low gradient riffle (5 ft.). Upper Coyote Creek Site B was within the transition zone and was comprised of mid-channel pool (82 ft.), run (68 ft.), lateral scour pool (34 ft.) and low gradient riffle (18 ft.). Upper Coyote Creek Site C was in the rural zone and was comprised of mid-channel pool (33 ft.), lateral scour pool (59 ft.), backwater pool (21 ft.), and low gradient riffle (94 ft.). Upper Coyote Creek Site D was also in SCVURPPP's rural zone and was comprised of lateral scour pool (58 ft.), run (78 ft.), and low gradient riffle (67 ft.).

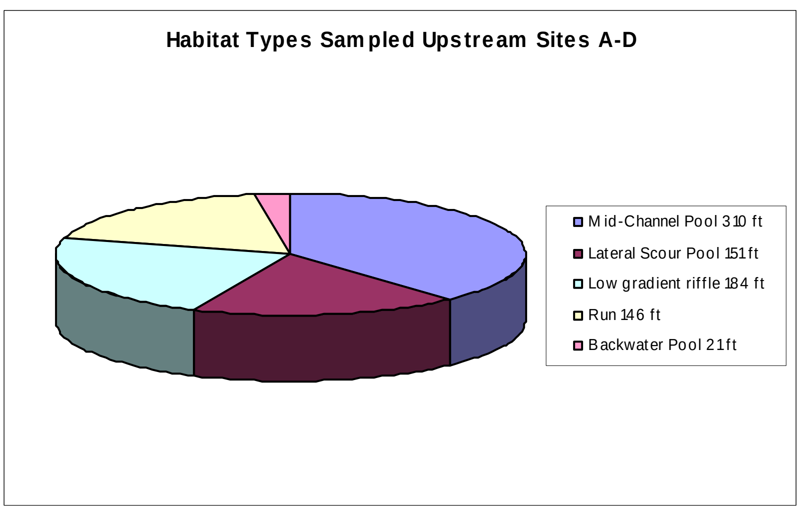


Figure 27. Total linear feet of each habitat type sampled during May 2007 for the four reference reaches on Coyote Creek above Interstate 280 to Anderson Reservoir.

Eleven species of fish, representing seven families, were captured at four sampling sites on Coyote Creek upstream of the flood protection project limits (Figure 28). Six of the eleven fish captured are native to the Coyote watershed with two of the species being found in the greatest abundance, *L. symmetricus* and *C. asper*. *L. symmetricus* was captured at three sites (UCC A, C, D) however the majority were captured at UCC site A (40). The majority of *C. asper* captured occurred at UCC sites C and D. *C. occidentalis* was captured at two sites, UCC C and D, with greatest abundance found at site D (30). *O. mykiss* was captured at three sites, UCC B, C and D, with the greatest abundance at site C (24). Fork lengths for *O. mykiss* ranged from 25-110 mm (Figure 29). The majority of *O. mykiss* captured were in riffle habitat however several were also captured at the head of a pool, and one 25 mm fish was captured at the margin of a pool in slow water. It could not be determined if these fish were resident or the anadromous form of *O. mykiss*. Upper Coyote Creek site C was the only site in which *G. aculeatus* was captured. All *G. aculeatus* were captured in a backwater pool with emergent vegetation. The two rural sites (UCC C and D) supported 100% native fish populations (Figure 30).

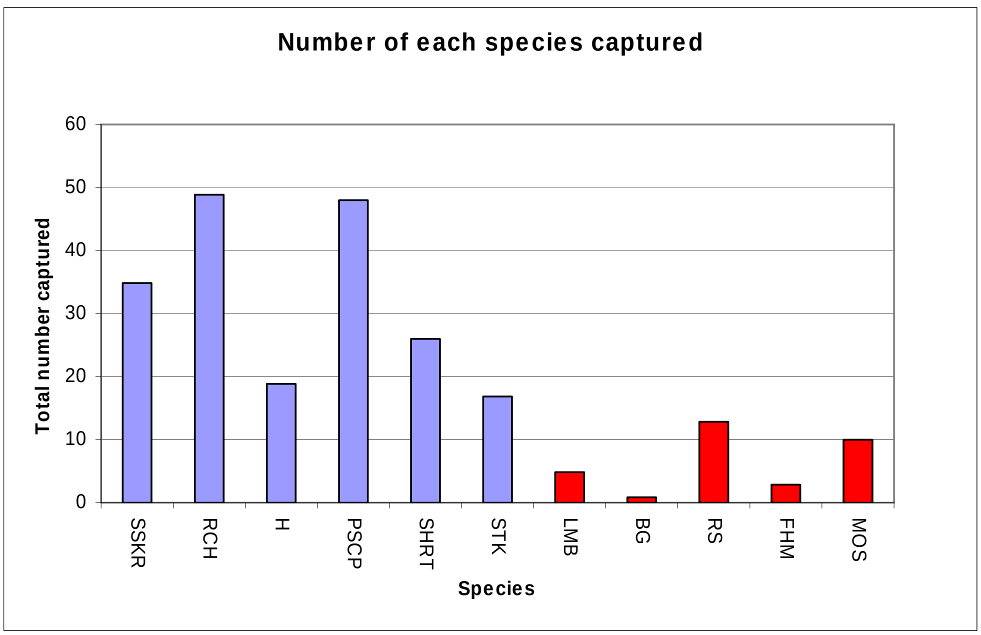


Figure 28. Total number of each species captured in the four reference reaches on Coyote Creek above Interstate 280 to Anderson Reservoir. (Native fish are depicted in blue. Introduced fish depicted in red)

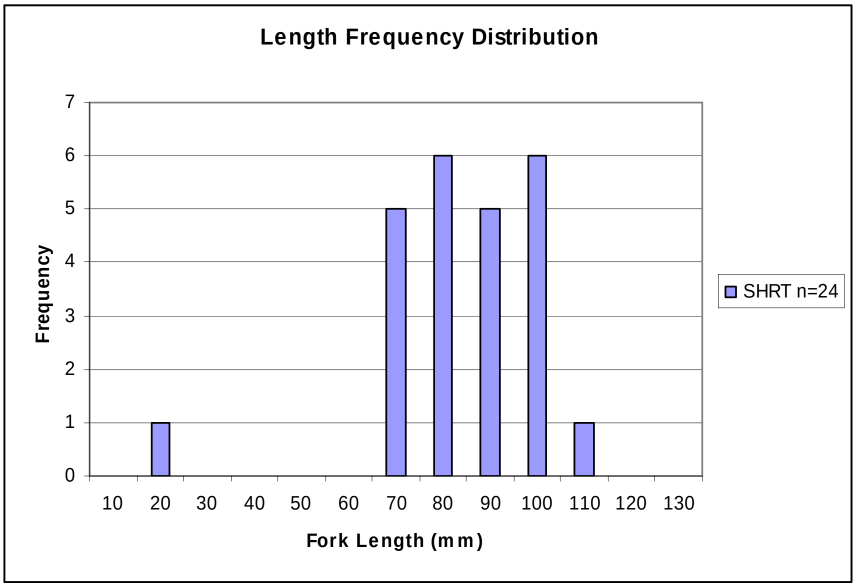


Figure 29. Length frequency histogram for *O. mykiss* captured at Upper Coyote Creek sampling Site C.

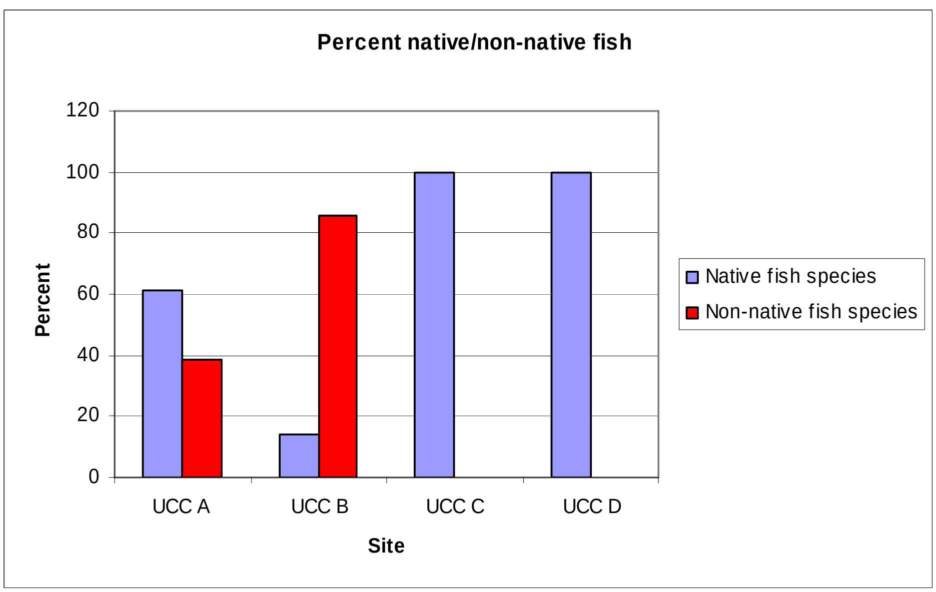
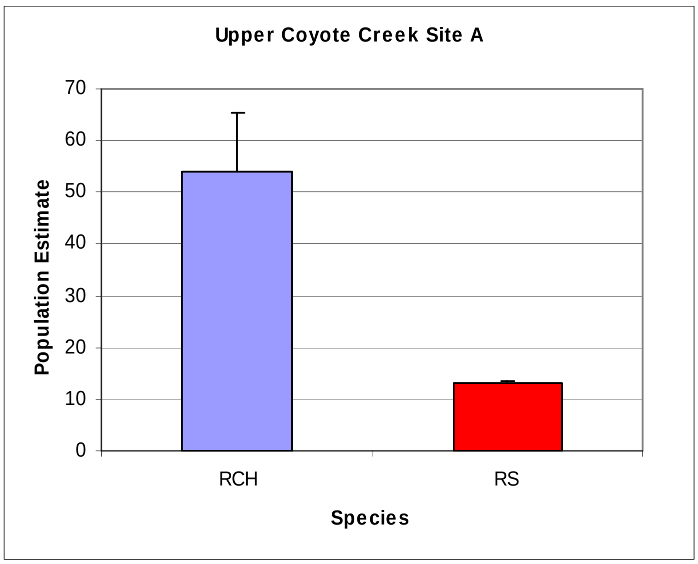


Figure 30. Percent of native/introduced fish species captured at each sampling location upstream of the flood protection project.

Population Estimates

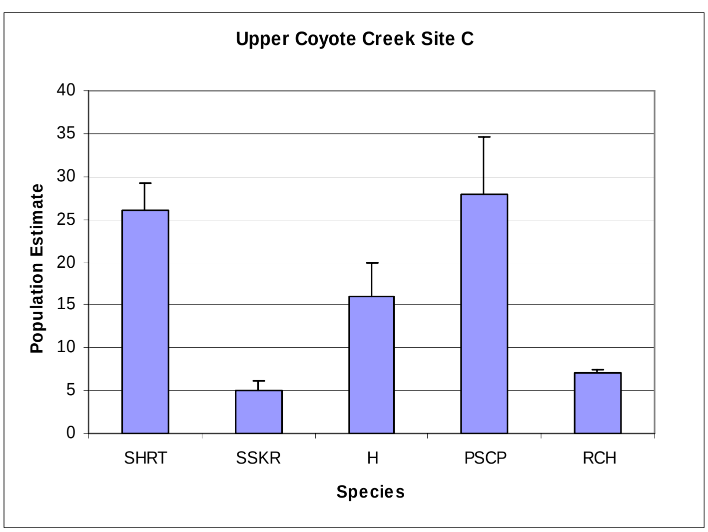
Population estimates were calculated for the four reference sites upstream of the flood protection project limits. Figures 31-33 depict the species captured at each site along with the population estimate, confidence interval and standard error.

The greatest number of fish captured was at UCC Site C (90) with the fewest number of fish captured at UCC Site B (7). Of the seven fish captured at Site B, only one fish was native, a 65 mm *O. mykiss*. No population estimates were calculated for Upper Coyote Creek Site B because numbers of fish were too low and depletion estimates poor.



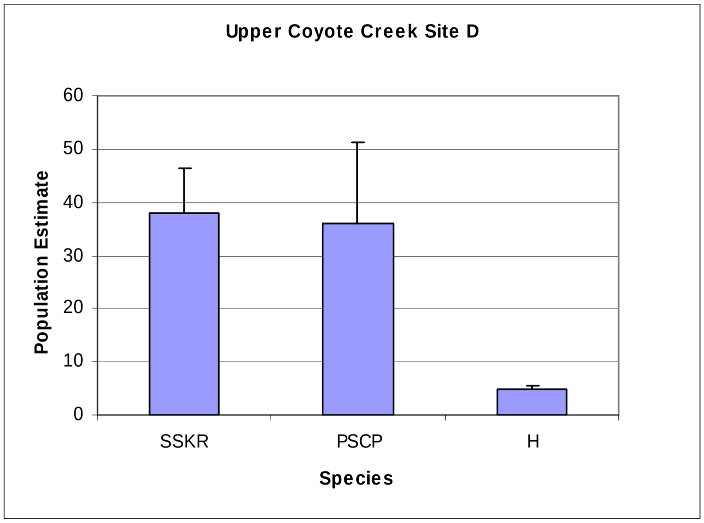
Species	Lower confidence interval	Upper confidence interval
RCH	31	77
RS	12	14

Figure 31. Results of population estimates from fish captured from Upper Coyote Creek Site A.



Species	Lower confidence interval	Upper confidence interval
SHRT	19	33
SSKR	2	8
H	8	24
PSCP	14	41
RCH	6	8

Figure 32. Results of population estimates from fish captured from Upper Coyote Creek Site C.



Species	Lower confidence interval	Upper confidence interval
SSKR	21	55
PSCP	5	67
H	4	6

Figure 33. Results of population estimates from fish captured from Upper Coyote Creek Site D.

Water Quality Sampling

Water quality parameters were recorded at each sampling site prior to electrofishing activities (Table 10). All sites had sufficient dissolved oxygen levels to support aquatic life. Water temperatures ranged within the four reference stations from 14.5 °C to 18.0 °C. Turbidity and conductivity was significantly lower at the transition and rural sites then at all other sampling sites on the mainstem of Coyote Creek.

Table 10. Water quality results for fish sampling Sites Upper Coyote Creek A-D.

Station ID/Time of measurement	Water Temperature (°C)	Dissolved Oxygen (mg/l)	pH	Turbidity (NTU)	Conductivity (mS/cm)
Upper Coyote Creek Site A/08:45	18.0	9.4	8.18	14	1.08
Upper Coyote Creek Site B/09:30	17.5	8.9	8.27	4	0.487
Upper Coyote Creek Site C/09:30	16.1	9.7	8.54	4	0.379
Upper Coyote Creek Site D/08:40	14.5	10.0	8.29	2	0.372

Section 3-Upper Penitencia Creek Sites A and B and Lower Silver Creek Site A

A total of 700 linear feet of stream was sampled in Upper Penitencia Creek in 2007 (Figure 34). Upper Penitencia Creek Site A is 500 linear feet in length and is comprised of lateral scour pool (211 ft.), run (188 ft.) and low gradient riffle (101 ft.). Upper Penitencia Creek Site B is comprised of mid-channel pools (Noble fish ladder pools) (60 ft.), lateral scour pool (56 ft.), run (46 ft.) and low gradient riffle (38 ft.).

