

# Sisquoc River Steelhead Trout Population Survey Fall 2005



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## PROJECT BACKGROUND

The objective of this study was to document the presence of steelhead trout (*Oncorhynchus mykiss irideus*) in the Sisquoc River watershed with particular emphasis on documentation of any large, sea-run, adult steelhead that may have remained in the system following connectivity between the Santa Maria River and the ocean during the high winter flows of 2004/2005. Conducting snorkeling surveys for adult steelhead that may have elected to oversummer or were trapped in the watershed provided an important opportunity to document anadromy in the system and also to assess the population dynamics of juveniles in variable reaches of the watershed. In addition, a significant steelhead migration impediment under the Garey Bridge near Sisquoc was recently removed improving upstream steelhead migration conditions. The first scheduled revision to the Twitchell Dam Water Control Manual (WCM) since steelhead were listed as an endangered species is reportedly in progress and steelhead migration flow and recovery discussions should benefit from the data collected in this study.

## SANTA MARIA/SISQUOC RIVER STEELHEAD

The Santa Maria River is the northernmost watershed in the Southern California Steelhead Evolutionarily Significant Unit (ESU) that supports the endangered southern steelhead (See Appendix A- Sisquoc River Area Map). In 1945 the DFG biologist Leo Shapovalov identified the Santa Maria River steelhead run as the second largest in Santa Barbara County, behind the Santa Ynez River, with the Sisquoc River being the primary steelhead spawning tributary (Shapovalov 1944, 1945). Prior to the construction of migration barriers within the Santa Maria River watershed, steelhead had access to over 500 miles of stream habitat. The construction of Twitchell Dam in 1958, on the large Cuyama River tributary, is estimated to have blocked steelhead from accessing approximately 264 stream miles and 60% of the entire watershed (Shapovalov, 1945). A recent report, *Steelhead Migration Barrier Assessment and Recovery Opportunities for the Sisquoc River*, identifies over 234 stream miles located within the Sisquoc River and Santa Maria and Cuyama Rivers below Twitchell Dam that are currently accessible to steelhead (Stoecker 2003). Over 200 stream miles occur within the productive Sisquoc River drainage where steelhead have been consistently documented for over a century and where no impassable mainstem fish migration barriers occur.

As early as 1879, steelhead were documented in the Sisquoc and Santa Maria Rivers with adult steelhead runs reported into the 1940's and periodic adult steelhead observations into the late 1990's following high flow years (Stoecker 2003). Refer to the 11 page Salmonid Documentation Table in Stoecker 2003 for additional historic documentation, photographs, and 2003 survey results. An amazing February 13, 1941 Santa Maria Newspaper article reported that anglers caught five steelhead on the flood inundated Cook Street and shows a photo of anglers fishing the submerged streets of Santa Maria (Stoecker 2003). Following the large flows of the 1998 El Nino winter, several adult steelhead measuring between 20-28 inches were observed and photographs by Los Padres National Forest and Department of Fish and Game biologists (Stoecker 2003). Even with a long history of hatchery rainbow trout planting efforts in the watershed, recent studies of the Sisquoc River steelhead population reveal that the native

gene pool is still present and reproducing populations occur in many of the headwater streams (Titus et al. 2000, Stoecker 2003).

During years with high stream flow and ocean connectivity, the Sisquoc River likely has the most abundant high quality habitat currently accessible to sea-run steelhead in the entire Southern Steelhead ESU and possibly south of San Francisco. In addition, the Santa Maria/Sisquoc River watershed likely has the greatest potential to restore a large, self-sustainable run of wild steelhead for the least cost in the southern half of California. No major dams or physical structures requiring expensive fish passage projects are needed for the mainstem of the Santa Maria or Sisquoc Rivers and the vast majority of the high quality habitat and existing steelhead population is already protected within the Los Padres National Forest.

Recent observations and documentation of steelhead in the Sisquoc River indicate that with adequate winter stream flow and releases from Twitchell Dam, steelhead have access upstream on the Santa Maria River and into the Sisquoc River. Ocean connectivity to the Santa Maria and Sisquoc Rivers may currently only occur a few times each decade and appears to be highly influenced by water releases from Twitchell Dam, groundwater extraction near Santa Maria, and gravel extraction operations in the river channel.

## PROJECT METHODS

### Personnel

Stoecker Ecological was retained by the Community Environmental Council (CEC) of Santa Barbara to conduct this study. Matt Stoecker prepared this report and conducted all sampling surveys with research assistants Doug Stoecker and Shaw Allen. Mauricio Gomez, Watershed Restoration Program Manager with the CEC, administered the funds from the Department of Fish and Game and acted as the administrative coordinator for this project.

### Survey Access and Locations

Fish sampling surveys took place on public lands within the Los Padres National Forest. Access was obtained with a Forest Service Administrative Pass and Forest gate key and utilized access points along the Sierra Madre Road, Manzana Schoolhouse, Davy Brown Campsite, and Nira Campground. See Appendix B for Stream Reach Survey Maps that show reaches surveyed.

Due to the presence of surface flow connectivity between the Sisquoc River and ocean during the past winter, this survey focused on areas where over-summering deep pool habitat occurs and has a high likelihood of supporting adult steelhead through the summer and fall. The surveyed reaches on the lower and upper Sisquoc River and upper Manzana Creek met this criteria as determined by Stoecker during Fall 2002 surveying of migration barriers (Stoecker 2003). Portions of several tributaries known to support naturally reproducing populations of steelhead including the South Fork Sisquoc River, Davy Brown Creek, and Rattlesnake Creek were also surveyed. In addition, the downstream margins of summer surface flows on the Sisquoc River where outmigrating adult steelhead may have been trapped by receding flows were surveyed. Some areas known to support steelhead and contain adequate over-summering habitat could not be surveyed due to budget and time constraints. Additional surface flow and isolated pools

continued to occur downstream of Manzana Creek, into November, onto private lands that were not accessible (pers. comm. Cooper 2005).

### Fish Sampling Methods

Streambank and underwater fish sampling methods described in the California Department of Fish and Game's *California Salmonid Stream Habitat Restoration Manual* where utilized (CDFG 2002). Essential data fields from the "Stream Bank or Underwater Observation Field Form" of the CDFG Manual were recorded and are presented here in a report format. Photographs and video of fish were taken during bank and underwater surveying. All fish listed in this reports populations tables are positively identified *O. m. irideus*. Additional information about other fish species observed is noted within the stream reach discussions. A Garmin Foretrex 101 GPS receiver using WGS 84 map datum was used for obtaining all field GPS coordinates. All GPS coordinates within this report are shown in parenthesis with North then West degrees-minutes-seconds (ex. (34-44-51.3, 119-53-12.8). Appendix C contains a table of GPS coordinates for the downstream end of many surveyed reaches. A Browning laser meter was utilized to measure surveyed reach distances.

### Fish Population Table Definitions

*Reach ID*- The Reach ID identifies the stream name and survey order listed from the furthest downstream reach to the furthest upstream. For example, SC20 identifies the 20<sup>th</sup> reach surveyed upstream on the Sisquoc River. Other stream abbreviations include, Manzana Creek (MA), Davy Brown (DB), South Fork Sisquoc River (SF), and Rattlesnake Creek (RE).

*Habitat Type*- See Appendix D for a DFG table of habitat type abbreviations and descriptions. For longer reaches surveyed, the dominant habitat type is specified and other habitat types may occur within this reach.

*Reach Length*- Reach length was determined in the field using a laser finder and following the streams thalweg. All measurements are given in feet.

*Observation Method*- Within each reach surveyed, *O. m. irideus* were identified by underwater snorkeling (UW), bank observation (BO), or a mix of both of these sampling techniques (MX).

*Age Classes*- Following the DFG manual criteria, only 4 age classes were recorded (O+ or YOY, 1+, 2+, 3+). Fish counted within the 3+ age class include a wide range of *O. m. irideus* lengths between 9 and the maximum observed 20 inches.

*Total Number of Fish*- This identifies the total number of *O. m. irideus* observed.

*Maximum Fish Length*- This identifies the total length of the longest observed *O. m. irideus*, in inches. The last row on each table is the "Total" for each column and for this row the Maximum Fish Length documented within the reaches is listed.

*Fish Density*- This density number was calculated by dividing the total number of *O. m. irideus* observed within each reach by that reaches distance in feet. The resulting number gives the number of fish per foot of stream. For example, the highest density score recorded was 0.666, which can be thought of as 0.666 fish/foot of stream, 6.6 fish for every 10 feet of stream, or 66.6 fish for every 100 feet of stream.