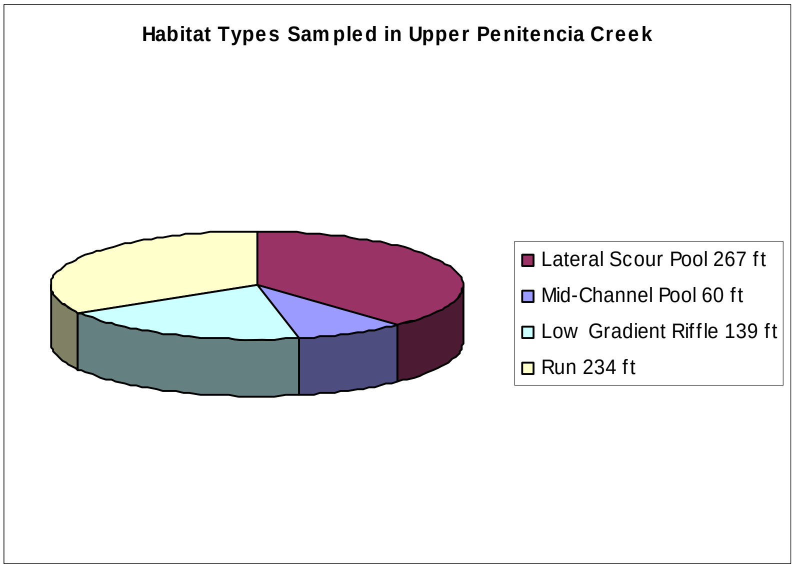


Figure 34. Total linear feet of each habitat type sampled in 2007 for the two reference reaches in Upper Penitencia Creek

Six different fish species representing six families of fish were captured in Upper Penitencia Creek (Figure 35). All but one species of fish captured, *M. salmoides*, was native to the watershed. *C. occidentalis* and *L. symmetricus* were the two most abundant species captured and were found at both sampling sites. A total of 96 young of the year *O. mykiss* were captured during the July sampling at site A (Figure 36). A total of seven *O. mykiss* were captured ranging in size from 155-495 mm in fork length were captured at Site B in May. Only 2.2 % of the total catch on Upper Penitencia Creek was comprised of introduced fish.

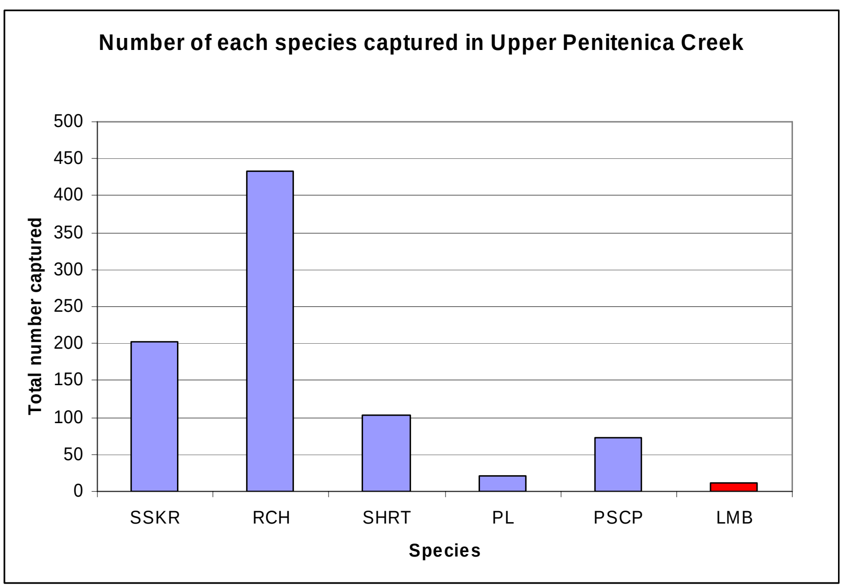


Figure 35. Total number of each species captured at the two reference reaches on Upper Penitencia Creek.

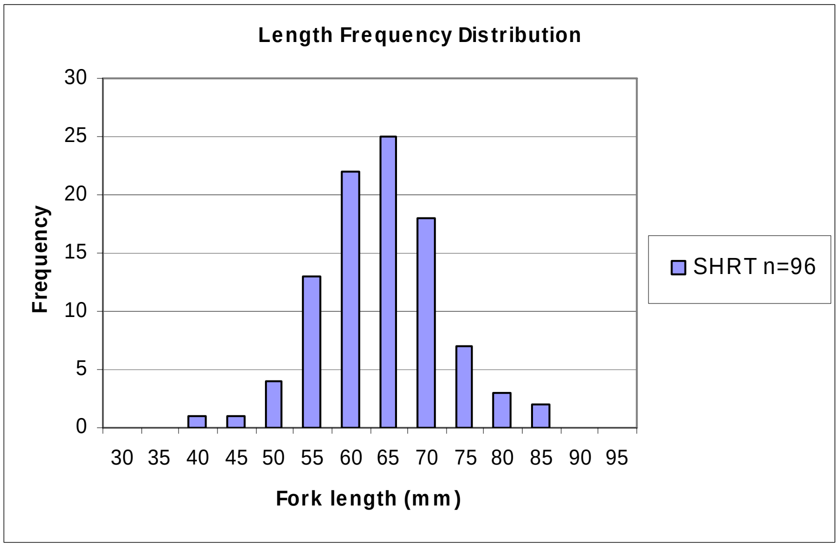
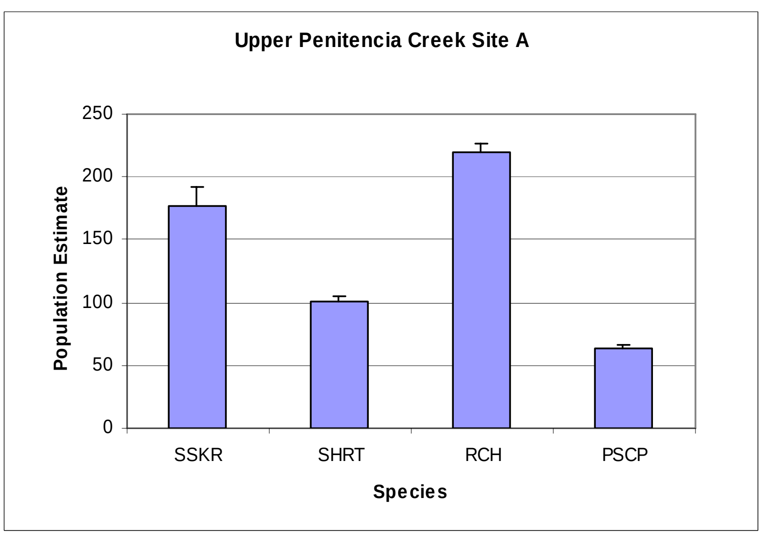


Figure 36. Length frequency histogram for *O. mykiss* captured at sampling site A in July, 2007 on Upper Penitencia Creek.

Population Estimates

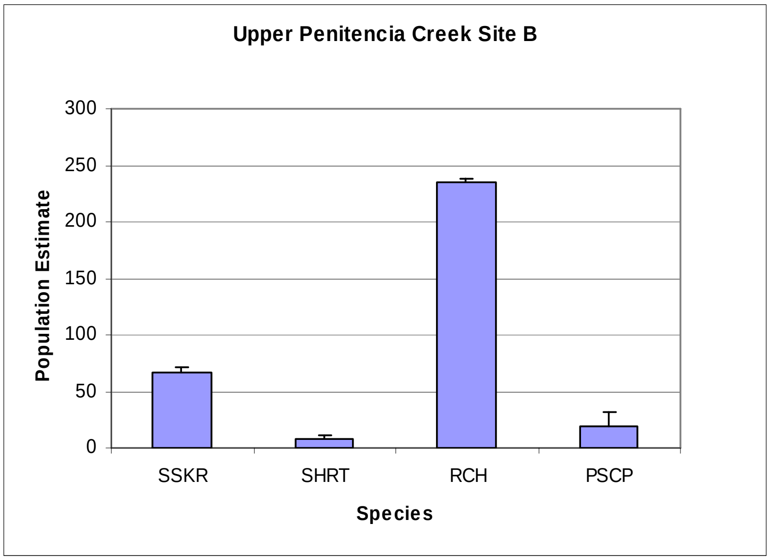
Population estimates were calculated for the two reference sites on Upper Penitencia Creek. Figures 37 and 38 depict the species captured at each site along with the population estimate, confidence interval and standard error.

The Upper Penitencia Creek Site A was the longest site sampled at 500 linear feet so consequently the greatest number of fish was captured (538). However, Site B was 200 linear feet in length with 307 native fish captured. This site had the greatest number of fish captured at any of the sampling sites within the study limits. No population estimate was calculated for *M. salmoides* at Site A due to the low catch number (5) and poor depletion estimate.



Species	Lower confidence interval	Upper confidence interval
SSKR	147	207
SHRT	94	108
RCH	206	234
PSCP	61	70

Figure 37. Results of population estimates from fish captured from Upper Penitencia Creek Site A.



Species	Lower confidence interval	Upper confidence interval
SSKR	54	78
SHRT	1	15
RCH	228	242
PSCP	-9	47

Figure 38. Results of population estimates from fish captured from Upper Penitencia Creek Site B.

Lower Silver Creek Site A

One site for a total of two-hundred linear feet of stream was sampled on Lower Silver Creek in 2007 (Figure 39). The habitat was comprised of mid-channel pool (150 ft.), run (45ft.) and low gradient riffle (10 ft.). This was the only site sampled within or adjacent to the flood protection project that had emergent wetland vegetation (*Typha spp*.).

Six fish species representing four families were captured in Lower Silver Creek (Figure 40). *C. occidentalis* and *L. symmetricus* were the two most abundant native species captured. All of the *C. occidentalis* captured were young of the year fish with fork lengths ranging from 33-60 mm.

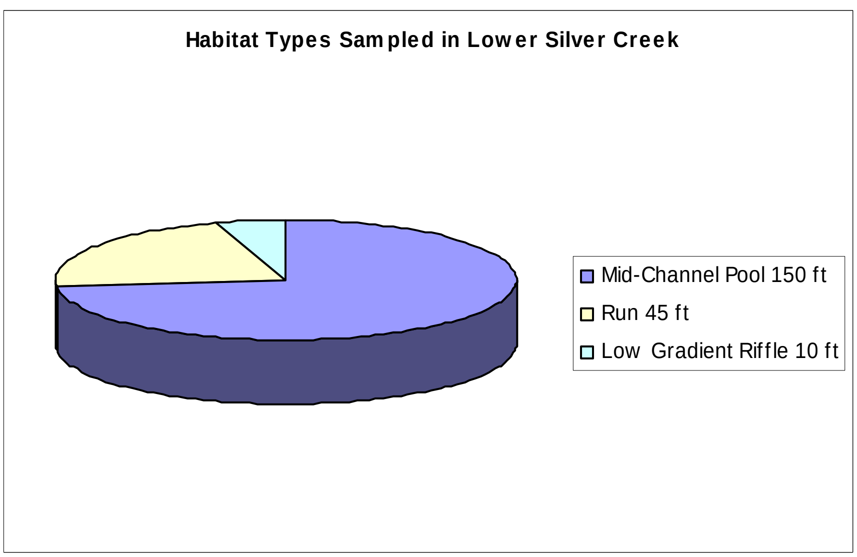


Figure 39. Total linear feet of each habitat type sampled in May 2007 at Lower Silver Creek.

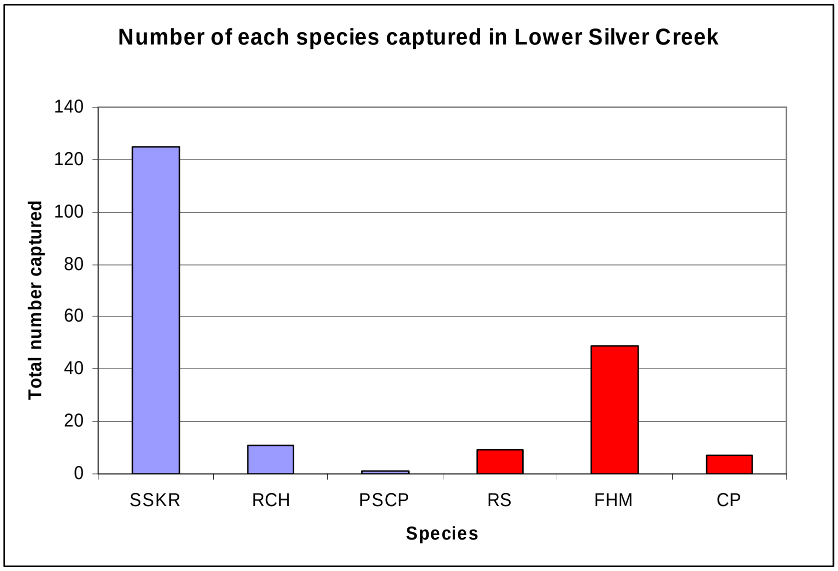
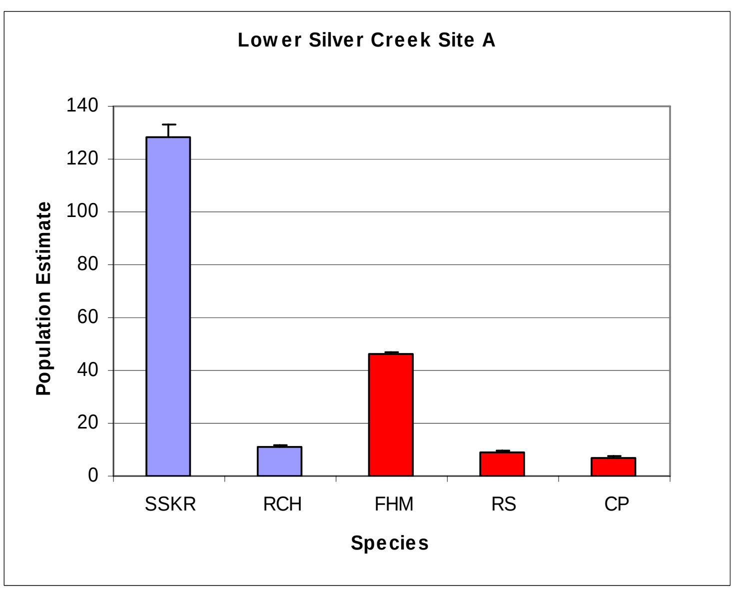


Figure 40. Total number of each species captured in Lower Silver Creek

Population Estimate

A population estimate was calculated for the Lower Silver Creek sampling Site A. Figure 41 depicts the species captured at each site along with the population estimate, confidence interval and standard error.

A population estimate was not calculated for *C. asper* that was captured at this site because of low catch numbers (1).



Species	Lower confidence interval	Upper confidence interval
SSKR	118	137
RCH	9	13
FHM	44	48
RS	7	11
CP	6	8

Figure 41. Results of population estimates from fish captured in Lower Silver Creek.

Water Quality Sampling

Water quality measurements were recorded at each sampling site prior to electrofishing activities (Table 11). All sites had sufficient dissolved oxygen to support aquatic life. Water temperatures ranged within the tributary reference stations from 14.2 °C to 22.1 °C. Fish sampling at Site A was conducted in July when water temperatures were elevated. Discharge was minimal at UPC Site A in May when sampling was conducted due to the low water year and the releases from the upstream reservoir (Cherry Flat) were discontinued.

Table 11. Water quality monitoring results for Upper Penitencia Creek, Sites A and B, and Lower Silver Creek Site A.

Station ID/Time of measurement	Water Temperature (°C)	Dissolved Oxygen (mg/l)	pH	Turbidity (NTU)	Conductivity (mS/cm)	Discharge (cfs)
Upper Penitencia Creek Site A/09:40	22.1	9.68	8.41	2	0.292	5.5
Upper Penitencia Creek Site B/08:40	14.2	10.44	8.61	1	1.17	0.65
Lower Silver Creek Site A/08:45	17.1	9.96	8.33	14	1.30	17.0

Fish Passage

Measurements taken at the Upper Penitencia Creek culvert were analyzed using the FishXing software for both *O. mykiss* and *L. tridentata*. Table's 12 and 13 summarize the biological criteria and fish passage results for adult and juvenile *O. mkiss* respectively. Table 14 summarizes the biological criteria and fish passage results for adult *L. tridentata*.

In summary, the culvert met fish passage criteria for adult *O. mykiss* during a flow range from 20.84-24.97 cfs. Flows below 20.84 cfs are considered a depth barrier for upmigrating adults while flows above 24.97 cfs are regarded as a velocity barrier for the adult fish. The culvert meets passage criteria for out-migrant *O. mykiss* when flow is at 10 cfs or higher. Flows below 10 cfs are regarded as a depth barrier for the fish.

In general, the swimming performance for *L. tridentata* is inefficient compared to that of *O. mykiss*. The passable flow range for these adult fish is much lower, 3.78-7.44 cfs; however the program did not take into account the role of attachment when the fish is confronted with rapid current velocities. Attachment surface to the culverts bottom is likely not an issue with this culvert since the bottom is embedded allowing for a natural substrate foundation. While it is known that *L. tridentata* ammocetes make downstream movements during their fresh water residency period, the extent of upstream movement for juveniles is unknown. No analysis was performed for juvenile movement upstream however it should be noted that the culvert could be a passage impediment for juvenile fish.

Based on the fish passage criteria for adult *O. mykiss* (Table 12) and recorded flows from the Piedmont Avenue stream gauge on Upper Penitencia Creek (Figure 42), the culvert presented a depth barrier for upmigrant fish in the spring of 2007. For out-migrant smolts (Table 13) from March 1 through May 31, 2007, the culvert was a depth barrier in all days except two in which flows exceeded the 9.2 cfs mark. Fish passage for adult lamprey (Table 14) was better in spring of 2007 in which flows were optimum for upstream passage for 40 days from March 1 through June 30.

Table 12. Fish passage evaluation summary results for adult *O. mykiss*. (Results are based on the physical parameters of the pipe, biological criteria and a flow range from 1-500 cfs)

Biological Criteria for Adult *O. mykiss*	
Fish length	50 cm
Minimum water depth	0.8 ft
Prolonged swimming speed	6 ft/s
Prolonged time to exhaustion	30 min
Burst swimming speed	10 ft/s
Burst time to exhaustion	5 s

Fish Passage Summary	
Low passage design flows	1.0 cfs
High passage design flows	500.0 cfs
Percent of flows passable	0.8 %
Passable flow range	20.84 to 24.97 cfs
Depth barrier	1.0 to 20.84
Outlet drop barrier	None
Velocity barrier	24.97 to 500.00 cfs
Pool depth barrier	None

Table 13. Fish passage evaluation summary results for juvenile *O. mykiss*. (Results are based on the physical parameters of the pipe, biological criteria and a flow range from 1-500 cfs)

Biological Criteria for out-migrant *O. mykiss*	
Fish length	20 cm
Minimum water depth	0.5 ft
Prolonged swimming speed	4 ft/s
Prolonged time to exhaustion	30 min
Burst swimming speed	5 ft/s
Burst time to exhaustion	5 s

Fish Passage Summary	
Low passage design flows	1.0 cfs
High passage design flows	500.0 cfs
Percent of flows passable	18 %*
Passable flow range	10.0 to 100 cfs
Depth barrier	1.0 to 9.15 cfs
Outlet drop barrier	None
Velocity barrier	100-500 cfs*
Pool depth barrier	None

*Since these fish are out-migrants and swim downstream, the velocity barrier may not inhibit fish from going downstream through the culvert. Therefore, the range of passable flows should be higher for anadromous *O. mykiss*. The velocity barrier would pertain to resident *O. mykiss* moving into the tributary.

Table 14. Fish passage evaluation summary results for adult *L. tridentate.* (Results are based on the physical parameters of the pipe, biological criteria and a flow range from 1-500 cfs)

Biological Criteria for Adult *L. tridentata*	
Fish length	45 cm
Minimum water depth	0.3 ft
Prolonged swimming speed	1.48 ft/s
Prolonged time to exhaustion	30 min
Burst swimming speed	4.59 ft/s
Burst time to exhaustion	60 s

Fish Passage Summary	
Low passage design flows	1.00 cfs
High passage design flows	500.00 cfs
Percent of flows passable	70.0 %
Passable flow range	3.78 to 7.44 cfs
Depth barrier	0 to 3.78 cfs
Outlet drop barrier	None
Velocity barrier	7.44 cfs and above
Pool depth barrier	None

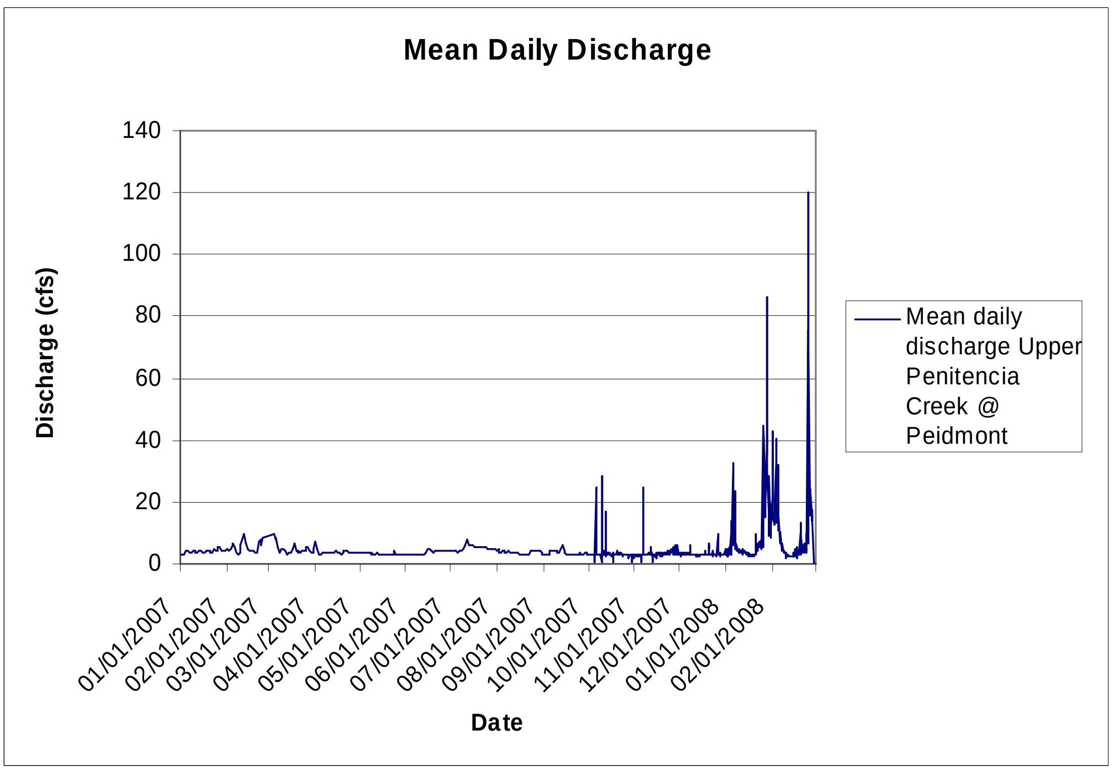


Figure 42. Mean daily discharge for Piedmont gauge station from January 1, 2007 through February 29, 2008.

Discussion

A total of 4463 linear feet of stream spread over 20 separate locations within the Coyote Creek Watershed was sampled in 2007 for year one of the Mid-Coyote Creek Baseline Fisheries Study. These sites will be sampled for year two and three of the study. Once data collection is complete, a full analysis of habitat variables coupled with population estimates will be presented for the three sampling years in a final comprehensive report. This analysis will help determine which variables favor native fish in Coyote Creek. With year one of the baseline fisheries study complete, the District has obtained valuable information on the distribution and population structure of native fish within the Coyote Creek Watershed. It is premature to draw detailed conclusions from this first year of sampling data however, the previously established goals and objectives are on target to be met by the conclusion of the sampling effort in year three (2009).

At the completion of the study predictable fish assemblages will be determined within the project site and at sites with presumably lower habitat values (i.e. mid-channel pool locations). Sites sampled within the flood protection project footprint that had homogenized habitat (i.e.mid-channel pool) had a higher percentage of introduced fish than sites with variable habitat types during the first year of sampling. Sites on Upper Penitencia Creek yielded higher numbers of native fish than any other site on the mainstem of Coyote Creek. Sites sampled in the rural zone of the mainstem of Coyote Creek supported a greater diversity of native fish including *O. mykiss*. The culvert at Upper Penitiencia does not meet fish passage requirements for both *L. tridentata* and *O. mykiss* under a majority of flow conditions. In 2006/07 rainfall was below average and this may allow for a comparison of hydrologic variability between years.

A couple of changes are planned to occur for year two of the sampling program. Age structure for *L. symmetricus, C. occidentalis* and *O. mykiss* was difficult to elucidate based on the results of year one length frequency histograms. Therefore, for the 2008 sampling season, scales will be collected to provide a clearer picture of the size structure for these populations of native fish.

The fish passage evaluation component of the study will continue in 2008. Flows and passage through the Upper Penitencia Creek culvert will continue to be monitored through the 2008 migration season. An additional site will be selected for fish passage analysis in 2008.

Ongoing collaboration with SCVURPPP will persist as their program continues to sample benthic macroinvertebrates on the mainstem of Coyote Creek. Incorporating the benthic macroinvertebrate data will be valuable information for the baseline fisheries study to aid in the understanding of food chain dynamics, ecological integrity, and aquatic system function. This information will be incorporated in the final 2009 report. An additional fish sampling site will be added in 2008 at Tully Road to complement a macroinvertbrate sampling site previously selected by the SCVURPPP researchers.

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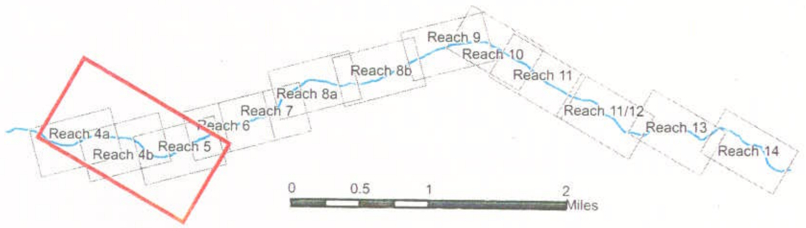
APPENDIX A
MAPS



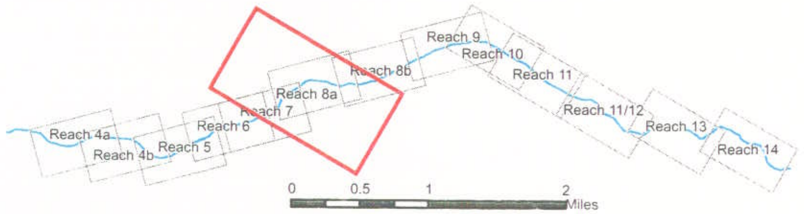
Habitat Units

- Backwater Pool
- Channel Confluence Pool
- Dammed Pool
- L. Scour Pool - Log Enhanced
- L. Scour Pool - Root Wad Enhanced
- Lateral Scour Pool
- Low Gradient Riffle
- Mid-Channel Pool
- Run
- Secondary Channel Pool
- Fish Sampling Site
- Reach Breaks

Map 1

Coyote Creek Fish Sampling Sites 1-4

Santa Clara Valley Water District



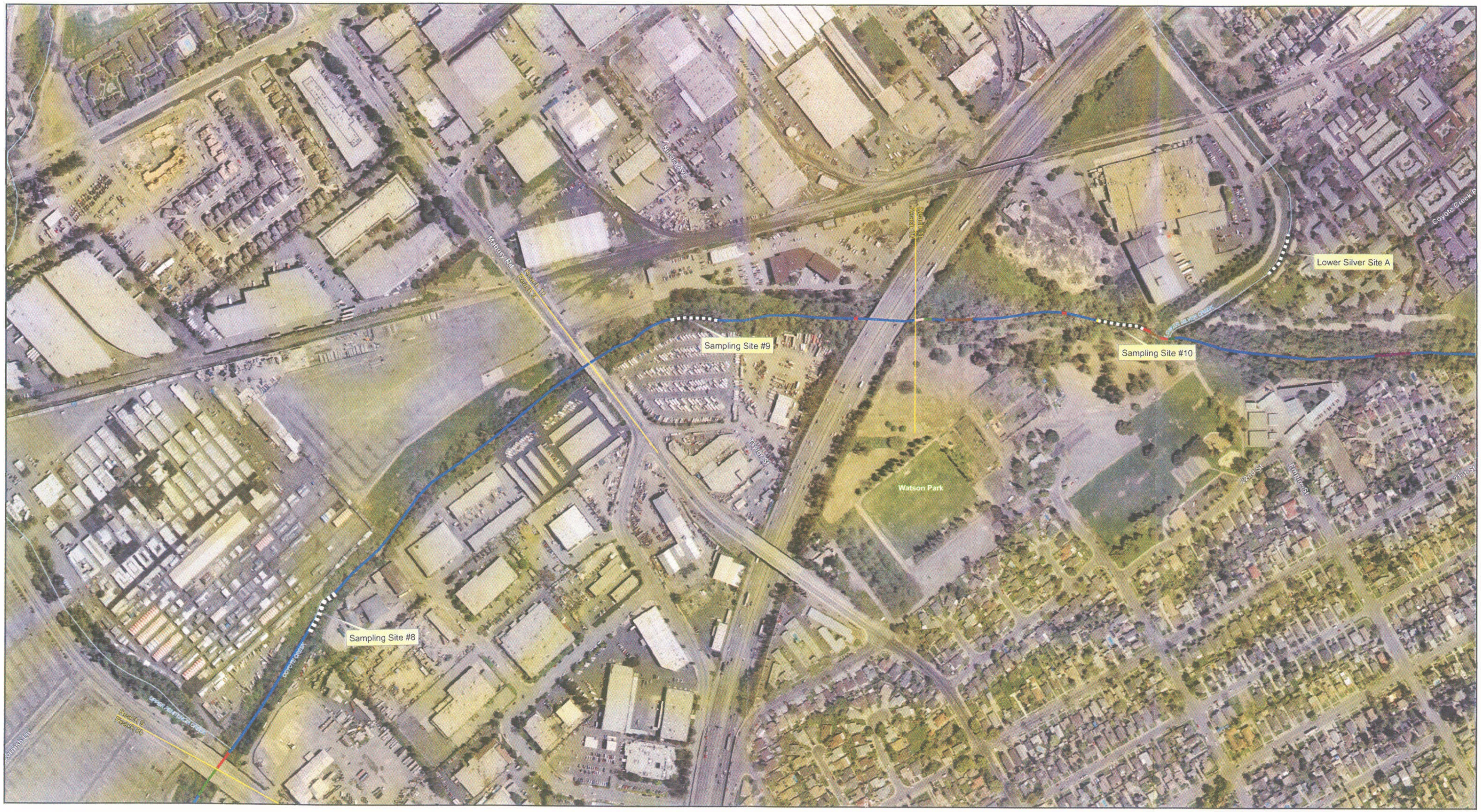
Habitat Units

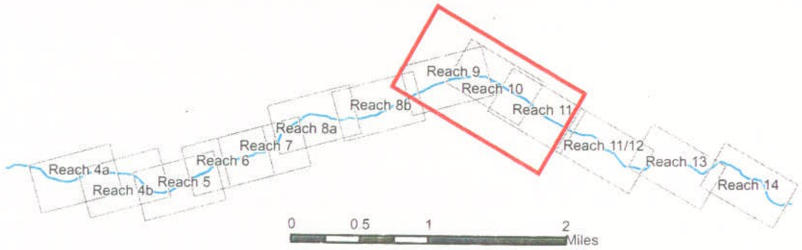
- Backwater Pool
- Channel Confluence Pool
- Dammed Pool
- L. Scour Pool - Log Enhanced
- L. Scour Pool - Root Wad Enhanced
- Lateral Scour Pool
- Low Gradient Riffle
- Mid-Channel Pool
- Run
- Secondary Channel Pool
- Fish Sampling Site
- Reach Breaks