## SURVEY RESULTS

Note: For the remainder of this report the term *steelhead* will be used to identify all *Oncorhynchus mykiss irideus* observed. This terminology will be used because all *O. m. irideus* identified within the reaches surveyed occur within anadromous stream reaches that are accessible to and from the ocean. The terms *chub* and *bullhead* will be used to describe Arroyo Chub (*Gila orcutti*) and Black Bullhead (*Ameiurus melas*)

### Lower Sisquoc River

#### *Survey Notes*

Access to the lower Sisquoc River was obtained by driving to Manzanita Schoolhouse and backpacking up the Sisquoc River. Two sections of the lower Sisquoc River were surveyed containing 26 stream reaches for a total of 23,048 feet. The lower Sisquoc River was surveyed by Matt Stoecker and Shaw Allen from October 22 to October 26, 2005.

#### *Habitat Description*

No surface flows were observed on the Sisquoc River from Manzanita Creek upstream to approximately 1000 feet downstream from the trail crossing southwest of the Water Canyon Campsite. Five small puddles associated with bedrock scour bends were observed between the Bald Mountain Canyon and the first observed surface flow downstream from Water Canyon Campsite.



*Bedrock scour pool SC1 adjacent to Water Canyon Campsite.*

The lowest reaches surveyed (SC1-SC3) are located adjacent to the Water Canyon Campsite. At 13:10 on October 26th the water and air temperatures measured 66F and 76F respectively. Two bedrock scour pools (SC1 and SC3) are separated by a shallow low gradient riffle (SC2). Both scour pools averaged 25 feet wide with depths of 6 feet in



SC1 and 8 feet 6 inches in SC3. The Water Creek tributary occurs immediately upstream of these reaches and was dry for the 100 feet observed above the Sisquoc River.



*Boulder scour pool SC7 where 20 inch steelhead was observed.*

Reaches SC4-SC26 extend from the trail crossing downstream of Morman Campsite (SC4) upstream to approximately 0.75 miles upstream of Miller Campsite. Throughout this section habitat types altered between shallow, low gradient riffles and runs and lateral scour pools formed by bedrock and to a lesser degree large boulders. Poor salmonid habitat conditions occurred within the riffles where low instream cover, low riparian canopy cover, elevated mid-day water temperatures, and shallow depths were observed. Surveying upstream from SC4 began at 10:21 on October 23rd and the water and air temperatures measured 59F and 68F respectively. Surveying upstream from SC15 began at 12:17 on October 24th and the water and air temperatures measured 65F and 72F respectively. The lateral scour pools contained depths up to 7 feet and some pools contain extensive undercut ledges and moderate to high instream cover. All reaches, however, contained an abundance of algal growth, high sun exposure, and low surface flows that may lead to excessive water temperatures, low dissolved oxygen levels, and suboptimal water quality in mid-summer. A 460-foot long pool (SC19) created by a beaver dam provided excellent steelhead rearing habitat with extensive undercut banks associated with alder roots and boulders.



*Underwater surveying in beaver dam pool SC19.*

*Fish Survey Results*

Lower Sisquoc R. Steelhead Sampling Results										
Reach ID	Habitat Type	Reach Length (ft.)	Observation Method	0+ (Less Than 3")	1+ (3-6")	2+ (6-9")	3+ (9" or greater)	Total # of Fish	Max. Fish Length (in.)	Fish Density
SC1	LSBK	271	UW	0	0	0	0	0	0	0.000
SC2	LGR	162	BO	0	0	0	0	0	0	0.000
SC3	LSBK	117	UW	0	0	0	0	0	0	0.000
SC4	LGR	604	BO	0	0	0	0	0	0	0.000
SC5	LSBK	86	UW	0	0	0	0	0	0	0.000
SC6	LGR	414	BO	0	0	0	0	0	0	0.000
SC7	LSBO	243	UW	0	0	0	1	1	20	0.004
SC8	LGR	3069	BO	0	0	0	0	0	0	0.000
SC9	LSBK	105	UW	0	0	0	1	1	13	0.010
SC10	LGR	1095	BO	0	0	0	0	0	0	0.000
SC11	LSBK	137	UW	0	0	0	0	0	0	0.000
SC12	LGR	964	BO	0	0	0	0	0	0	0.000
SC13	LSBK	385	UW	0	0	0	0	0	0	0.000
SC14	LGR	5115	BO	0	0	0	0	0	0	0.000

SC15	LSBK	153	UW	0	0	0	0	0	0	0.000
SC16	LGR	1347	BO	0	0	0	0	0	0	0.000
SC17	LSBK	156	UW	0	0	0	0	0	0	0.000
SC18	LGR	1244	BO	0	0	0	0	0	0	0.000
SC19	DPL	460	UW	0	0	1	0	1	14	0.004
SC20	LGR	3340	BO	0	0	0	0	0	0	0.000
SC21	LSBK	98	UW	0	0	0	0	0	0	0.000
SC22	LSBK	370	UW	0	0	0	0	0	0	0.000
SC23	LGR	435	BO	0	0	0	0	0	0	0.000
SC24	LSBK	215	UW	0	0	1	0	1	8	0.005
SC25	LGR	2385	BO	0	0	0	0	0	0	0.000
SC26	LSBK	78	UW	0	0	0	0	0	0	0.000
Total		23048	MX	0	0	2	2	4	20	0.0002

A total of four steelhead ranging from 8 to 20 inches in total length were observed in the lower Sisquoc River. This reach contained the lowest overall density of Steelhead observed in the entire watershed (0.0002). No young-of-the-year (YOY) or 1+ age class steelhead were observed. The 20-inch long adult steelhead was both the largest steelhead documented in the entire watershed survey and the furthest downstream steelhead observed in the survey, occurring near the downstream end of flows and apparently trapped in the system by receding flows. This 20-inch steelhead was identified as a sea-run adult steelhead due to the size and physical characteristics. In addition, the location of this large steelhead near the downstream extent of surface flows in the suboptimal habitat of the lower Sisquoc River following a winter with connectivity to the ocean further indicates that this fish was anadromous. The 20-inch steelhead is pictured on cover of this report (Shaw Allen photo credit).

All steelhead observed were in the bedrock or boulder scour pools and beaver dam pool. These pools contained good instream cover in the form of undercut ledges and water depths greater than 4 feet. Inaccessible, deep holes were dug into the banks of the beaver dam pool and may have contained additional steelhead that could not be observed while underwater. Two of the four steelhead observed in this section of the lower Sisquoc River occurred in the beaver dam pool, which contained high quality rearing habitat. No steelhead were observed in the lowest reaches surveyed near Water Campsite or upstream in any of the shallow riffle and run habitat. The lower Sisquoc River is likely primarily used as a migration corridor for Sisquoc River steelhead traveling between the ocean, Manzana Creek, and other downstream tributaries.

High densities of chub were observed in all pools from SC1-SC26 and moderate densities occurred in riffle and run habitat. Isolated puddles downstream from SC1 were packed with chub and lesser amounts of bullhead that were dying as the puddles dried up. Bullhead to 10 inches in length were observed in low densities in reaches SC1-SC3 and very few were observed in SC4-SC26.

## Upper Sisquoc River

### *Survey Notes*

Access to the upper Sisquoc River was obtained from Sierra Madre Road and the Sweetwater Trail to downstream of the South Fork Station. Four different sections of the upper Sisquoc River containing 26 surveyed stream reaches were surveyed for a total of 4,927 feet. Matt Stoecker and Doug Stoecker conducted the surveys between October 17 and October 21, 2005. The first section surveyed (SC27-SC32) extended from 620 feet downstream of the South Fork Sisquoc River upstream 401 feet for a total of 1,021 feet. The second section surveyed (SC33-SC37) extended from the 2740-foot elevation upstream for a total of 794 feet. The third section surveyed (SC38-SC47) extended from the trail crossing downstream of the Rattlesnake Creek confluence upstream for a total of 1,009 feet to the Rattlesnake Creek confluence. The fourth section surveyed (SC48-SC52) extended from directly adjacent to Heath Campsite upstream for a total of 2,103 feet.

### *Habitat Description*

Habitat types from downstream of the South Fork Sisquoc River (SC27) upstream to near the South Fork Station (SC32) varied between lateral scour pools created by bedrock and boulders to step pools and mid-channel pools separated by runs and riffles. At 10:00 surface flows at SC27 were estimated at 1.5 cfs and the water and air temperatures measured at 53F and 66F respectively.