Map 2

Coyote Creek Fish Sampling Sites 5-7

Santa Clara Valley Water District





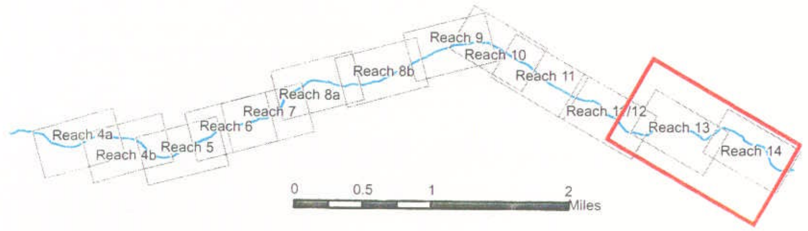
Habitat Units

- Backwater Pool
- Channel Confluence Pool
- Dammed Pool
- L. Scour Pool - Log Enhanced
- L. Scour Pool - Root Wad Enhanced
- Lateral Scour Pool
- Low Gradient Riffle
- Mid-Channel Pool
- Run
- Secondary Channel Pool
- Fish Sampling Site
- Reach Breaks

Map 3

Coyote Creek Fish Sampling Sites 8-10 & Lower Silver Site A

Santa Clara Valley Water District



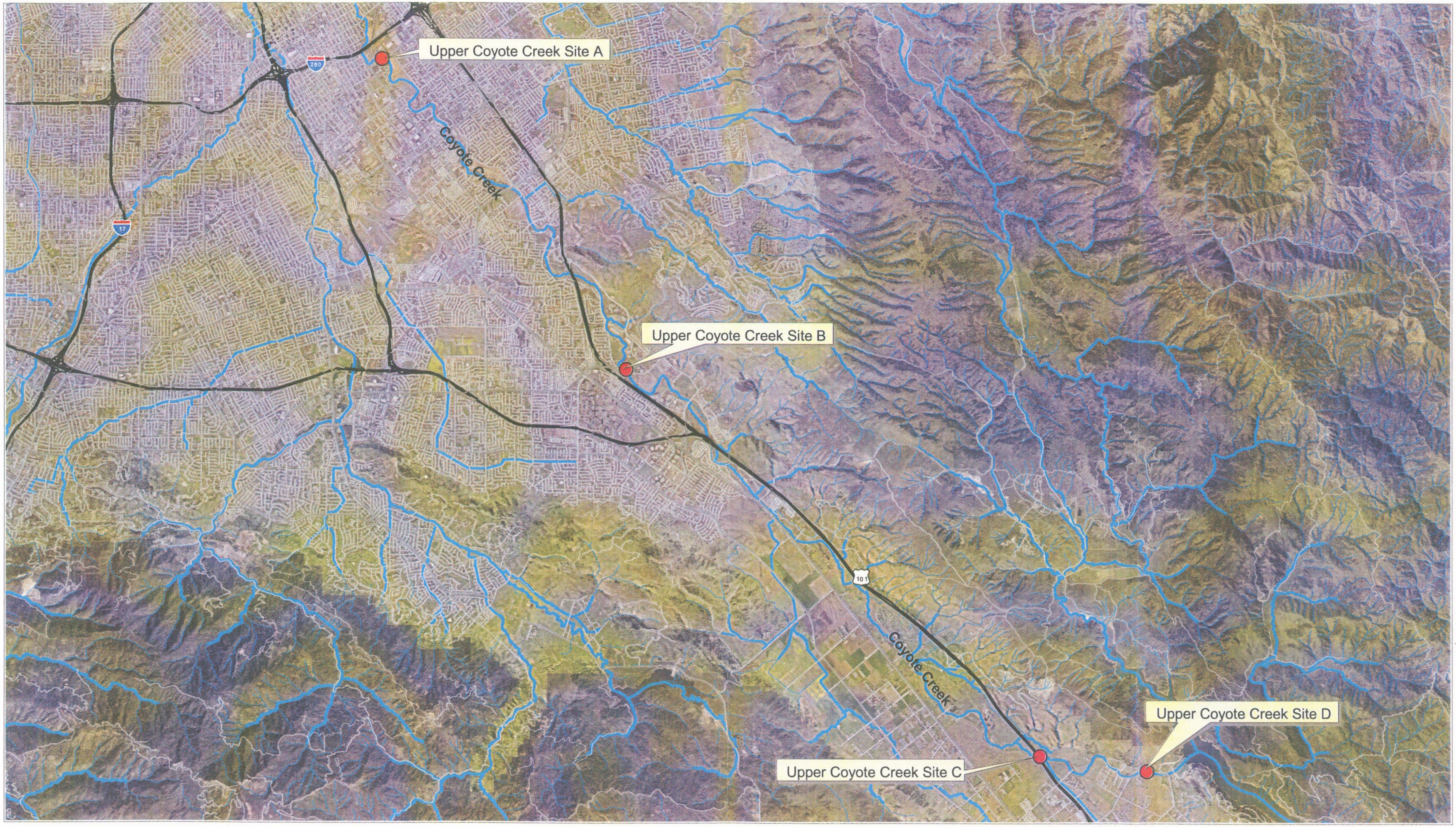
Habitat Units

- Backwater Pool
- Channel Confluence Pool
- Dammed Pool
- L. Scour Pool - Log Enhanced
- L. Scour Pool - Root Wad Enhanced
- Lateral Scour Pool
- Low Gradient Riffle
- Mid-Channel Pool
- Run
- Secondary Channel Pool
- Fish Sampling Site
- Reach Breaks

Map 4

Coyote Creek Fish Sampling Sites 11-13

Santa Clara Valley Water District



Map 5 **Upper Coyote Creek Fish Sampling Sites A-D**

1 0 1 2 Miles

Fish Sampling Site

Santa Clara Valley Water District

Map 6

Upper Penitencia Creek Fish Sampling Sites A & B

0.4 0 0.4 Miles

Fish Sampling Site

Santa Clara Valley Water District

Coyote Creek Map 7
Temperature Monitoring Stations

Legend

- Temperature Monitoring Stations
- Creeks

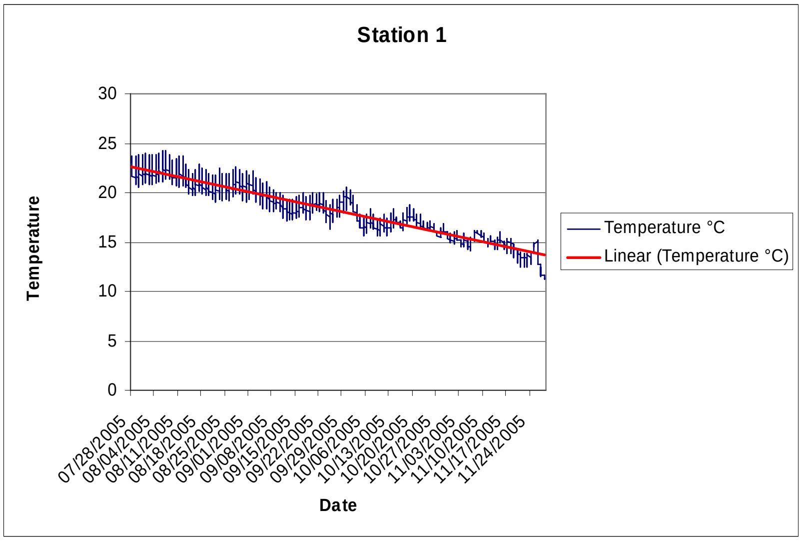
APPENDIX B
TEMPERATURE MONITORING RESULTS

Temperature Logger Stations

Temperature Logger Station ID	Location	Project Reach Number
1	Downstream Montague Expressway	4a
2	Downstream Charcot Avenue	4b
3	Downstream O' Toole	5
4	Upstream Ridder Park Drive	7
5	Upstream Old Oakland Road	8a
6	Downstream Berryessa Road	8b
7	Upstream Berryessa Road	9
8	Upstream Mabury Road	10
9	Downstream East Julian Street	11
10	Downstream East Santa Clara Street	12
11	Downstream East San Antonio Street	13
12	Upstream East William Street	14
13	Upstream Interstate 280	n/a
14	Lower Silver Creek upstream of confluence with Coyote Creek	n/a

2005 Temperature Monitoring

Temperature Logger Station ID	Location	Date and time water monitors began recording	Date and time water monitors finished recording
1	Downstream Montague Expressway	July 28, 2005: 12:00	November 28, 2005:10:00
2	Downstream Charcot Avenue	July 28, 2005: 12:00	November 28, 2005:10:00
3	Downstream O' Toole	July 28, 2005:11:00	November 28, 2005:11:00
4	Upstream Ridder Park Drive	July 28, 2005: 12:00	November 28, 2005:11:00
5	Upstream Old Oakland Road	July 26,2005: 13:00	November, 28,2005:12:00
6	Downstream Berryessa Road	July 26, 2005: 12:00	November 28, 2005: 12:00
7	Upstream Berryessa Road	July 26, 2005:13:00	December 6,2005: 10:00
8	Upstream Mabury Road	July 25,2005: 13:00	November, 28, 05: 14:00
9	Downstream East Julian Street	July 25, 2005: 12:00	November 15, 2005: 12:00
10	Downstream East Santa Clara Street	July 25,2005: 11:00	November 15, 2005:11:00
11	Downstream East San Antonio Street	July 25, 2005: 9:00	November 15, 2005:11:00
12	Upstream East William Street	July 25, 2005: 10:00	November 15, 2005:11:00
13	Upstream Interstate 280	July 25,2005: 9:00	November 15,2005 10:00
14	Lower Silver Creek upstream of confluence with Coyote Creek	August 9, 2005: 12:00	November 15,2005: 12:00


Station 1
Temperature
30
25
20
15
10
5
0
Date
07/28/2005
08/04/2005
08/11/2005
08/18/2005
08/25/2005
09/01/2005
09/08/2005
09/15/2005
09/22/2005
09/29/2005
10/06/2005
10/13/2005
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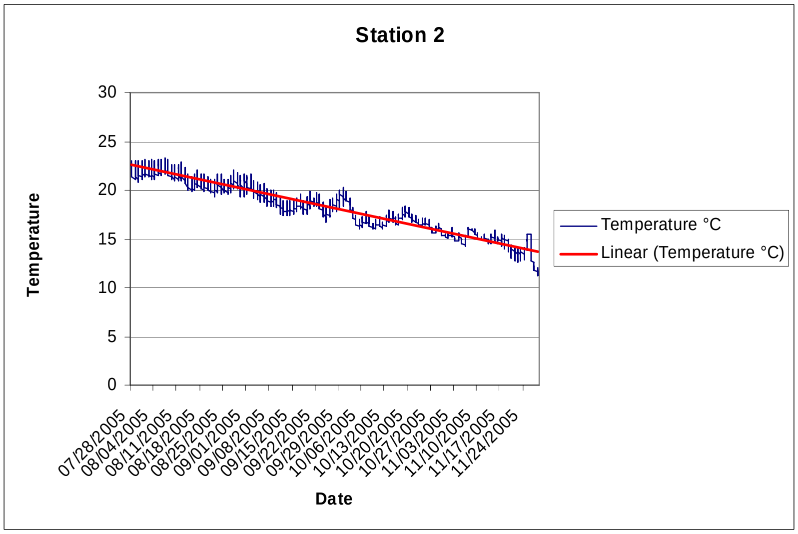
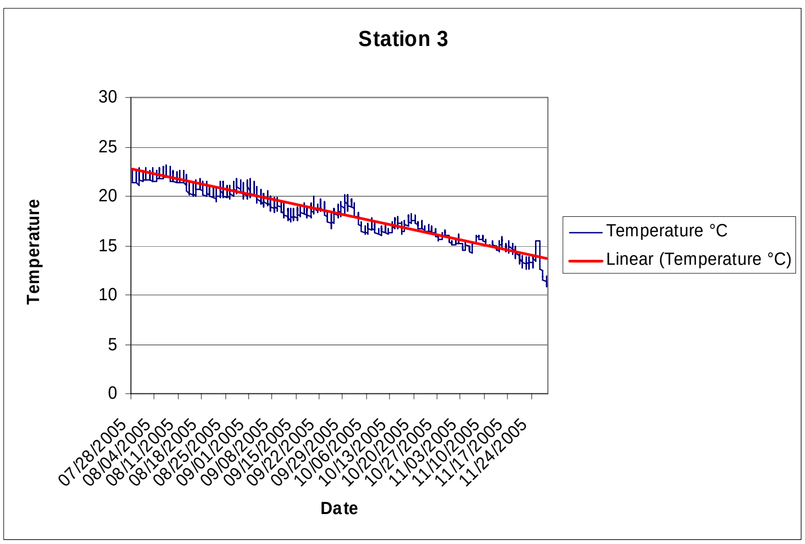
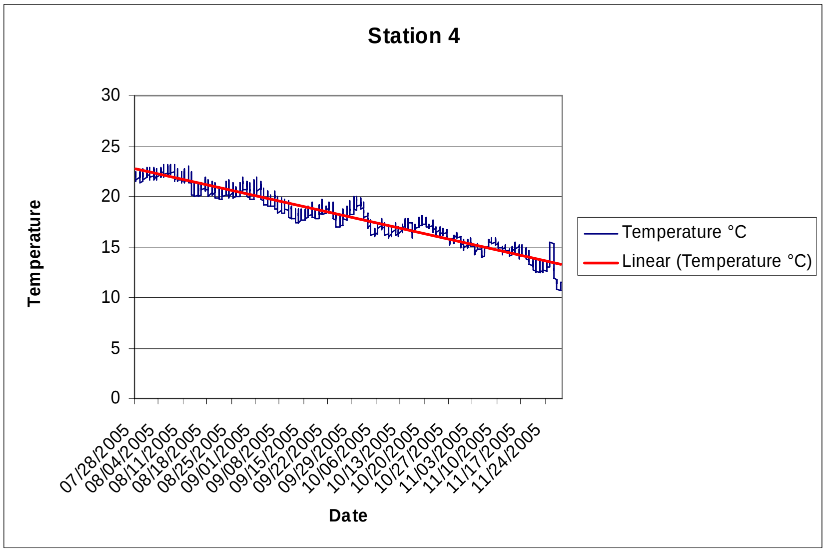
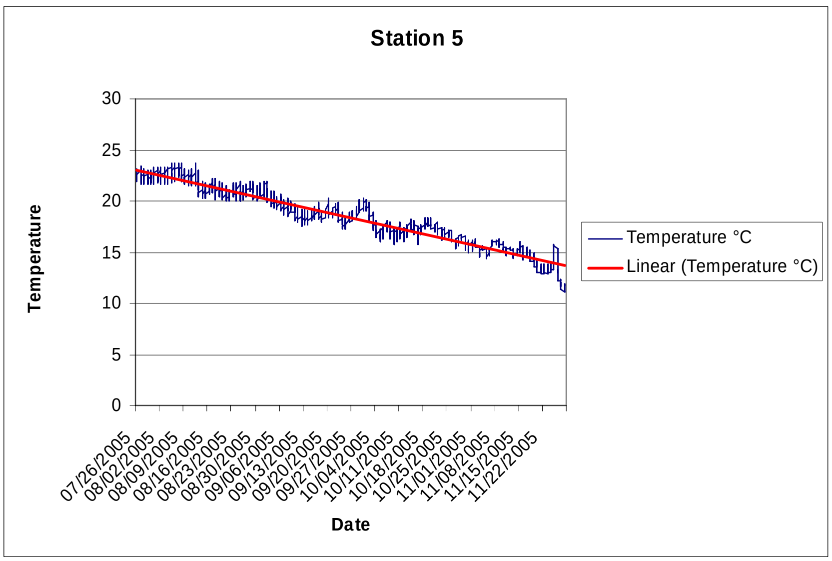
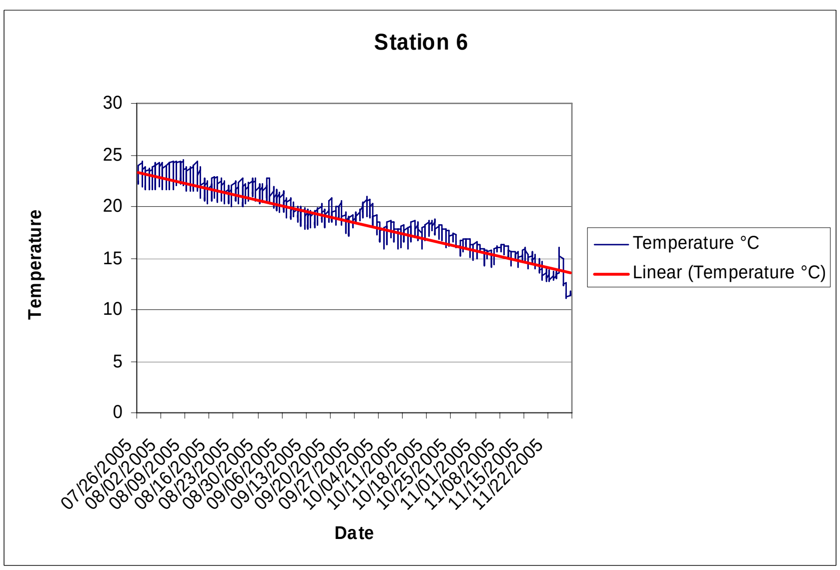
10/27/2005
11/03/2005
11/10/2005
11/17/2005
11/24/2005
Temperature °C
Linear (Temperature °C)

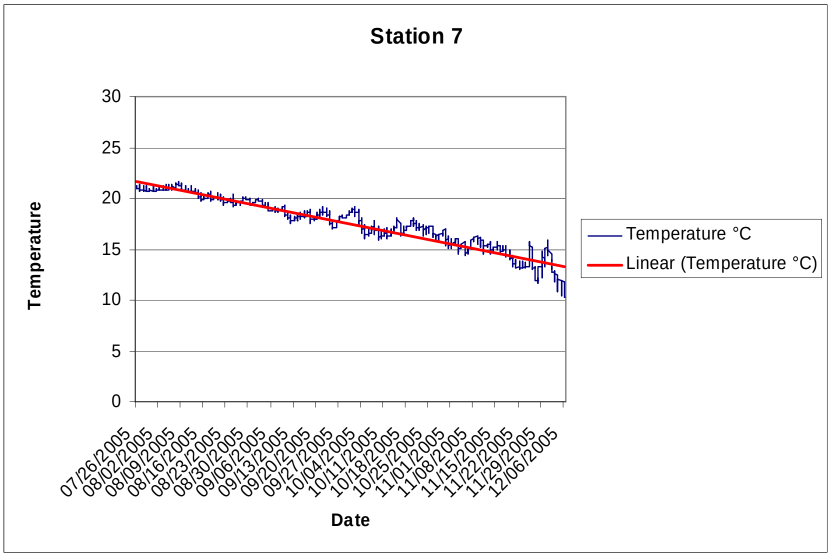

Station 2
Temperature
30
25
20
15
10
5
0
Date
07/28/2005
08/04/2005
08/11/2005
08/18/2005
08/25/2005
09/01/2005
09/08/2005
09/15/2005
09/22/2005
09/29/2005
10/06/2005
10/13/2005
10/20/2005
10/27/2005
11/03/2005
11/10/2005
11/17/2005
11/24/2005
Temperature °C
Linear (Temperature °C)

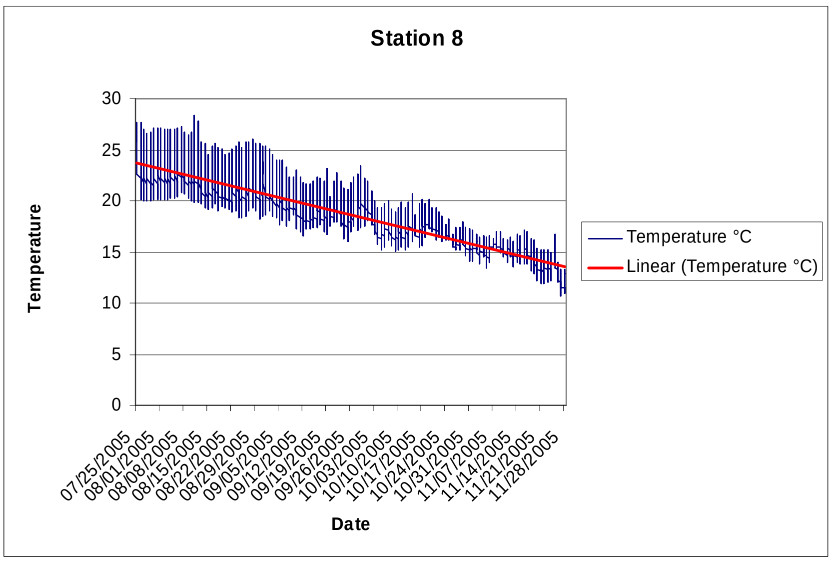

Station 3
Temperature
30
25
20
15
10
5
0
Date
07/28/2005
08/04/2005
08/11/2005
08/18/2005
08/25/2005
09/01/2005
09/08/2005
09/15/2005
09/22/2005
09/29/2005
10/06/2005
10/13/2005
10/20/2005
10/27/2005
11/03/2005
11/10/2005
11/17/2005
11/24/2005
Temperature °C
Linear (Temperature °C)


Station 4
30
25
20
15
10
5
0
Temperature
07/28/2005
08/04/2005
08/11/2005
08/18/2005
08/25/2005
09/01/2005
09/08/2005
09/15/2005
09/22/2005
09/29/2005
10/06/2005
10/13/2005
10/20/2005
10/27/2005
11/03/2005
11/10/2005
11/17/2005
11/24/2005
Date
Temperature °C
Linear (Temperature °C)


Station 5
30
25
20
15
10
5
0
Temperature
07/26/2005
08/02/2005
08/09/2005
08/16/2005
08/23/2005
08/30/2005
09/06/2005
09/13/2005
09/20/2005
09/27/2005
10/04/2005
10/11/2005
10/18/2005
10/25/2005
11/01/2005
11/08/2005
11/15/2005
11/22/2005
Date
Temperature °C
Linear (Temperature °C)


Station 6
30
25
20
15
10
5
0
Temperature
07/26/2005
08/02/2005
08/09/2005
08/16/2005
08/23/2005
08/30/2005
09/06/2005
09/13/2005
09/20/2005
09/27/2005
10/04/2005
10/11/2005
10/18/2005
10/25/2005
11/01/2005
11/08/2005
11/15/2005
11/22/2005
Date
Temperature °C
Linear (Temperature °C)


Station 7
Temperature
30
25
20
15
10
5
0
07/26/2005
08/02/2005
08/09/2005
08/16/2005
08/23/2005
08/30/2005
09/06/2005
09/13/2005
09/20/2005
09/27/2005
10/04/2005
10/11/2005
10/18/2005
10/25/2005
11/01/2005
11/08/2005
11/15/2005
11/22/2005
11/29/2005
12/06/2005
Date
Temperature °C
Linear (Temperature °C)


Station 8
Temperature
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25
20
15
10
5
0
07/25/2005
08/01/2005
08/08/2005
08/15/2005
08/22/2005
08/29/2005
09/05/2005
09/12/2005
09/19/2005
09/26/2005
10/03/2005
10/10/2005
10/17/2005
10/24/2005
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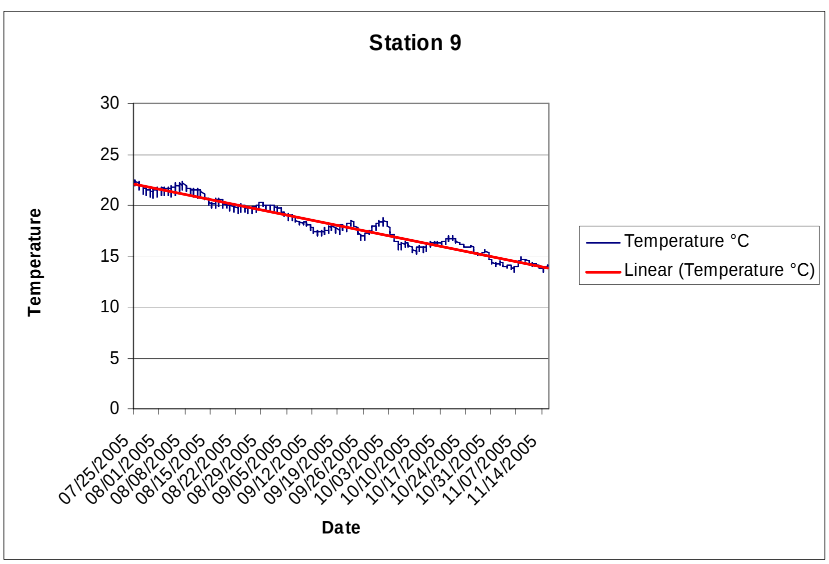
11/07/2005
11/14/2005
11/21/2005
11/28/2005
Date
Temperature °C
Linear (Temperature °C)


Station 9
Temperature
30
25
20
15
10
5
0
07/25/2005
08/01/2005
08/08/2005
08/15/2005
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08/29/2005
09/05/2005
09/12/2005
09/19/2005
09/26/2005
10/03/2005
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10/24/2005
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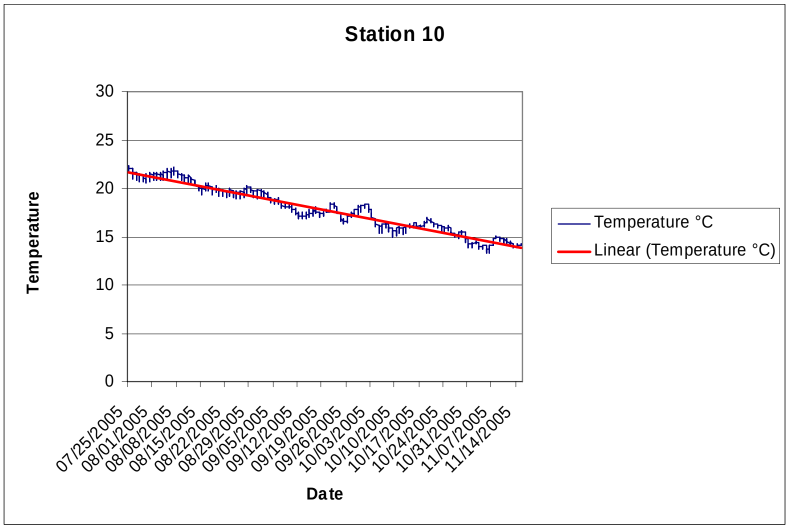
11/07/2005
11/14/2005
Date
Temperature °C
Linear (Temperature °C)


Station 10
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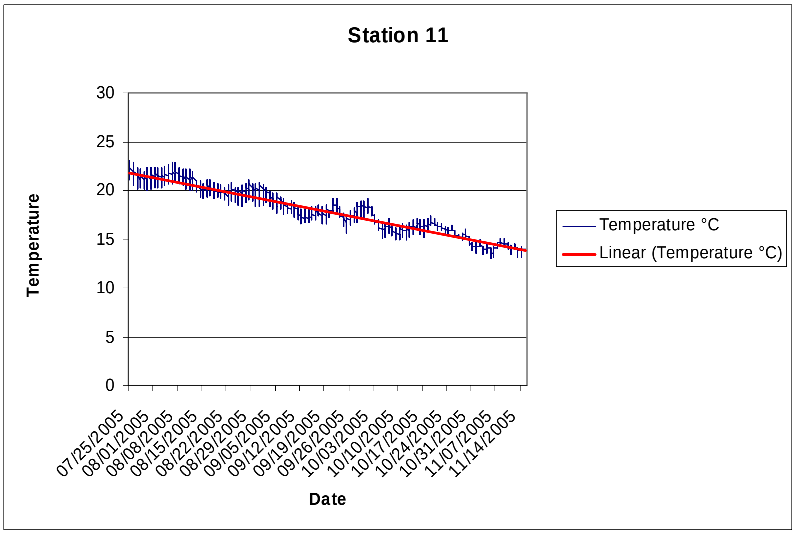
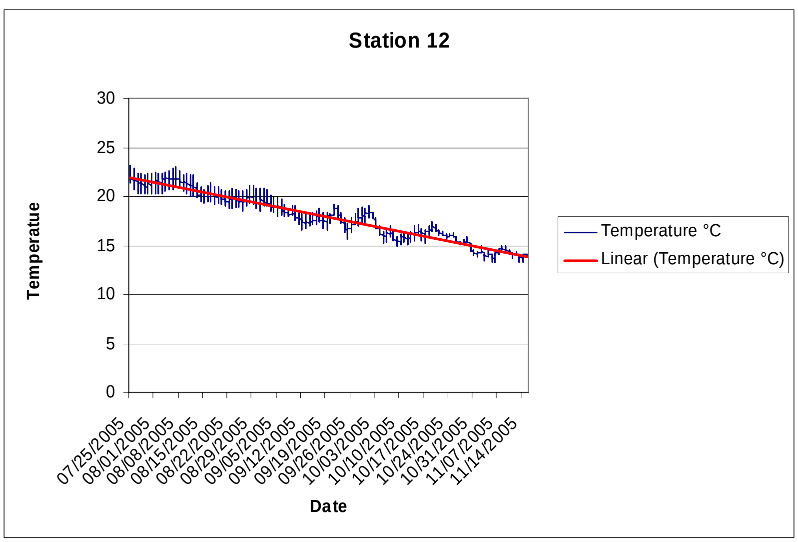
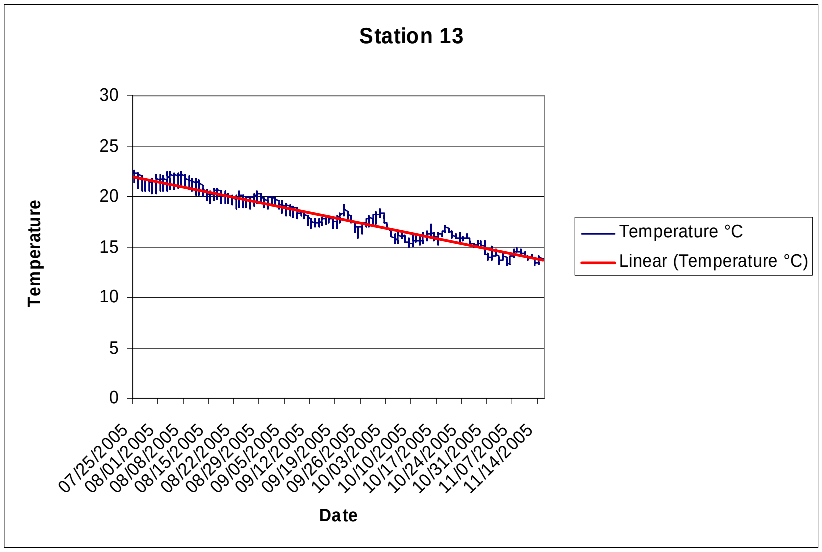
25
20
15
10
5
0
Temperature
07/25/2005
08/01/2005
08/08/2005
08/15/2005
08/22/2005
08/29/2005
09/05/2005
09/12/2005
09/19/2005
09/26/2005
10/03/2005
10/10/2005
10/17/2005
10/24/2005
10/31/2005
11/07/2005
11/14/2005
Date
Temperature °C
Linear (Temperature °C)