*Mid-channel pool SC32 adjacent to South Fork Station.*

The section containing reaches SC33-SC37 contains several large bedrock scour pools to 6 feet in depth with extensive undercut banks and instream cover under riparian tree roots, sedges, and large boulders. A long stretch of large boulder pocket water occurs in reach SC36.

Downstream of Rattlesnake Creek the Sisquoc River flows through a confined canyon and these reaches (SC38-SC47) of large bedrock scour pools and trench pools are separated by boulder step pools and sheet flow over bedrock. Excellent rearing habitat occurs in the deeper bedrock scour pools, trench pools, and smaller boulder step pools. Spawning gravels are not abundant in these reaches due to the abundance of bedrock.

Good to excellent spawning and rearing habitat occur throughout the reaches (SC48-SC52) with pools to 7 feet deep, variable riparian canopy cover up to 90%, excellent instream cover provided by boulders, bedrock ledges, undercut banks, roots, and woody debris.

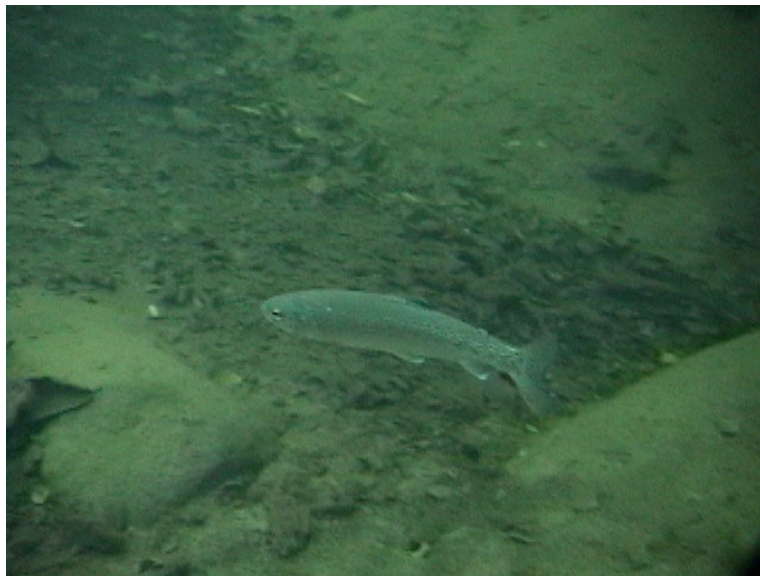
*Fish Survey Results*

Upper Sisquoc R. Steelhead Sampling Results										
Reach ID	Habitat Type	Reach Length (ft.)	Observation Method	0+ (Less Than 3")	1+ (3-6")	2+ (6-9")	3+ (9" or greater)	Total # of Fish	Max. Fish Length (in.)	Fish Density
SC27	LSBK	70	UW	1	0	2	1	4	9	0.057
SC28	POW	550	BO	2	0	1	0	3	8	0.005
SC29	POW	120	BO	0	0	0	0	0	0	0.000
SC30	LSBO	85	UW	0	0	0	0	0	0	0.000
SC31	POW	106	BO	0	0	0	0	0	0	0.000
SC32	MCP	90	UW	0	0	1	1	2	11	0.022
SC33	LSBK	108	UW	0	1	2	2	5	15	0.046
SC34	BRS	27	BO	0	0	0	0	0	0	0.000
SC35	LSBK	177	UW	0	0	1	1	2	10	0.011
SC36	POW	320	BO	0	0	0	0	0	0	0.000
SC37	LSBK	162	UW	1	2	1	0	4	8	0.025
SC38	STP	130	UW	0	0	0	0	0	0	0.000
SC39	LSBK	100	UW	0	0	1	0	1	7	0.010
SC40	BRS	87	UW	0	1	0	0	1	5	0.011
SC41	STP	155	BO	2	2	1	0	5	7	0.032
SC42	LSBK	78	UW	0	0	4	0	4	8	0.051
SC43	TRP	132	UW	0	0	2	2	4	15	0.030
SC44	BRS	45	UW	0	0	0	0	0	0	0.000
SC45	STP	84	UW	0	0	0	0	0	0	0.000
SC46	LSBK	153	UW	0	1	1	0	2	7	0.013
SC47	STP	45	BO	0	0	0	0	0	0	0.000

SC48	STP	504	MX	16	5	2	0	23	9	0.046
SC49	PLP	30	UW	0	5	2	0	7	8	0.233
SC50	STP	1275	MX	67	22	14	2	105	10	0.082
SC51	PLP	36	UW	0	1	0	1	2	12	0.056
SC52	STP	258	MX	8	4	3	1	16	10	0.062
Total		4927	MX	97	44	38	11	190	15	0.039

Young-of-the-year (YOY) steelhead occurred in only 4 of the 21 most downstream reaches surveyed on the upper Sisquoc River (SC27-SC47). Upstream of Heath Campsite (SC48-SC52) the stream gradient increased, large boulder step pools increased, riparian canopy cover increased, instream shelter increased, and YOY steelhead were observed in high numbers. This trend of more abundant YOY steelhead occurring in the upper reaches of the Sisquoc River and tributaries is likely the result of the higher quality habitat conditions that occur in the headwater reaches.

Low to medium densities of 1+ to 3+ steelhead occurred in most of the lower gradient reaches downstream of Heath Campsite although steelhead up to 15 inches long were observed in larger pools associated with bedrock. Upstream of Heath Campsite, the dominant habitat type changed to step pool and plunge pool habitat and the number of steelhead observed increased significantly with densities as high as 0.233 and a total of 153 of the 190 steelhead identified in all upper Sisquoc River reaches surveyed.



*15-inch Sisquoc River steelhead in SC33.*

Chub were observed in all reaches downstream of Heath Campsite, but none were observed upstream. No bullhead were observed in the upper Sisquoc River.

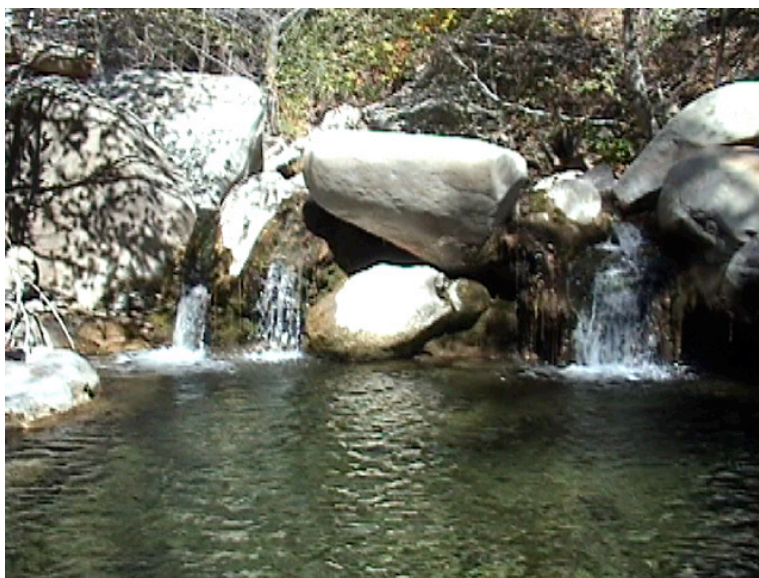
## Manzana Creek

### *Survey Notes*

En route to the lower Sisquoc River on October 22 and 26, surface flows were observed on Manzana Creek from upstream of Dry Creek downstream to approximately 0.5 miles upstream of the Sisquoc River where the creek went dry. While hiking to the upper Manzana Creek survey area on October 30<sup>th</sup>, surface flow was also observed from Davy Brown Creek upstream to Fish Creek with only short sections of dry streambed and isolated pools midway. Upstream of Fish Creek, Manzana Creek was observed to be dry for several hundred feet. The fish sampling survey of upper Manzana Creek began near the 2350-foot elevation where excellent pool habitat and flow was observed.