Station 11
30
25
20
15
10
5
0
Temperature
07/25/2005
08/01/2005
08/08/2005
08/15/2005
08/22/2005
08/29/2005
09/05/2005
09/12/2005
09/19/2005
09/26/2005
10/03/2005
10/10/2005
10/17/2005
10/24/2005
10/31/2005
11/07/2005
11/14/2005
Date
Temperature °C
Linear (Temperature °C)


Station 12
30
25
20
15
10
5
0
Temperatue
07/25/2005
08/01/2005
08/08/2005
08/15/2005
08/22/2005
08/29/2005
09/05/2005
09/12/2005
09/19/2005
09/26/2005
10/03/2005
10/10/2005
10/17/2005
10/24/2005
10/31/2005
11/07/2005
11/14/2005
Date
Temperature °C
Linear (Temperature °C)


Station 13
30
25
20
15
10
5
0
Temperature
07/25/2005
08/01/2005
08/08/2005
08/15/2005
08/22/2005
08/29/2005
09/05/2005
09/12/2005
09/19/2005
09/26/2005
10/03/2005
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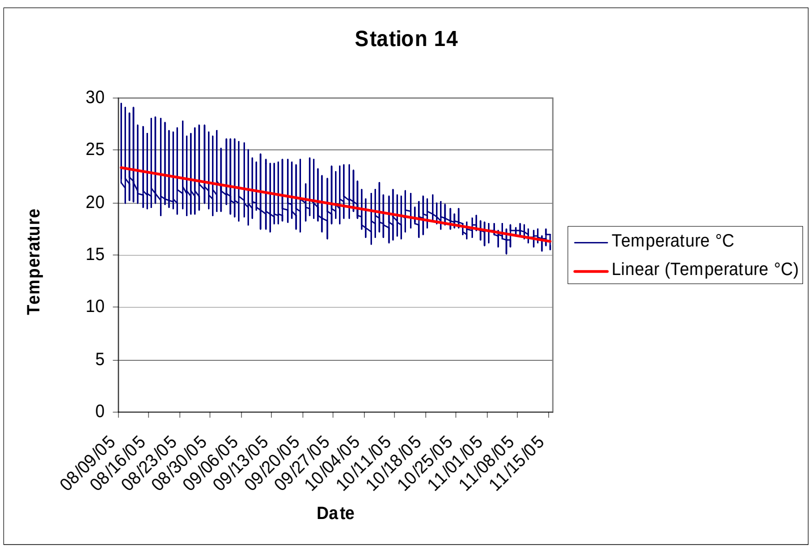
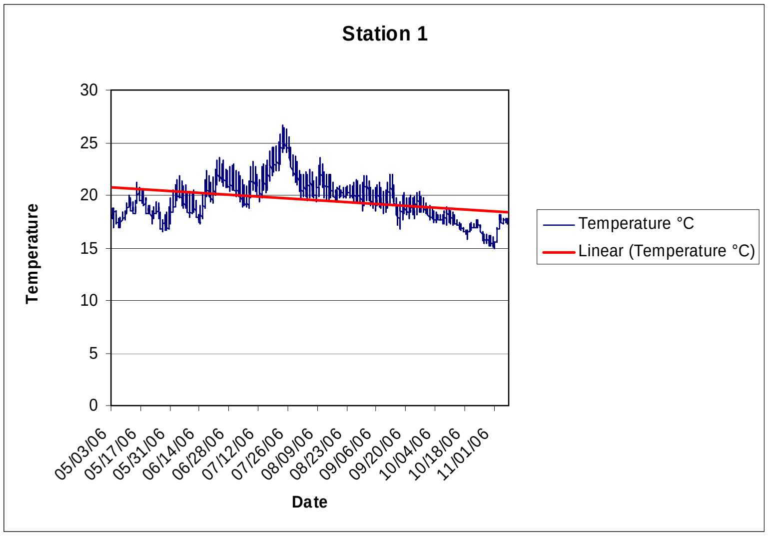
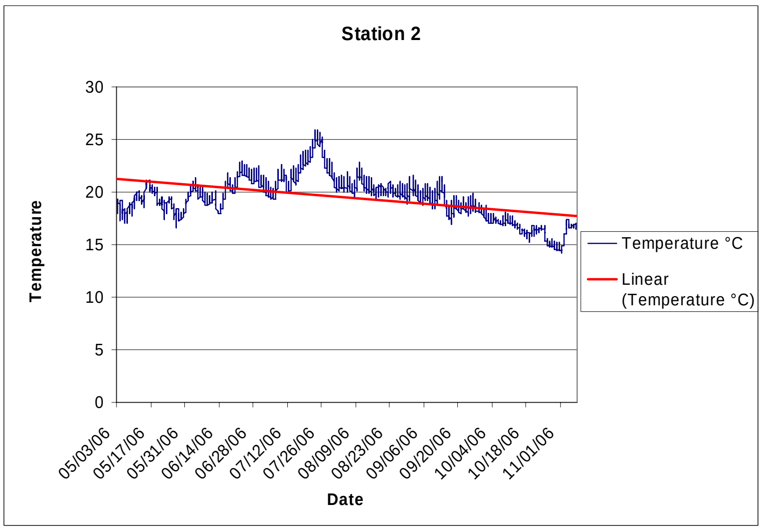
11/07/2005
11/14/2005
Date
Temperature °C
Linear (Temperature °C)


Station 14
30
25
20
15
10
5
0
Temperature
08/09/05
08/16/05
08/23/05
08/30/05
09/06/05
09/13/05
09/20/05
09/27/05
10/04/05
10/11/05
10/18/05
10/25/05
11/01/05
11/08/05
11/15/05
Date
Temperature °C
Linear (Temperature °C)

2006 Temperature Monitoring

Temperature Logger Station ID	Location	Date and time water monitors began recording	Date and time water monitors finished recording
1	Downstream Montague Expressway	May 3, 2006: 9:00	November 7, 2006: 9:00
2	Downstream Charcot Avenue	May 3, 2006 9:00	November 7, 2006: 10:00
3	Downstream O' Toole	May 3, 2006: 9:00	November 7, 2006: 10:00
4	Upstream Ridder Park Drive	May 3, 2006: 11:00	November 7, 2006: 11:00
5	Upstream Old Oakland Road	May 3, 2006 11:00	November 7, 2006: 11:00
6	Downstream Berryessa Road	May 3, 2006: 12:00	August 23, 2006: 12:00
7	Upstream Berryessa Road	May 3, 2006: 13:00	November 7, 2006: 11:00
8	Upstream Mabury Road	Loggers not found	Loggers not found
9	Downstream East Julian Street	May 4, 2006: 10:00	November 7, 2006: 12:00
10	Downstream East Santa Clara Street	May 4, 2006: 9:00	November 9, 2006: 10:00
11	Downstream East San Antonio Street	May 4, 2006: 9:00	November 9, 2006: 9:00
12	Upstream East William Street	May 4, 2006: 8:00	November 9, 2006: 9:00
13	Upstream Interstate 280	May 4, 2006: 8:00	November 9, 2006: 9:00
14	Lower Silver Creek upstream of confluence with Coyote Creek	May 3, 2006: 14:00	November 9, 2006: 10:00


Station 1
Temperature
30
25
20
15
10
5
0
05/03/06
05/17/06
05/31/06
06/14/06
06/28/06
07/12/06
07/26/06
08/09/06
08/23/06
09/06/06
09/20/06
10/04/06
10/18/06
11/01/06
Date
Temperature °C
Linear (Temperature °C)


Station 2
Temperature
30
25
20
15
10
5
0
05/03/06
05/17/06
05/31/06
06/14/06
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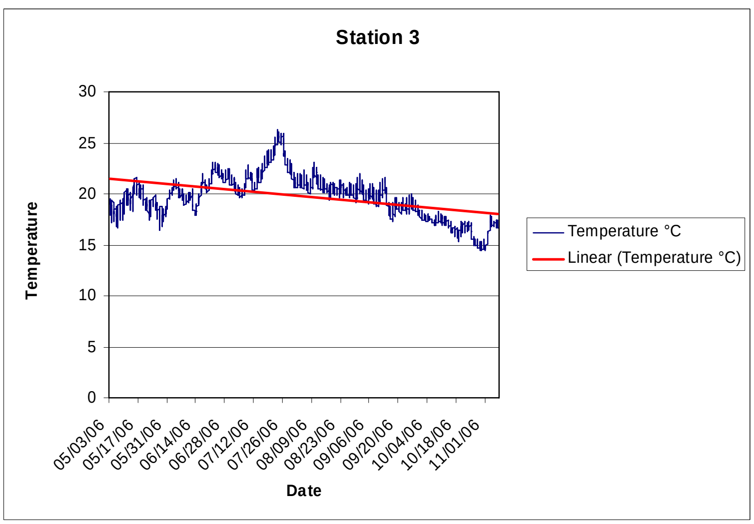
07/12/06
07/26/06
08/09/06
08/23/06
09/06/06
09/20/06
10/04/06
10/18/06
11/01/06
Date
Temperature °C
Linear (Temperature °C)


Station 3
Temperature
30
25
20
15
10
5
0
05/03/06
05/17/06
05/31/06
06/14/06
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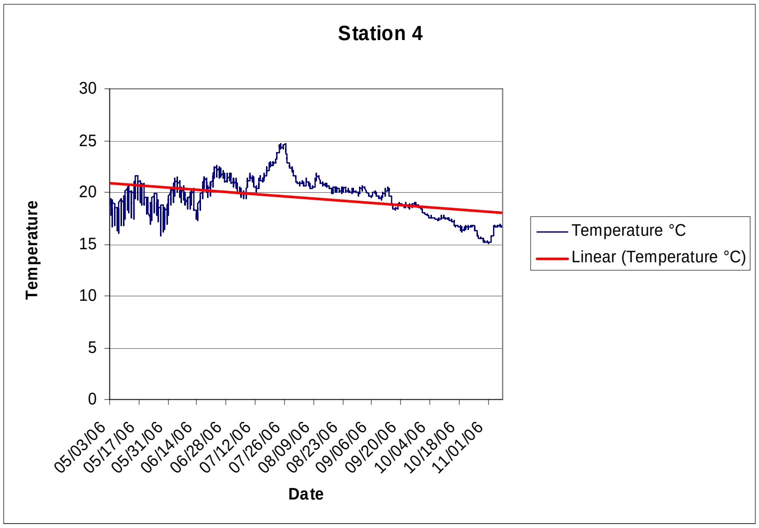
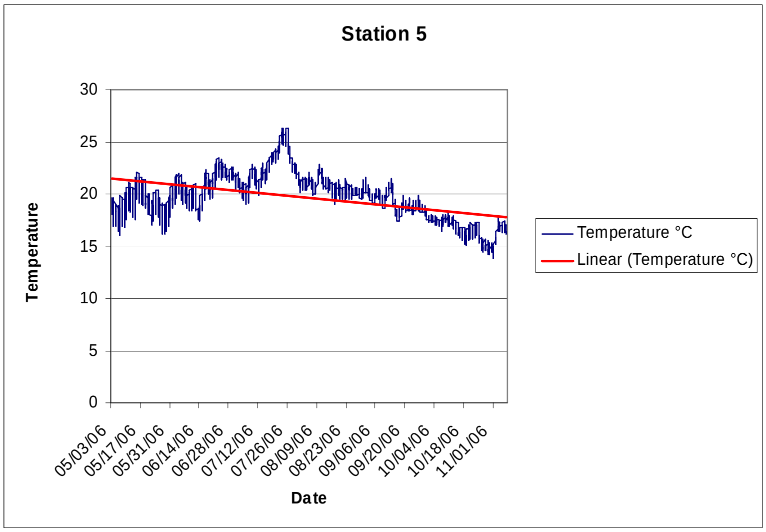
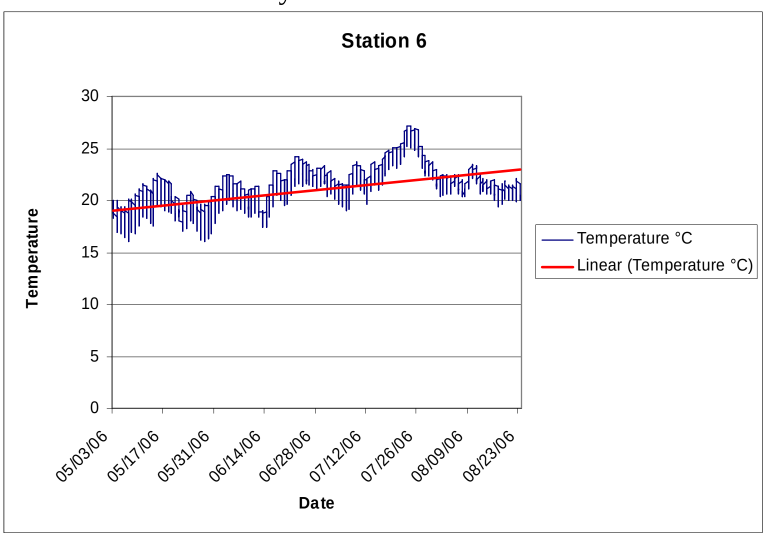
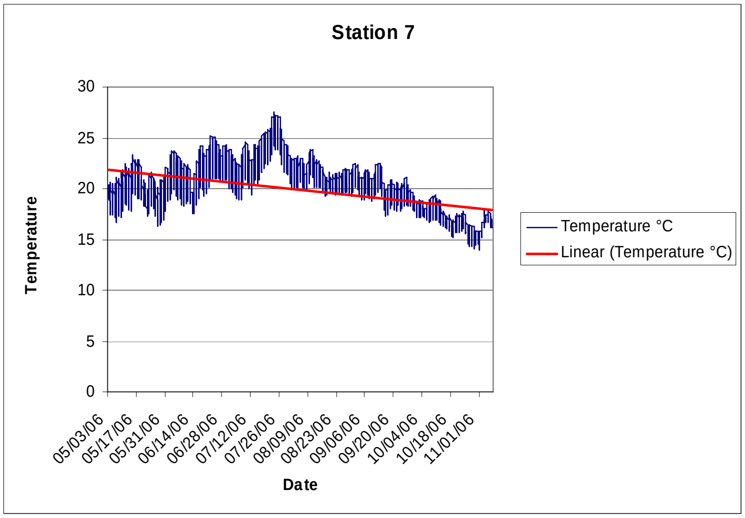
07/12/06
07/26/06
08/09/06
08/23/06
09/06/06
09/20/06
10/04/06
10/18/06
11/01/06
Date
Temperature °C
Linear (Temperature °C)





*Station 6 removed early due to instream construction




Station 7
Temperature
30
25
20
15
10
5
0
05/03/06
05/17/06
05/31/06
06/14/06
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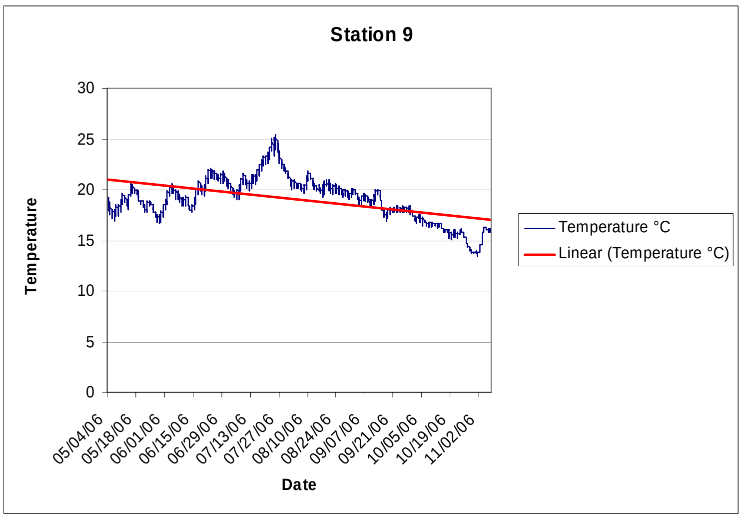
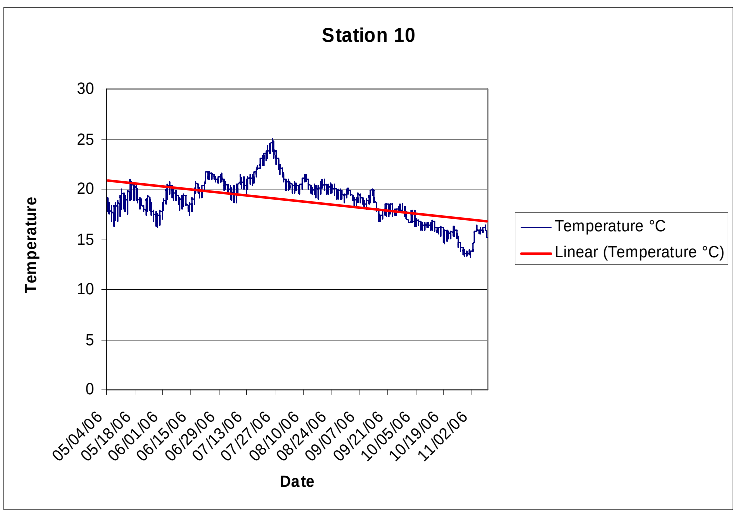
07/12/06
07/26/06
08/09/06
08/23/06
09/06/06
09/20/06
10/04/06
10/18/06
11/01/06
Date
Temperature °C
Linear (Temperature °C)


Station 9
Temperature
30
25
20
15
10
5
0
05/04/06
05/18/06
06/01/06
06/15/06
06/29/06
07/13/06
07/27/06
08/10/06
08/24/06
09/07/06
09/21/06
10/05/06
10/19/06
11/02/06
Date
Temperature °C
Linear (Temperature °C)


Station 10
Temperature
30
25
20
15
10
5
0
05/04/06
05/18/06
06/01/06
06/15/06
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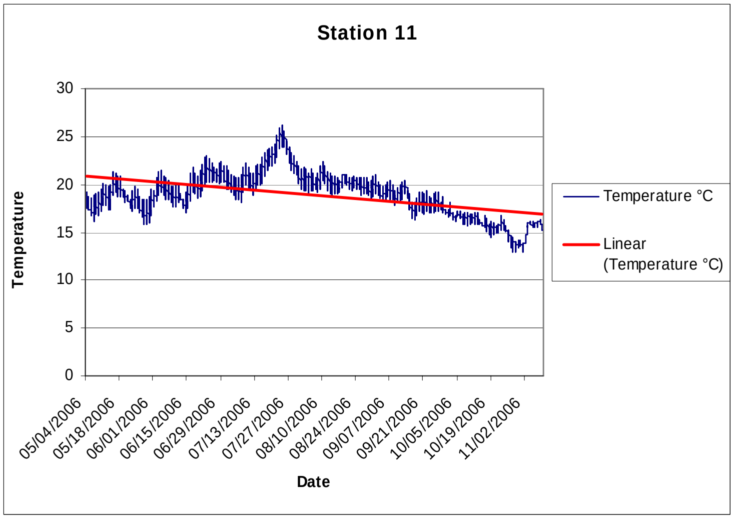
07/13/06
07/27/06
08/10/06
08/24/06
09/07/06
09/21/06
10/05/06
10/19/06
11/02/06
Date
Temperature °C
Linear (Temperature °C)


Station 11
30
25
20
15
10
5
0
Temperature
05/04/2006
05/18/2006
06/01/2006
06/15/2006
06/29/2006
07/13/2006
07/27/2006
08/10/2006
08/24/2006
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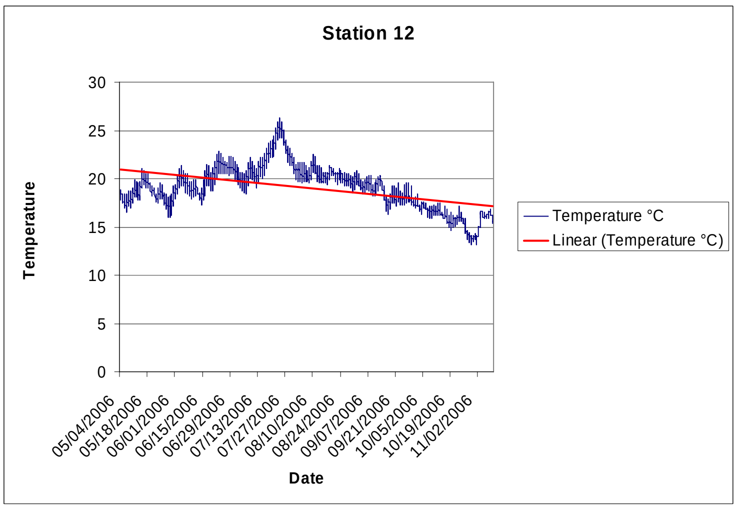
09/21/2006
10/05/2006
10/19/2006
11/02/2006
Date
Temperature °C
Linear (Temperature °C)


Station 12
30
25
20
15
10
5
0
Temperature
05/04/2006
05/18/2006
06/01/2006
06/15/2006
06/29/2006
07/13/2006
07/27/2006
08/10/2006
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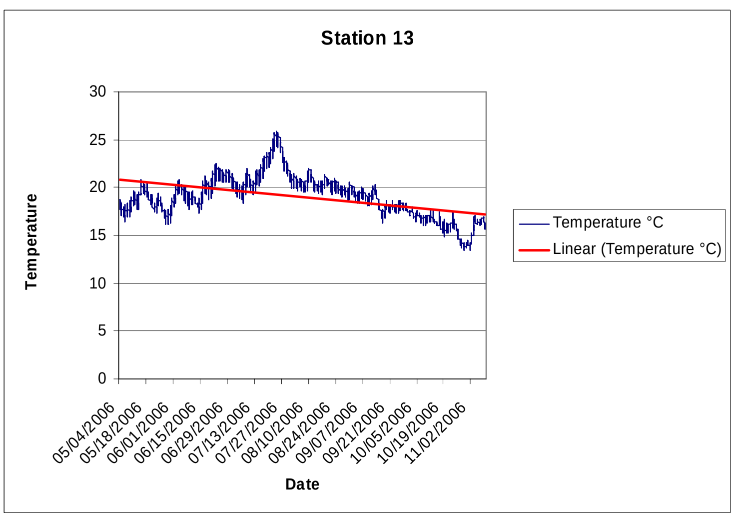
09/07/2006
09/21/2006
10/05/2006
10/19/2006
11/02/2006
Date
Temperature °C
Linear (Temperature °C)


Station 13
30
25
20
15
10
5
0
Temperature
05/04/2006
05/18/2006
06/01/2006
06/15/2006
06/29/2006
07/13/2006
07/27/2006
08/10/2006
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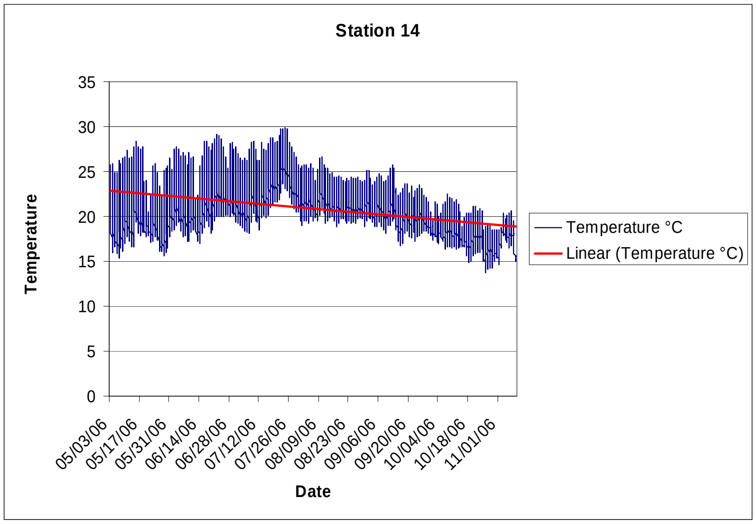
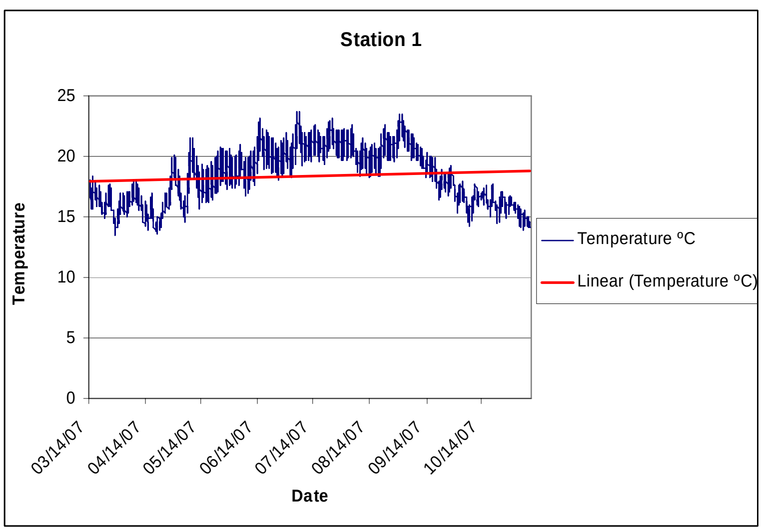
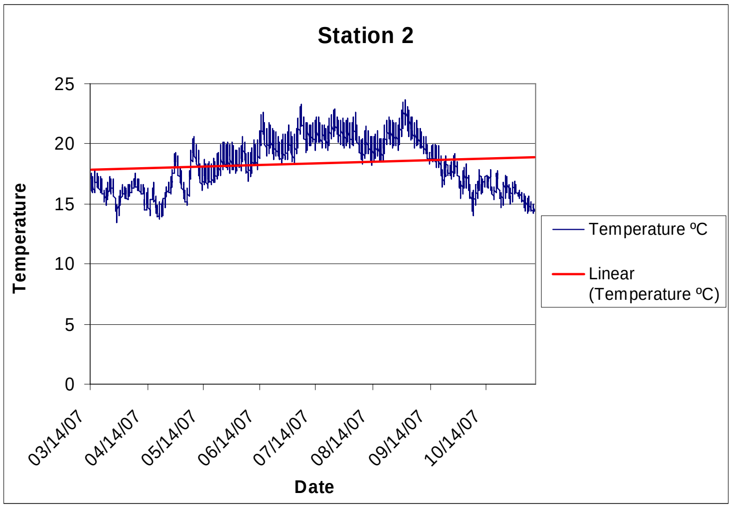
10/19/2006
11/02/2006
Date
Temperature °C
Linear (Temperature °C)

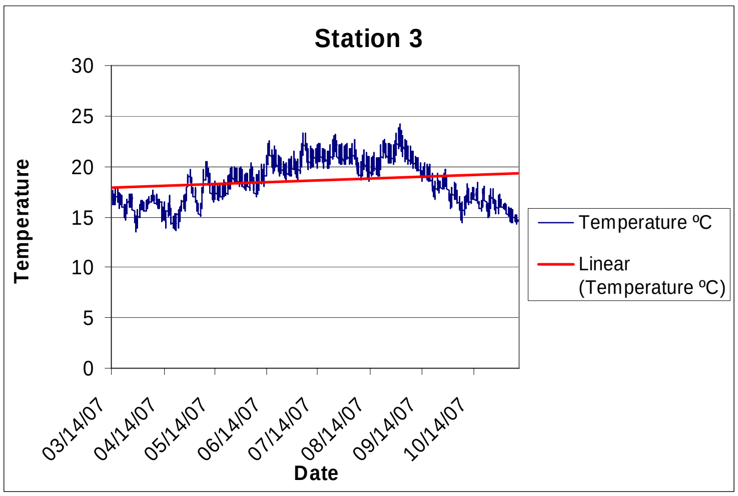

Station 14
Temperature
Date
35
30
25
20
15
10
5
0
05/03/06
05/17/06
05/31/06
06/14/06
06/28/06
07/12/06
07/26/06
08/09/06
08/23/06
09/06/06
09/20/06
10/04/06
10/18/06
11/01/06
Temperature °C
Linear (Temperature °C)