### *Habitat Description*

Beginning at reach MA1, large boulder step pools were the dominant habitat type. At 10:00 surface flows were estimated at 1.5 cfs and the water and air temperatures measured 53F and 66F respectively. Good to excellent spawning and rearing habitat occurred throughout the surveyed reaches with pools to 7 feet deep, riparian canopy cover averaging 70%, excellent instream cover provided by boulders, bedrock ledges, undercut banks, roots, and woody debris. Alder trees were observed throughout the reach indicating perennial flow. Large boulder and bedrock scour pools continued from MA5 upstream to a 12-foot tall bedrock waterfall barrier at the upstream survey limit. A small river-left tributary occurs at the downstream end of MA5 with a flow estimated at 0.3 cfs and water temperature measured at 51F. Water temperature upstream of the tributary measured 52F at 11:55. The large bedrock scour pool MA6 measured 23 feet long, 18 feet wide, 7 feet deep, and contained extensive undercut boulders and roots. MA8 is a large boulder scour pool. Water temperature in MA8 measured 54F at 13:40. An impassable 12-foot tall bedrock waterfall occurs at the upstream end of the MA10 bedrock scour pool that measured 37 feet long, 29 feet wide, and 4 feet deep.



*Boulder scour pool MA8.*

*Fish Survey Results*

Manzana Ck. Steelhead Sampling Results										
Reach ID	Habitat Type	Reach Length (ft.)	Observation Method	0+ (Less Than 3")	1+ (3-6")	2+ (6-9")	3+ (9" or greater)	Total # of Fish	Max. Fish Length (in.)	Fish Density
MA1	STP	679	MX	0	0	2	3	5	17	0.007
MA2	STP	2758	BO	0	10	9	11	30	18	0.011
MA3	STP	2258	BO	0	4	3	2	9	14	0.004
MA4	STP	1078	BO	13	4	1	0	18	8	0.017
MA5	STP	824	BO	27	9	6	1	43	10	0.052
MA6	LSBK	23	UW	2	2	1	2	7	19	0.304
MA7	STP	177	BO	8	7	4	0	19	7	0.107
MA8	LSBO	30	UW	6	3	3	1	13	10	0.433
MA9	STP	305	BO	36	17	12	5	70	11	0.230
MA10	LSBK	37	UW	5	5	4	3	17	10	0.459
Total		8169	MX	97	61	45	28	231	19	0.028

While hiking to upper Manzana Creek, steelhead to 12 inches in length were observed in low to moderate numbers adjacent to Nira Campsite and at the first upstream trail crossing. Most habitat and fish within reach MA1 could be observed from the bank. One pool within MA1 with deep undercuts was surveyed underwater where two steelhead estimated at 16 inches in length were observed and one was recorded underwater with video (See still photo below from the video). This pool measured 4 feet deep, 36 feet long, and 15 feet wide and occurred approximately 700 feet upstream from the survey start point at an elevation 2385 feet. Another steelhead measuring 14 inches was observed in reach MA1. Reach MA1 contained only larger steelhead between 8-17 inches. No 0+ or 1+ age classes were observed in reach MA1.





*16-inch steelhead in MA1.*

Large steelhead were observed in reach MA2, with three fish observed to measure 15,16, and 18 inches in length. No YOY steelhead were observed in reach MA2 although 1+ age class fish began to appear in low numbers. The first YOY steelhead were observed to occur in MA4. The largest steelhead observed in Manzana Creek was 19 inches long, silver in coloration, and appeared to be a sea-run adult. The pool that this large steelhead was in was snorkeled and attempts to capture the fish on video were unsuccessful as the fish spooked into a deep hole in an undercut bank that became murky with suspended sediment.

Chub were observed at instream crossings on lower Manzana Creek downstream of Dry Creek on October 22 and 26, 2005. Chub were also observed on October 30<sup>th</sup> adjacent to Nira Campsite and upstream into MA3. No chub were observed upstream of MA3.

## Davy Brown Creek

### *Survey Notes*

While driving from Nira Campsite upstream on October 30th, continuous surface flows were observed in Davy Brown Creek from the confluence of Manzana Creek upstream to Munch Creek. Surface flow was also observed on October 29<sup>th</sup> surveying throughout Davy Brown Creek from Munch Creek upstream to an impassable series of bedrock waterfalls at the upstream survey limit 4220 feet upstream of Munch Creek. Surface flows were also observed on Munch Creek from Davy Brown Creek upstream through the Davy Brown Campsite area.

### *Habitat Description*

Immediately upstream from the Munch Creek confluence, Davy Brown Creek was observed to have surface flow of approximately 0.8 cfs. Water temperature measured 51F at 13:00, with an air temperature of 65F. At the upstream end of the survey the water temperature measured 51F at 15:45. Good to excellent spawning and rearing habitat conditions occur along the entire 4220 feet surveyed on Davy Brown Creek. Thick riparian vegetation with an average of 80% canopy cover provides extensive shade, instream cover in the form of woody debris, and extensive undercut stream banks associated with roots and boulder. Clean substrate conditions with embeddedness values less than 25% and a moderate to high abundance of adequately sized spawning substrate provide excellent spawning conditions. An abundance of ants, caddisfly, and stonefly food sources were observed throughout Davy Brown Creek. The bedrock plunge pool DB2 (pictured below) occurs directly below a two part, 12-foot tall bedrock waterfall that presents a complete barrier to further upstream steelhead passage. This pool measured 7 feet deep and provides excellent rearing and over-summering habitat.



*Bedrock waterfall plunge pool DB2 and upstream steelhead barrier.*

At Davy Brown Campsite, Munch Creek was observed to have approximately 1.0 cfs and good to excellent steelhead habitat similar to Davy Brown Creek. On October 29<sup>th</sup> the water temperature of Munch Creek measured 51F at 13:00 with an air temperature of 65F.

*Fish Survey Results*

Davy Brown Ck. Steelhead Sampling Results										
Reach ID	Habitat Type	Reach Length (ft.)	Observation Method	0+ (Less Than 3")	1+ (3-6")	2+ (6-9")	3+ (9" or greater)	Total # of Fish	Max. Fish Length (in.)	Fish Density
DB1	STP	4200	BO	181	55	34	13	283	11	0.067
DB2	PLP	20	UW	0	2	3	0	5	9	0.250
Total		4220	MX	181	57	37	13	288	11	0.068

This tributary contains high numbers of YOY steelhead indicating the presence of successful natural reproducing. A good distribution of age classes indicates high quality rearing habitat. Sulphur springs were observed to discharge into Davy Brown Creek at the upstream end of DB1 at the bedrock waterfall barrier. The signs of sulphur in the creek extended downstream approximately 570 feet. The impact of sulphur in this upper reach of Davy Brown Creek appears to have significantly reduced the number of steelhead. Only six steelhead were observed in this 570-foot long reach with a low density of 0.008. In addition, only larger fish between 6-10 inches were observed, which might indicate that larger fish can survive the sulphur input better than YOY and 1+ age class steelhead. Overall, steelhead density was moderate to high ranging from 0.067 to 0.250 with a total density of 0.068. While Munch Creek was not formally surveyed due to time constraints, one 7-inch steelhead was observed in Munch Creek adjacent to Davy Brown Campsite and a reproducing population occurs in this creek (pers. obs. Stoecker 1994-2005).

Chub were observed in Davy Brown Creek from the Munch Creek confluence upstream for approximately 1500 feet and are known to occur downstream of Munch Creek to the Sisquoc River (pers. obs. Stoecker 2002).

## South Fork Sisquoc River

### *Survey Notes*

Three separate sections of the South Fork Sisquoc River comprising 9 stream reaches and 598 feet of stream were surveyed by Matt Stoecker and Doug Stoecker on October 17, 2005. The lowest reach surveyed (SF1) occurs immediately upstream of the trail crossing from the South Fork Station, approximately 250 feet upstream from the Sisquoc River. The middle section, with reaches SF2 through SF7, were surveyed continuously from 279 feet downstream of the trail crossing at Lonnie Davis Campsite upstream for 416 feet. The upper section (SF8-SF9) begins at the 3019-foot elevation approximately 0.5 miles upstream of the Lonnie Davis Campsite trail crossing and consists of two bedrock trench pools with a combined length of 92 feet.

### *Habitat Description*

The long mid-channel pool SF1 contained a moderate amount of large boulder instream cover and undercut banks. The pool measured 90 feet long, 22 feet wide, and 2 feet 6 inches at the deepest point. Riparian cover averaged 50%. At 12:00 the water and air temperature measured 54F and 59F, respectively.



*South Fork Sisquoc River at downstream end of SCI.*

Reaches SF2-SF7 are dominated by boulder step pool and plunge pool habitat. At 13:30, the water and air temperature measured 54F and 59F respectively. Pools to 5 feet deep were present in this reach of high instream cover, moderate riparian cover, abundant spawning gravels, and low substrate embeddedness.