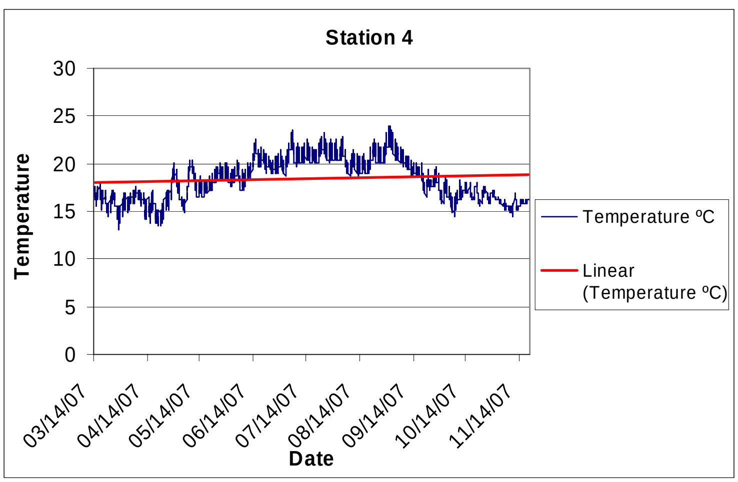
2007 Temperature Monitoring

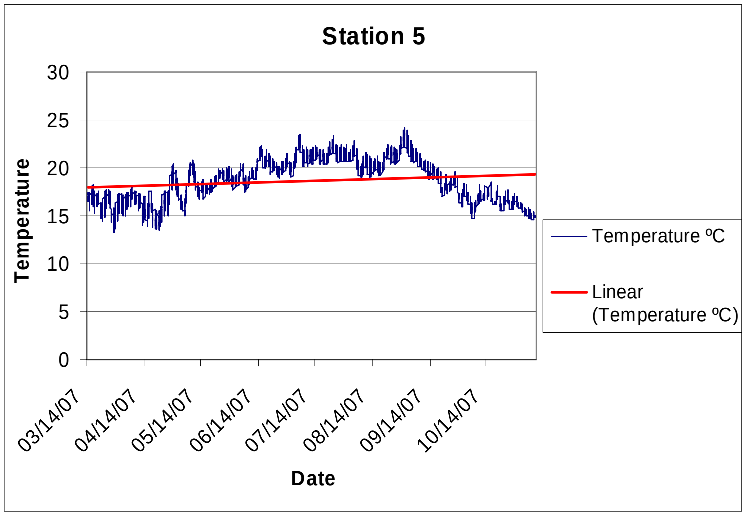
Temperature Logger Station ID	Location	Date and time water monitors began recording	Date and time water monitors finished recording
1	Downstream Montague Expressway	March 14, 2007:9:00	November 9, 2007:9:00
2	Downstream Charcot Avenue	March 14, 2007:10:00	November 9, 2007:10:00
3	Downstream O' Toole	March 14, 2007:10:00	November 9, 2007: 10:00
4	Upstream Ridder Park Drive	March 14, 2007:11:00	November 19, 2007: 12:00
5	Upstream Old Oakland Road	March 14, 2007: 12:00	November 9,2007: 11:00
6	Downstream Berryessa Road	March 14, 2007: 12:00	November 9,2007: 11:00
7	Upstream Berryessa Road	March 14, 2007: 12:00	November 9,2007: 12:00
8	Upstream Mabury Road	March 12, 2007: 13:00	November 14,2007: 14:00
9	Downstream East Julian Street	March 12, 2007: 12:00	November 8,2007: 10:00
10	Downstream East Santa Clara Street	March 12, 2007: 12:00	Logger lost
11	Downstream East San Antonio Street	March 12, 2007: 11:00	November 8, 2007: 9:00
12	Upstream East William Street	March 12, 2007: 11:00	Logger lost
13	Upstream Interstate 280	March 12, 2007: 10:00	November 8, 2007: 8:00
14	Lower Silver Creek upstream of confluence with Coyote Creek	March 14, 2007: 13:00	November 8, 2007: 10:00

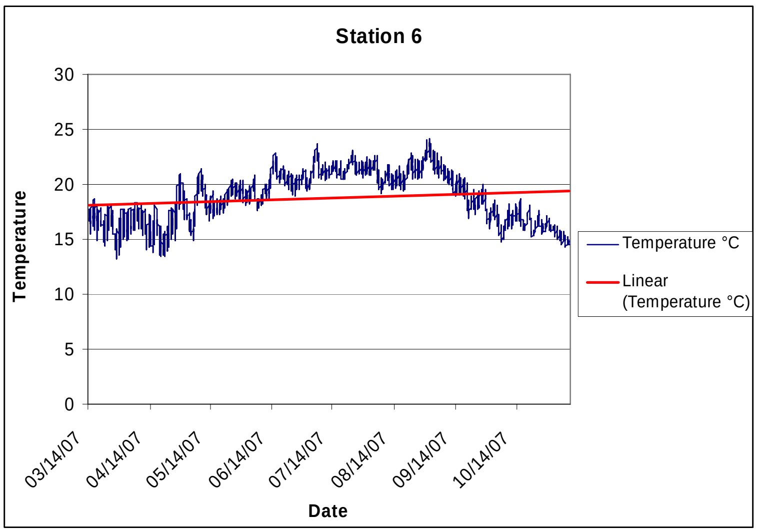


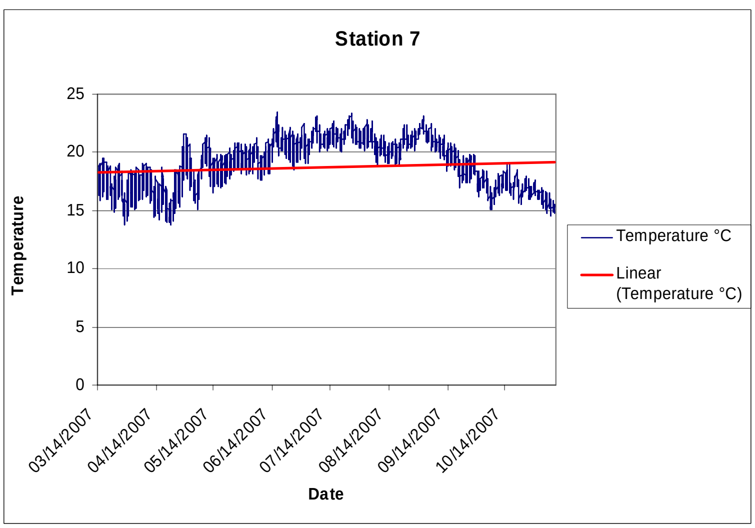

Station 2
25
20
15
10
5
0
Temperature
03/14/07
04/14/07
05/14/07
06/14/07
07/14/07
08/14/07
09/14/07
10/14/07
Date
Temperature ºC
Linear (Temperature ºC)

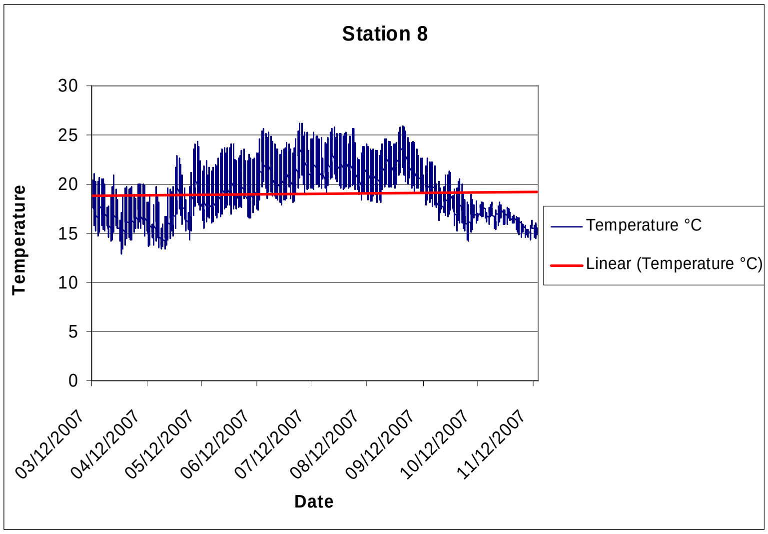

Station 3
30
25
20
15
10
5
0
Temperature
03/14/07
04/14/07
05/14/07
06/14/07
07/14/07
08/14/07
09/14/07
10/14/07
Date
Temperature ºC
Linear (Temperature ºC)

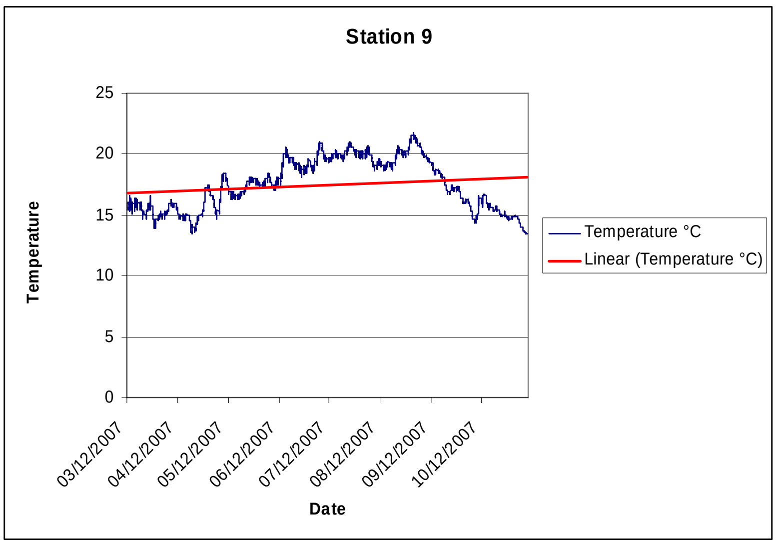

Station 4
30
25
20
15
10
5
0
Temperature
03/14/07
04/14/07
05/14/07
06/14/07
07/14/07
08/14/07
09/14/07
10/14/07
11/14/07
Date
Temperature ºC
Linear (Temperature ºC)

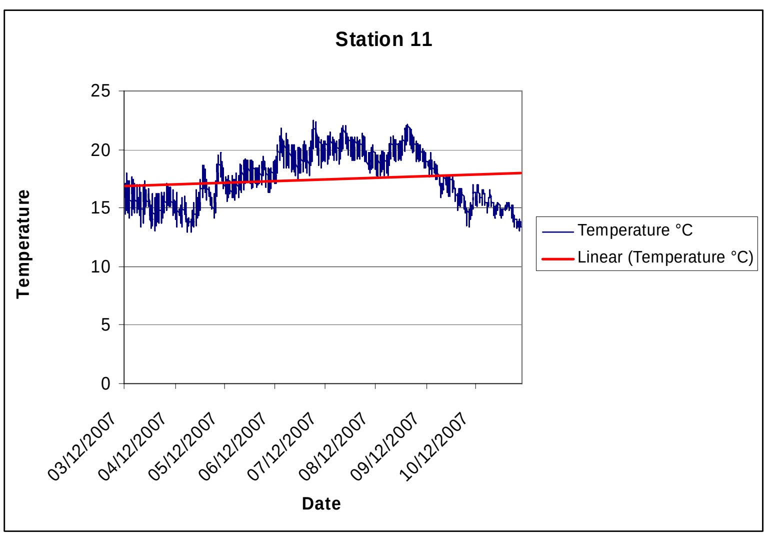

Station 5
Temperature
30
25
20
15
10
5
0
03/14/07
04/14/07
05/14/07
06/14/07
07/14/07
08/14/07
09/14/07
10/14/07
Date
Temperature ºC
Linear (Temperature ºC)

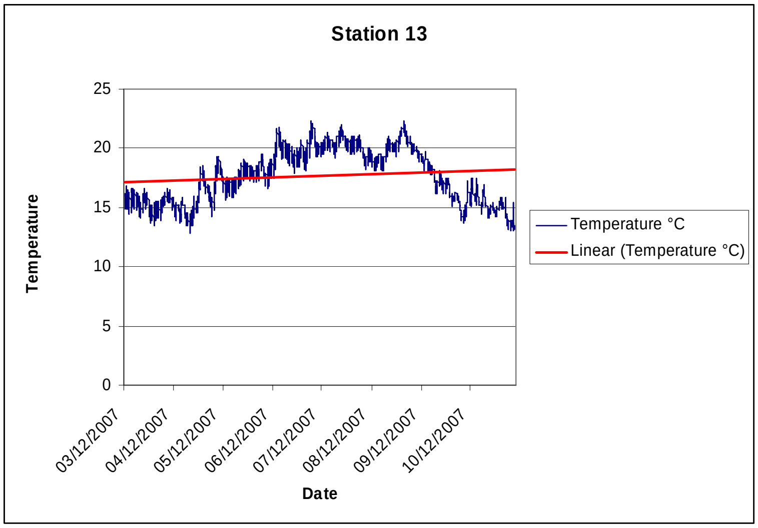

Station 6
Temperature
30
25
20
15
10
5
0
03/14/07
04/14/07
05/14/07
06/14/07
07/14/07
08/14/07
09/14/07
10/14/07
Date
Temperature °C
Linear (Temperature °C)

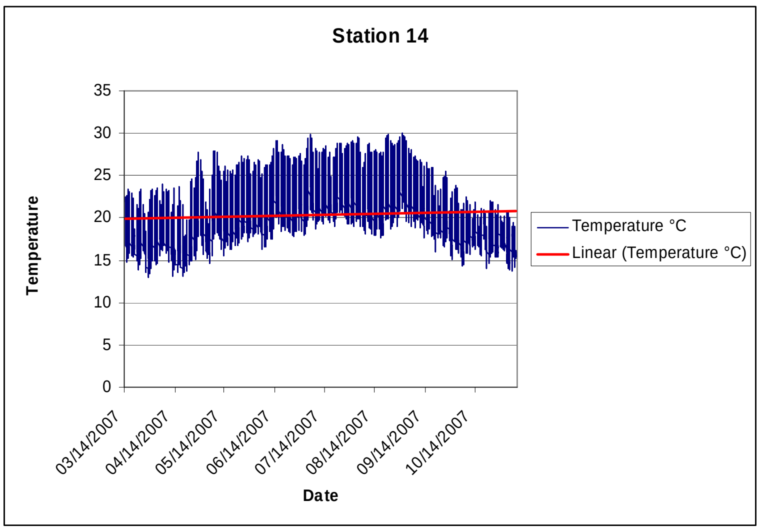

Station 7
Temperature
25
20
15
10
5
0
03/14/2007
04/14/2007
05/14/2007
06/14/2007
07/14/2007
08/14/2007
09/14/2007
10/14/2007
Date
Temperature °C
Linear (Temperature °C)


Station 8
30
25
20
15
10
5
0
Temperature
03/12/2007
04/12/2007
05/12/2007
06/12/2007
07/12/2007
08/12/2007
09/12/2007
10/12/2007
11/12/2007
Date
Temperature °C
Linear (Temperature °C)


Station 9
25
20
15
10
5
0
Temperature
03/12/2007
04/12/2007
05/12/2007
06/12/2007
07/12/2007
08/12/2007
09/12/2007
10/12/2007
Date
Temperature °C
Linear (Temperature °C)


Station 11
25
20
15
10
5
0
Temperature
03/12/2007
04/12/2007
05/12/2007
06/12/2007
07/12/2007
08/12/2007
09/12/2007
10/12/2007
Date
Temperature °C
Linear (Temperature °C)


Station 13
25
20
15
10
5
0
Temperature
03/12/2007
04/12/2007
05/12/2007
06/12/2007
07/12/2007
08/12/2007
09/12/2007
10/12/2007
Date
Temperature °C
Linear (Temperature °C)


Station 14
35
30
25
20
15
10
5
0
Temperature
03/14/2007
04/14/2007
05/14/2007
06/14/2007
07/14/2007
08/14/2007
09/14/2007
10/14/2007
Date
Temperature °C
Linear (Temperature °C)