Reaches SF8-SF9 occur in a narrow bedrock gorge that contains two large bedrock trench pools with depths to 9 feet. A steep bedrock chute that measured 7 feet tall and has a slope of approximately 35% separates the two pools and presents an impassable barrier to all fish during low to moderate flows and a partial barrier to fish

passage during high flows. Excellent rearing habitat occurs in both pools with extensive instream cover provided by undercut ledges, boulders, depth, and bubble curtains.



*Bedrock trench pool SF8.*

*Fish Survey Results*

S.F. Sisquoc R. Steelhead Sampling Results										
Reach ID	Habitat Type	Reach Length (ft.)	Observation Method	0+ (Less Than 3")	1+ (3-6")	2+ (6-9")	3+ (9" or greater)	Total # of Fish	Max. Fish Length (in.)	Fish Density
SF1	MCP	90	UW	0	0	2	1	3	10	0.033
SF2	PPL	39	UW	2	1	0	1	3	10	0.077
SF3	STP	240	SB	7	3	3	1	14	9	0.058
SF4	PPL	45	UW	14	4	3	0	21	8	0.466
SF5	STP	36	SB	0	0	0	0	0	0	0.000
SF6	PPL	24	UW	7	4	1	0	13	8	0.542
SF7	PPL	32	UW	9	6	2	0	17	7	0.531
SF8	TRP	65	UW	15	11	3	1	30	12	0.462
SF9	TRP	27	UW	11	7	3	0	18	9	0.666
Total		598		65	36	17	4	122	12	0.204

The South Fork Sisquoc River contained the highest overall steelhead density (0.204) of any sections surveyed within the Sisquoc River watershed, a density almost three times higher than the next highest section surveyed (Davy Brown Creek). This tributary also contained the survey reach with the highest recorded density of steelhead in the entire watershed at 0.666. With the exception of one fishless reach, densities ranged from 0.033 on the lowest reach (SC1) to 0.666 at the highest reach (SC9). Steelhead density generally increased further upstream. All age classes were represented in the tributary indicating successful reproduction and rearing. No Arroyo chub or other fish species were observed in this tributary.



*South Fork Sisquoc River steelhead in SF1.*

## Rattlesnake Creek

### *Survey Notes*

While surveying the Sisquoc River, the Rattlesnake Creek tributary was surveyed on October 20<sup>th</sup> 2005 upstream to the known waterfall migration barrier approximately 1000 feet upstream.

### *Habitat Description*

This small tributary contains shallow step run type habitat and a very low abundance of small pools, low instream cover, and a low abundance of spawning gravel. At 14:45 water and air temperatures were 55F and 74F respectively and surface flow was estimated at 0.75 cfs. The large bedrock plunge pool RE2 below Rattlesnake Falls contains depths to 7 feet and excellent instream cover for rearing, but a steep 7-foot tall boulder cascade downstream likely prevents fish migration to this pool.

### *Fish Survey Results*

Rattlesnake Ck. Steelhead Sampling Results										
Reach ID	Habitat Type	Reach Length (ft.)	Observation Method	0+ (Less Than 3")	1+ (3-6")	2+ (6-9")	3+ (9" or greater)	Total # of Fish	Max. Fish Length (in.)	Fish Density
RE1	SRN	1005	BO	1	2	3	0	6	7	0.006
RE2	PLP	38	UW	0	0	0	0	0	0	0.000
Total		1043	MX	1	2	3	0	6	7	0.006

Rattlesnake Creek contained the lowest steelhead density of any tributary surveyed. Only 6 steelhead were observed in the 1043 feet surveyed. In addition to the low density of fish observed (0.006), no 3+ age class fish were observed and the maximum fish length observed was 7 inches. Only one YOY steelhead was observed and it is likely that this tributary is not highly utilized for spawning and rearing due to its small size and shallow water depth, scarce spawning substrate, and low instream cover. No fish were observed in the large scour pool RE2 below Rattlesnake Falls. Chub were only observed in the lower 150 feet of Rattlesnake Creek.

## KEY STEELHEAD POPULATION FINDINGS

### Sisquoc River Watershed

Steelhead Sampling Results-Watershed Survey Totals								
Stream	Distance Surveyed (ft.)	0+ (Less Than 3")	1+ (3-6")	2+ (6-9")	3+ (9" or greater)	Total # Fish	Max. Fish Length (in.)	Fish Density
Lower Sisquoc R.	23048	0	0	2	2	4	20	0.0002
Upper Sisquoc R.	4927	97	44	38	11	190	15	0.039
Manzana Ck.	8169	97	61	45	28	231	19	0.028
Davy Brown Ck.	4220	181	57	37	13	288	11	0.068
S.F. Sisquoc R.	598	65	36	17	4	122	12	0.204
Rattlesnake Ck.	1043	1	2	3	0	6	7	0.006
Survey Total	42005	441	200	142	58	841	20	0.020

Six different sections of the Sisquoc River watershed were surveyed for a total of 42,005 feet of stream. All six sections surveyed contained steelhead for a total of 841 fish observed. The combined steelhead density of all surveyed sections in the watershed was 0.020. The average density for the South Fork Sisquoc River (0.200), Davy Brown Creek (0.068), upper Sisquoc River (0.039), and Manzana Creek (0.028) were all higher than the watershed average. The density for the lower Sisquoc River (0.0002) and Rattlesnake Creek (0.006) were both lower than the watershed average. The lower Sisquoc River contained the largest steelhead at 20 inches long, with Manzana Creek a close second with steelhead to 19 inches and the greatest number of steelhead over 15 inches. The upper Sisquoc River contained steelhead up to 15 inches and the South Fork Sisquoc River, Davy Brown Creek, and Rattlesnake Creek contained smaller fish up to 12, 11, and 7 inches respectively. The watershed's overall age class distribution was well respected with 441 YOY or 0+ age class (52%), 200 1+ age class (24%), 142 age class 2+ (17%), and 58 3+ age class (7%).

#### Lower Sisquoc River

Of the 23,048 feet of stream sampled on the lower Sisquoc River only 4 steelhead were documented giving the lowest density (0.0002) observed in the watershed. This is also the only section where no YOY or 1+ age class fish were observed. This section is also the location where the largest steelhead, at 20 inches long, was observed. The four steelhead observed in this section were in the 2+ and 3+ age classes. The suboptimal habitat in this section, the receding surface flows, the atypical age class distribution, and



larger fish size of these steelhead may indicate that these fish were trapped while trying to outmigrate as three smolts and one returning adult.

#### Upper Sisquoc River

The upper Sisquoc River contained the third highest density of steelhead (0.039), the third largest number of fish (190), and third largest maximum fish length at 15 inches. The upper Sisquoc River tied for the second highest number of YOY (97) and third highest YOY density (0.02). All age classes were represented in this tributary indicating a healthy reproducing population. This section is both an important spawning and rearing area.

#### Manzana Creek

Manzana Creek contained the second highest amount of steelhead observed (231) within 8169 feet of stream surveyed giving the fourth highest overall density (0.028). This section also contained the second longest steelhead observed at 19 inches and the greatest number of steelhead 15 inches or longer at 6 steelhead. This tributary contained the largest number of 3+ age class steelhead at 28. Manzana Creek tied for the second highest number of YOY (97) and fourth highest YOY density (0.02). All age classes were represented in this tributary indicating a healthy reproducing population. This section is both an important spawning and rearing area as well as a refuge for larger steelhead.



*Manzana Creek steelhead upstream of Manzana Campsite*

#### Davy Brown Creek

Davy Brown Creek contained the greatest number of YOY or 0+ age class steelhead (181) and the highest percentage of YOY (63%) indicating the tributaries high spawning productivity. This tributary also had the second highest overall steelhead density at 0.068. All age classes were represented in this tributary indicating a healthy reproducing population.

### *South Fork Sisquoc River*

The South Fork Sisquoc River contains an abundance of excellent spawning and rearing habitat and contained the highest overall density of steelhead (0.204) observed in the watershed. This density is almost three times higher than the next highest section surveyed (Davy Brown Creek at 0.068). This tributary contained the individual stream reach with the highest density in the watershed at (0.666). This tributary also contained the highest density of YOY in the watershed at 0.109, over twice the second highest score on Davy Brown Creek (0.043). All age classes were represented in this tributary indicating a healthy reproducing population. For a given length of stream, the South Fork Sisquoc River appears to best the most productive spawning and rearing area in the watershed.



*High juvenile steelhead density and excellent rearing habitat in the SF Sisquoc R.*

### *Rattlesnake Creek*

Rattlesnake Creek contains relatively shallow runs, small pools, and low instream shelter that likely accounted for the tributary having the lowest overall steelhead density (0.006) of any tributary. This tributary was the only surveyed section without a 3+ age class observation and the smallest maximum fish length at 7 inches. The age class distribution was also atypical, like the lower Sisquoc River, with higher numbers of older and larger fish than younger and smaller fish. Only one YOY steelhead was observed, the second lowest only to the lower Sisquoc River that had none.

### *Steelhead and Chub Relationship*

The highest occurrence of YOY steelhead and highest overall steelhead abundance was observed in tributary habitat such as the South Fork Sisquoc River, Davy Brown Creek, upper Manzana Creek, and upper headwater habitat of the Sisquoc River. Chub were observed to be abundant throughout the entire mainstem of the Sisquoc River to downstream of Heath Campsite and were present in the lower to middle reaches of Manzana, Davy Brown, and Rattlesnake Creeks. There appears to be a strong negative relationship between the presence and abundance of YOY steelhead and chub. This may

be explained by the comparatively large numbers and schooling habits of chub and the resulting high competition for similar food sources utilized by similarly sized YOY steelhead. In addition, chub are more tolerant of higher water temperatures and other characteristics of lower mainstem habitat, while juvenile steelhead prefer cooler headwater type habitat, especially in the summer and fall when these surveys were conducted. The superior jumping and swimming ability of trout also likely contributes to their presence further upstream than the chub. These and other potential factors appears to cause a distinct separation of chub and YOY steelhead populations.

## STEELHEAD RUN OBSERVATIONS BY FOREST SERVICE PERSONELL

While conducting surveys on Davy Brown Creek during October 30, Doug Colfax (Davy Brown Campsite Ranger for the Forest Service) reported valuable first hand observations of the 2005 steelhead run and other past fish observations. This Forest Service employee and longtime local fisherman has been living at the Davy Brown Campsite throughout the 2004/2005 winter and, with a keen interest in the fish population, he monitored Munch, Davy Brown, and Manzana Creeks regularly. Mr. Colfax reported that he observed “adult, sea-run steelhead this (2005) spring after the high flows that were not here before the winter”. He reported catching, measuring, and releasing “a square tail steelhead measuring 17.5 inches from Munch Creek at the Davy Brown Campsite in April 2005”. He also reported seeing other steelhead of similar size in Munch and Davy Brown Creeks in addition to one “large, silver, 22-inch steelhead in Manzana Creek just downstream from the Davy Brown Creek confluence”, this spring. He reported that he had not seen fish of this size for several years prior to the winter rains of 2004/2005 and that these big fish were only present for a couple of months before apparently “heading back downstream after spawning as flows subsided in the late spring”.

Mr. Colfax also reported catching adult steelhead between 18 and 24 inches in Manzana Creek and lower Fish Creek in the 1960's and 1970's following large winter flow events similar to those encountered this past year. He noted that in his observations the adult steelhead are not present following relatively dry winter years, but rather following “big winter rains like this last (2005) year”.

These observations are consistent with the authors survey observations of the watershed in the Fall of 2002 (Stoecker 2003) following a winter with no ocean connectivity and no steelhead observed greater than 14 inches in length in the entire Sisquoc River drainage. By comparison the surveys conducted for this project during the Fall of 2005 following a heavy rain year and ocean connectivity identified 9 steelhead adults between 15 and 20 inches in the Sisquoc River and Manzana Creek.

## TWITCHELL DAM AND MIGRATION FLOW DISCUSSION

### Twitchell Dam Background

Twitchell Dam and Reservoir are owned and operated by the U.S. Bureau of Reclamation and Santa Maria Valley Water Conservation District. Reservoir releases within the flood control pool are regulated by the Army Corp's Corps Water Control Plan for Twitchell. Santa Barbara County Public Works is also a stakeholder in the operations at Twitchell Dam. Under the Current Water Control Manual (WCM), approved in 1960, downstream water releases from Twitchell Dam into the Cuyama River are not required until the reservoir water surface elevation has risen from 474 to 623 feet. When the 623-foot elevation mark has been reached, the lesser of either 500 cfs or the reservoir inflow must be released downstream. See the US Army Corps of Engineers website <http://www.spl.usace.army.mil/resreg/htdocs/twitchell.html> for additional information about the physical characteristics and entire schedule of controlled and uncontrolled water releases for Twitchell Dam.

### Impacts on Steelhead

Twitchell Dam and the manipulated water releases associated with it constitute the most limiting migration barrier to the endangered steelhead of the Santa Maria River watershed. This dam physically blocks steelhead from accessing over half of the watershed upstream of the dam, where numerous trout bearing streams such as Huasna River, Kelly Canyon Creek, Deal Creek, Alamo Creek, Bear Trap Creek, and Reyes Creek occur (Donna Toth files, LPNF. Stoecker 2003). In addition, the manipulated downstream water releases have exacerbated the discontinuity of surface flows, and in turn limited steelhead migration, along the Santa Maria River between the Pacific Ocean and the Sisquoc River.

Prior to the construction of Twitchell Dam a report was commissioned to assess the possible impacts of several proposed dams on the Santa Ynez and Santa Maria Rivers. This report also provided recommendations to maintain the two largest steelhead populations in Santa Barbara County found in these two rivers. In 1945 Leo Shapovalov, a California Division of Fish and Game biologist, authored the *Report on Relation to Maintenance of Fish Resources of Proposed Dams and Diversions in Santa Barbara County, California*. In discussing the Santa Maria River steelhead population, Shapovalov notes that "by far the largest part of the spawning takes place above the proposed Round Corral Dam, which would be located below all tributaries of the Sisquoc River with the exception of Tepusquet, Foxen Canyon, and La Brea Creeks." The construction of Round Corral Dam was proposed on the Sisquoc River 10 miles upstream from the Cuyama River, but was never built. While discussing this proposed dam site on the lower Sisquoc River, Shapovolov continues to state that preventing steelhead from accessing the upper Sisquoc River would "virtually destroy the (Santa Maria watershed's steelhead) run, unless adequate provisions were made for the safe passage of adult steelhead both up and down and of young fish on their downstream migration." In addition to the physical barriers of the proposed dams, Shapovalov acknowledged "properly regulated flow from the reservoirs (including Twitchell Dam) would serve the double purpose of retardation of flow for percolation and providing flow for ascent of

spawning steelhead and downstream migration of both adults and young steelhead at periods of low water.”

Despite steelhead being listed as a federally endangered species nearly 10 years ago, current Twitchell Dam water releases are not regulated to provide critical flow for upstream and/or downstream steelhead migration. In fact, the current operations minimize releases during the steelhead migration season and slowly release flows during the summer to recharge the underground aquifer. These releases generally do not reach the ocean nor do they correspond to a time when the Sisquoc River has adequate steelhead migration flows. Downstream water releases from Twitchell Dam are managed to prevent or minimize surface flows from reaching the Pacific Ocean and to allow as much stream flow as possible to percolate into the underground aquifer. Because of the current water release operations, the window of opportunity for steelhead to migrate between the ocean and Sisquoc River, which contains essentially all of the accessible spawning and rearing habitat within the Santa Maria River watershed, is dramatically reduced and during some years is eliminated.

Analysis of flow data from the former USGS gage on the Santa Maria River at Guadalupe, shows that surface flows of approximately 1000 cfs or greater occurred 9 times between the installation of the gage in 1941 to 1958, prior to the construction of Twitchell Dam (USGS website). Using 1000 cfs as a conservative estimate for providing adequate ocean connectivity and steelhead migration flow on the mainstem, this equates to fish passage on the mainstem of the Santa Maria River approximately every other year before the dam was built. Following the completion of Twitchell Dam in June of 1958, until the end of the gage’s available data in 1987, surface flows greater than 1000 cfs only occurred once every 3.2 years. While this data is limited to 47 years of winter flow record and the actual flow requirements for steelhead migration on the mainstem have not been determined, this hypothetical analysis suggests that the dam operations may be significantly reducing the occurrence of years when steelhead have adequate flows to migrate up the Santa Maria River and into the Sisquoc River. Additional factors since the gage data ended in 1987 such as increased water use, excessive turbidity from dam sediment flushing, timing of water releases, impacts of increased groundwater pumping, gravel extraction operations, and natural conditions may be further reducing the availability of adequate steelhead migration flows on the Santa Maria River.

#### Recommended Action for Improving Steelhead Migration Flows

In a section at the end of his 1945 report, “Recommendations for Protection of the Fishery Resources for the Santa Ynez and Santa Maria River”, Shapovalov of the DFG makes several recommendations that should accompany any dam building on the Cuyama and Sisquoc Rivers, including the following:

“During the winter season sufficient water be released from both Vaquero (now Twitchell) and Round Corral reservoirs to permit steelhead to ascend from the ocean past Round Corral Dam (up the Sisquoc River).”

“...(R)eleases of water for ground percolation...maintain proper conditions in the streams (for steelhead).”

The existing operations at Twitchell Dam do not reflect either of these important and incredibly insightful recommendations from Shapovalov. As a result, the second largest steelhead run in Santa Barbara County, and one of the largest in the Southern California ESU, is now endangered as he projected 60 years ago.

The currently approved water control manual (WCM) for Twitchell Dam and Reservoir is dated August 1960. The WCM is scheduled for revision this year. In order to revive and preserve the Santa Maria/Sisquoc River steelhead population, a comprehensive long-term management plan is needed to ensure adequate stream flow for upstream and downstream steelhead migration along the migration corridor of the Santa Maria River to the Sisquoc River. The upcoming scheduled revision of the WCM offers an opportunity to provide for conjunctive use of the Twitchell Dam releases to benefit both groundwater recharge, flood control, and steelhead migration along the Santa Maria River migration corridor. The development of a revised WCM should be carried out in coordination with NMFS, CDFG, Santa Maria Valley Water Conservation District, USBR, Army Corp, Santa Barbara County, and other watershed stakeholders. A similar process is ongoing on the Santa Ynez River resulting in the *Lower Santa Ynez River Fish Management Plan* (2000). A well planned out and revised WCM for Twitchell Dam that addresses groundwater recharge for Santa Maria urban and agricultural use and is consistent with CDFG and NMFS steelhead recovery objectives is necessary for effectively recovering and preserving the endangered steelhead of the Santa Maria/Sisquoc River.

The findings of this study regarding the existing steelhead population and quality and quantity of habitat for steelhead within the Sisquoc River watershed emphasizes the importance of this tributary for the steelhead trout run on the Santa Maria River. In order to effectively revise the WCM to enable steelhead recovery a detailed, independent, analysis of historic and currently altered surface flows on the Santa Maria River and identification of adequate steelhead migration flows between the ocean and the Sisquoc River should be conducted. Investigations should also review the steelhead recovery benefits and costs in the scope of the entire watershed, the numbers of adult steelhead likely to be needed in order to re-establish the run, the carrying capacity of the Sisquoc River and tributaries for all life stages of steelhead, and what role water releases from Twitchell Dam and groundwater extraction near Santa Maria may play in the re-establishment of a sustainable and “recovered” run. The revised WCM should include provision of passage of adult steelhead from the ocean through the mainstem of the Santa Maria River and lower Sisquoc River to Sisquoc River headwaters and provision of passage of juvenile steelhead (smolts) from lower Sisquoc River to the ocean.

A study should also investigate the historic Santa Maria River channel alignment, configuration, and geomorphic and vegetative characteristics. The existing channel has been modified and armored for flood protection. Restoration or enhancement of a more natural Santa Maria River stream channel that still provides flood protection may assist with improved surface flows, fish migration, and riparian function.

## ADDITIONAL RECOMMENDED STUDIES

### Adult Steelhead Monitoring Program

An annual adult steelhead monitoring program should be established in order to monitor current restoration efforts and pre and post release modification impacts to the Sisquoc River steelhead population and assist with assessing steelhead recovery objectives.

### Exotic Fish Species Recommendation

At least one introduced fish species, the Black Bullhead (*Ameiurus melas*), was observed in the Sisquoc River and others may occur. Historic stocking records exist for the planting of bass and perch species within Santa Maria River tributaries, including the Sisquoc River and Manzana Creek (Donna Toth files, LPNF. Stoecker 2003). Bullhead were observed in low to moderate densities in the Sisquoc River from Wellman Creek upstream to Sycamore Campsite during December 2002 (Stoecker 2003). Surveys for this report identified bullhead from the downstream extent of surface flows between Manzana Creek and Water Canyon upstream to near Miller Creek. This species likely occurs downstream on private property when water permits. Red-eye bass (*Micropterus coosae*) were reportedly introduced in the 1950s or 60s, but Swift reported that they have not been observed for a long time in the Sisquoc River and they may not have survived (Stoecker 2003). Exotic species compete with, and prey upon, salmonids and a plan to reduce their numbers and prevent further planting of any fish, including hatchery rainbow trout, should be formulated. Reservoirs and stocking ponds throughout the Santa Maria River watershed may be harboring these species and allowing dispersion into the Sisquoc River.

### Fish Passage Improvements

Several structures that partially impede or prevent fish migration occur along the lower Sisquoc River and tributaries such as Davy Brown Creek, Munch Creek, and Tepusquet Creek (Stoecker 2003). Further investigations should be conducted to assess the feasibility of modifying or removing these barriers to improve fish passage within the watershed. Stoecker Ecological, Community Environmental Council, Los Padres National Forest, Department of Fish and Game, NOAA Fisheries, and American Rivers are currently collaborating on a project to remove Horse Creek Dam to provide fish passage on Horse Creek, a Sisquoc River tributary (Stoecker 2005, Love 2005).



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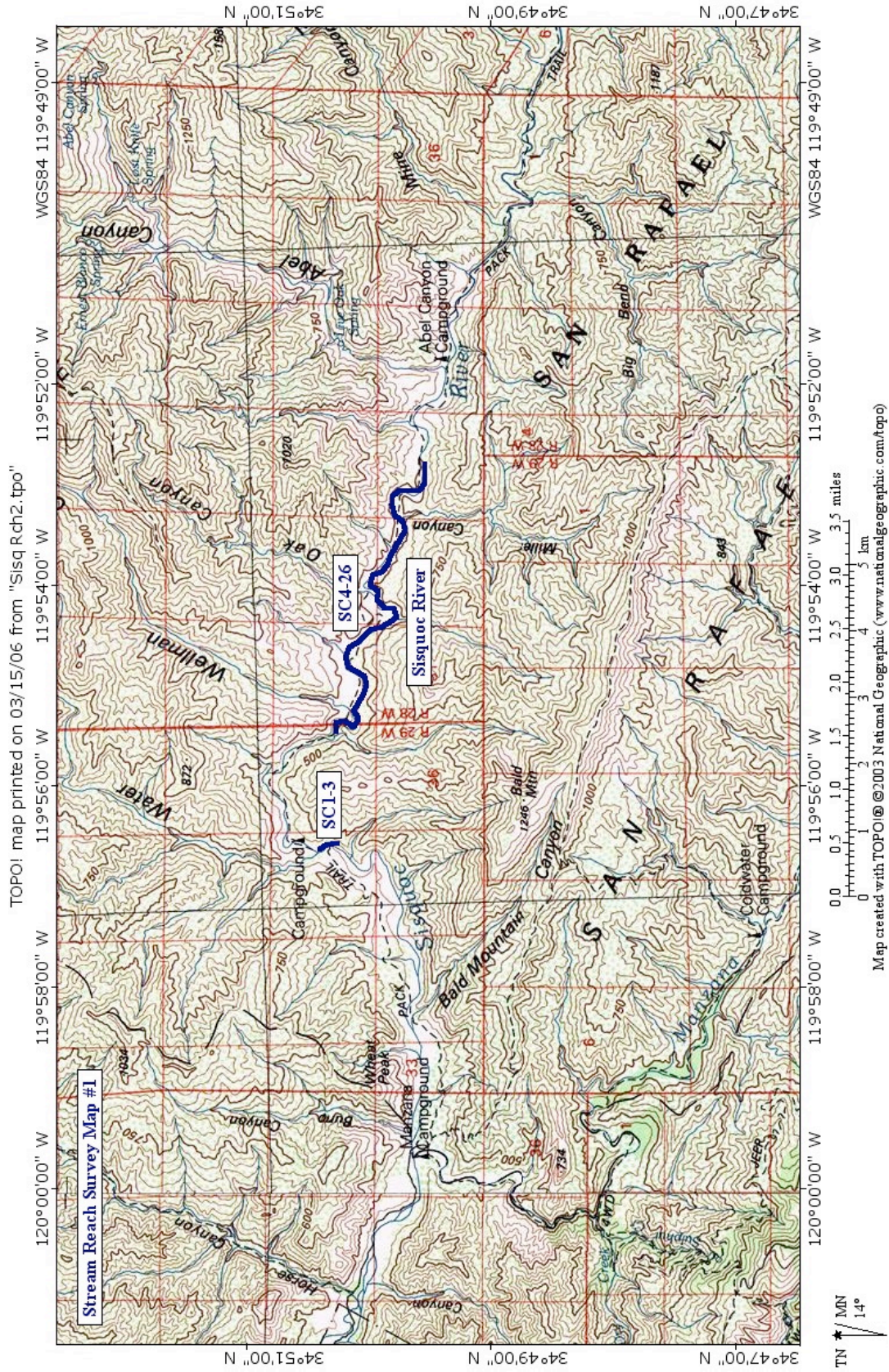
Personal Communications

Colfax, Doug. Davy Brown Campsite Host, USFS

Cooper, Kevin. Biologist, USFS

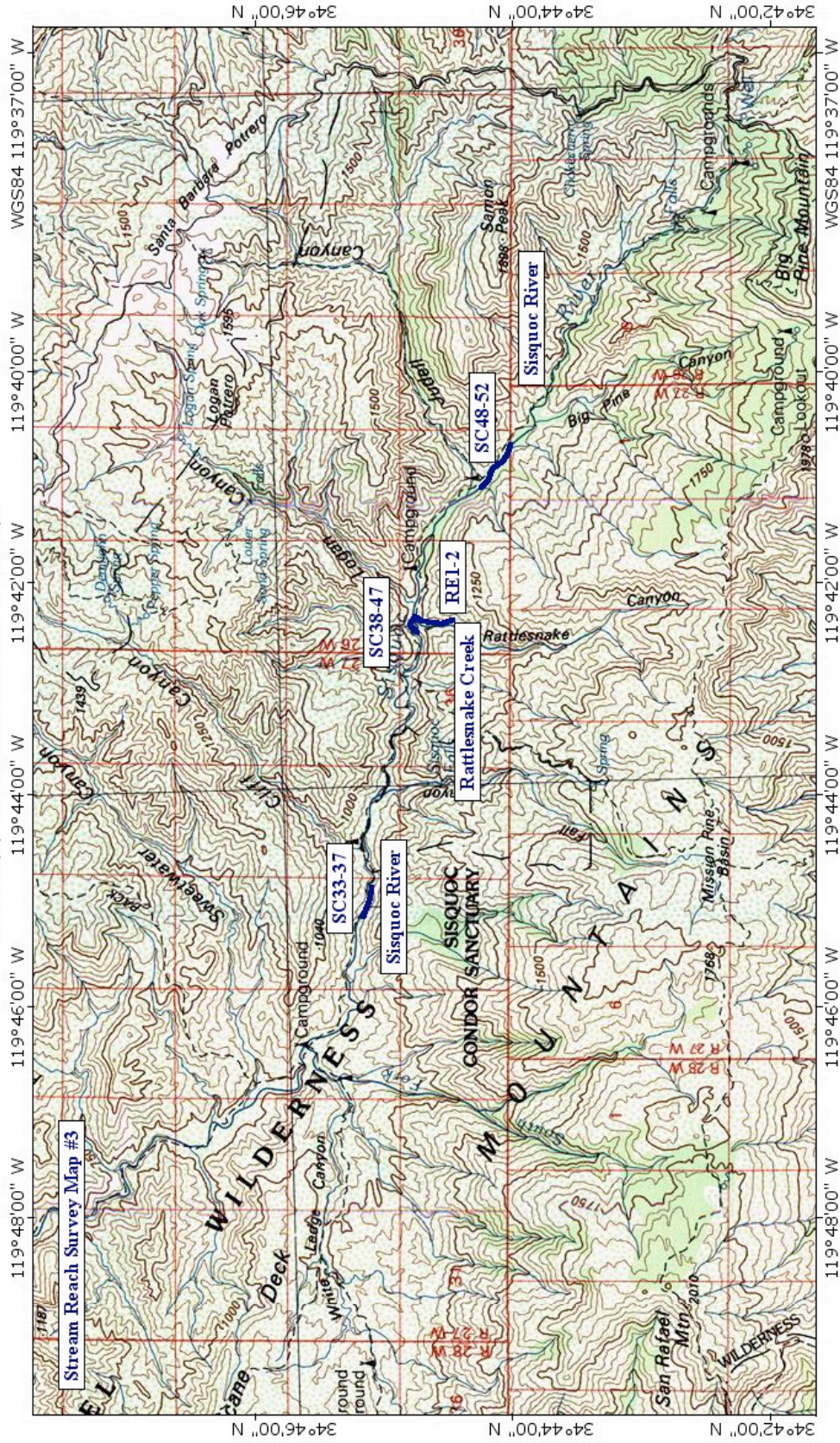


APPENDIX B





TOPOI map printed on 03/15/06 from "Untitled.tpo"



0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 miles  
0 1 2 3 4 5 km

Map created with TOPOI © 2003 National Geographic (www.nationalgeographic.com/topo)

APPENDIX C

Survey Reach GPS Coordinates		
Reach ID	Latitude (N)	Longitude (W)
SC1	34-50-22.6	119-56-37.6
SC4	34-50-18.0	119-55-29.7
SC5	34-50-18.2	119-55-22.5
SC7	34-50-14.3	119-55-23.4
SC9	34-50-7.2	119-54-57.2
SC11	34-50-10.5	119-54-45.7
SC13	34-50-6.7	119-54-34.2
SC15	34-50-1.9	119-54-2.5
SC17	34-49-53.7	119-53-52.2
SC19	34-49-48.6	119-53-37.8
SC21	34-49-49.1	119-53-7.0
SC24	34-49-44.2	119-53-5.6
SC26	34-49-35.1	119-52-50.4
SC27	34-45-39.9	119-46-31.0
SC29	34-45-38.6	119-46-23.5
SC30	34-45-37.6	119-46-21.9
SC32	34-45-36.7	119-46-20.1
SC34	34-45-10.8	119-45-5.2
SC37	34-45-7.7	119-45-0.7
SC38	34-44-45.9	119-42-27.9
SC48	34-44-14.1	119-41-2.9
SC49	34-44-10.1	119-41-0.4
SC51	34-44-3.6	119-40-47.8
MA1	34-44-31	119-53-19.2
MA2	34-44-25.8	119-53-16.6
MA3	34-44-9.7	119-52-57.6
MA4	34-44-3.4	119-52-41.1
MA5	34-44-8.1	119-52-29.8
MA6	34-44-10.7	119-52-21.6
MA8	34-44-10.6	119-52-18.3
MA10	34-44-14.0	119-52-13.7
DB1	34-45-34.4	119-57-18.4
DB2	34-45-16.1	119-57-53.8
SF1	34-45-36.3	119-46-23.5
SF2	34-45-22.7	119-46-41.0
SF4	34-45-19.6	119-46-41.0
SF8	34-45-1.0	119-46-43.3
RE1	34-44-48.1	119-42-20.4

APPENDIX D

**CALIFORNIA SALMONID STREAM  
HABITAT RESTORATION MANUAL**

**LEVEL III and LEVEL IV HABITAT TYPES**

**RIFFLE**

Low Gradient Riffle	(LGR)	[1.1]	{ 1 }
High Gradient Riffle	(HGR)	[1.2]	{ 2 }

**CASCADE**

Cascade	(CAS)	[2.1]	{ 3 }
Bedrock Sheet	(BRS)	[2.2]	{24}

**FLATWATER**

Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}

**MAIN CHANNEL POOL**

Trench Pool	(TRP)	[4.1]	{ 8 }
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}

**SCOUR POOL**

Corner Pool	(CRP)	[5.1]	{22}
L. Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
L. Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
L. Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
L. Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9 }

**BACKWATER POOLS**

Secondary Channel Pool	(SCP)	[6.1]	{ 4 }
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5 }
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6 }
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7 }
Dammed Pool	(DPL)	[6.5]	{13}

**ADDITIONAL UNIT DESIGNATIONS**

Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to a marsh	(MAR)	[9.1]	