Amphibian and Aquatic Reptile Monitoring Report

Sacramento Municipal Utility District

Hydro License Implementation • June 2017

Upper American River Project

FERC Project No. 2101

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Acronyms and Abbreviations

Acronym	Definition
°C	Degrees Celsius
CD	Camino Dam
CFS	Cubic Feet Per Second
FERC	Federal Energy Regulatory Commission
ft	feet
FYLF	Foothill yellow-legged frog
GIS	Geographic Information Systems
GPS	Global Positioning System
in	inch
JD	Junction Dam
m	meter
mi	mile
mm	millimeter
PG&E	Pacific Gas and Electric Company
RC	Rock Creek
RPD	Robbs Peak Dam
SCD	Slab Creek Dam
SF	South Fork
SMUD	Sacramento Municipal Utility District
SWRCB	State Water Resources Control Board
UARP	Upper American River Project
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
VES	Visual Encounter Survey
WPT	Western pond turtle
WQC	Water Quality Certification

1.0 INTRODUCTION AND BACKGROUND

This Amphibian and Aquatic Reptile Monitoring Report (Report) addresses monitoring requirements set forth in Sacramento Municipal Utility District's (SMUD) Amphibian and Aquatic Reptile Monitoring Plan (Plan) (SMUD 2016). Requirements for the Plan are found in State Water Resources Control Board (SWRCB) Conditions 8.C, 8.D, 9.A, 9.B, and 9.C, and U.S. Forest Service (USFS) 4(e) Conditions 31 and 32, located in Appendices A and B, respectively, of the Federal Energy Regulatory Commission's (FERC) Order Issuing New License for the Upper American River Project (UARP; FERC Project No. 2101), dated July 23, 2014. The Plan was developed in consultation with the SWRCB, USFS, California Department of Fish and Wildlife, and U.S. Fish and Wildlife Service (USFWS). FERC approved the Plan on May 19, 2016. This Report presents results of implementing the Plan in 2016.

SMUD owns and operates the UARP which is licensed by FERC. The UARP lies within El Dorado and Sacramento counties, primarily within lands of the Eldorado National Forest. The UARP consists of three major storage reservoirs: Loon Lake, Union Valley, and Ice House (with a combined capacity of approximately 379,000 acre-feet), eight smaller regulating or diversion reservoirs, and eight powerhouses. The UARP also includes recreation facilities containing over 700 campsites, five boat ramps, hiking paths, and bicycle trails at the reservoirs.

Surveys focused on Sierra Nevada yellow-legged frog (*Rana sierrae*) will be described under a separate monitoring plan, as required under the License.

2.0 MONITORING PLAN OBJECTIVES

The main objectives of the Plan are to monitor for and document the presence and distribution of sensitive amphibians and aquatic reptiles, focused primarily on foothill yellow-legged frog (*Rana boylii*) (FYLF) and western pond turtle (*Actinemys marmorata*) (WPT), over the term of the License (SMUD 2016). This includes identify FYLF breeding and larval periods in the Project-affected reaches by periodically surveying reaches of known and potential FYLF presence during spring and summer. The Plan also includes stream water temperature monitoring at specified sites with known breeding or suitable breeding habitat for FYLF.

During the first survey year, monitoring goals included determining the timing and success of the following life stages of known existing populations: egg laying, tadpole rearing, metamorphosis, and size/condition of metamorphs (newly metamorphosed individuals, also referred to as "young-of-year"). Documenting the size and condition of young-of-year, if found, in fall is an attempt to estimate the probability of overwintering success.

Determining presence and distribution of sensitive amphibian species and identifying breeding and larval periods are important in evaluating potential impacts resulting from streamflow modifications. In particular, along with temperature monitoring and other

aquatic species monitoring, FYLF monitoring may also help inform whether short-term fluctuations resulting from spill events below Slab Creek Reservoir Dam and/or Camino Reservoir Dam result in unacceptable environmental impacts. Identification of FYLF breeding and larval periods may also be used to monitor effects of spring recreational boating flows and future potential October recreational boating flows in the South Fork (SF) American River below Slab Creek Reservoir.

FYLF monitoring is being conducted to help determine if populations of this species in Project-affected streams are increasing or decreasing for any life stage as a result of Project streamflow changes or fluctuations. Monitoring each five-year period provides an opportunity to detect changes in amphibian populations, following sufficient response time to streamflow modifications. Trends in population size and/or changes in distribution over time will be monitored with consideration of Project-related changes in water temperature and habitat availability. Monitoring before (when feasible) and after spill events and during flow fluctuations will provide information on whether egg masses and/or larvae are being displaced or stranded.

Water temperature monitoring in known or suitable breeding sites is to provide information about the relationship between water temperature and the initiation of FYLF breeding.

3.0 MONITORING SITES AND FREQUENCY

3.1 MONITORING SITES

In accordance with the Plan (SMUD 2016), there are six monitoring sites within five Project reaches[1], listed in Table 1 and illustrated in Figure 1. These sites include locations with either documented FYLF presence (CD-A3 and CD-A4) or potential habitat, as described in the Plan.

[1] "Project reach" is a term to describe a segment of stream downstream of a dam (e.g., "Camino DamReach" is Silver Creek downstream of Camino Dam)

Table 1. Amphibian and Aquatic Reptile Monitoring Sites

Project Reach	Site Code	Site Description	UTM Coordinates[a]				Site Length[b,c]	Elev.[b,d]	FYLF[g] Observed in 2003/ 2004?	WPT[g] Observed in 2003/ 2004?	Water Temp. Monitoring ?
			Downstream End		Upstream End						
			N	E	N	E					
Junction Dam Reach	JD-A15	Silver Creek below Junction Reservoir Dam	4302306	713564	4302466[e]	713444[e]	653 ft/ 0.12 mi	3,045 ft	No	No	No
Camino Dam Reach	CD-A3	Silver Creek below Camino Reservoir Dam (near Camino Adit)	4298484	710087	4298651	710236	735 ft/ 0.14 mi	2,336 ft	Yes	No	Yes
	CD-A4	Silver Creek below Camino Reservoir Dam (at confluence with SF American River)	4296233	709331	4296310	709424	404 ft/ 0.08 mi	2,067 ft	Yes	No	Yes
Slab Creek Dam Reach	SCD-A1	SF American River below Slab Creek Reservoir Dam	4292873	692573	4295022	692931	10,404 ft/ 2.0 mi	1,007 ft	No	Yes	Yes
Rock Creek Reach	RC-A1	Rock Creek	4294981	692886	4296217	693204	4,954 ft/ 1.0 mi	1,102 ft	No	No	No
Robbs Peak Dam Reach[f]	RPD-A1	SF Rubicon River below Gerle Creek[f]	4315114	722291	4314923	725341	11,883 ft/ 2.25 mi[f]	4,505 ft	No	No	No

[a] Projection: NAD83 UTM Zone 10 North, N = Northing, E = Easting
[b] Site lengths and elevations are calculated in geographic information systems (GIS) (projection: NAD83 UTM Zone 10 North)
[c] Site lengths are reported in feet (ft) and miles (mi)
[d] Elevations are for downstream survey locations
[e] Visual Encounter Survey (VES) 1 upstream survey point N 713495, E 4302415
[f] Only 2.25 mi of the 4.8-mi Robbs Peak Dam reach (originally described in the Plan) was surveyed (see Figure 1) due to unsafe access conditions in the rest of the reach
[g] FYLF = Foothill yellow-legged frog; WPT = Western pond turtle

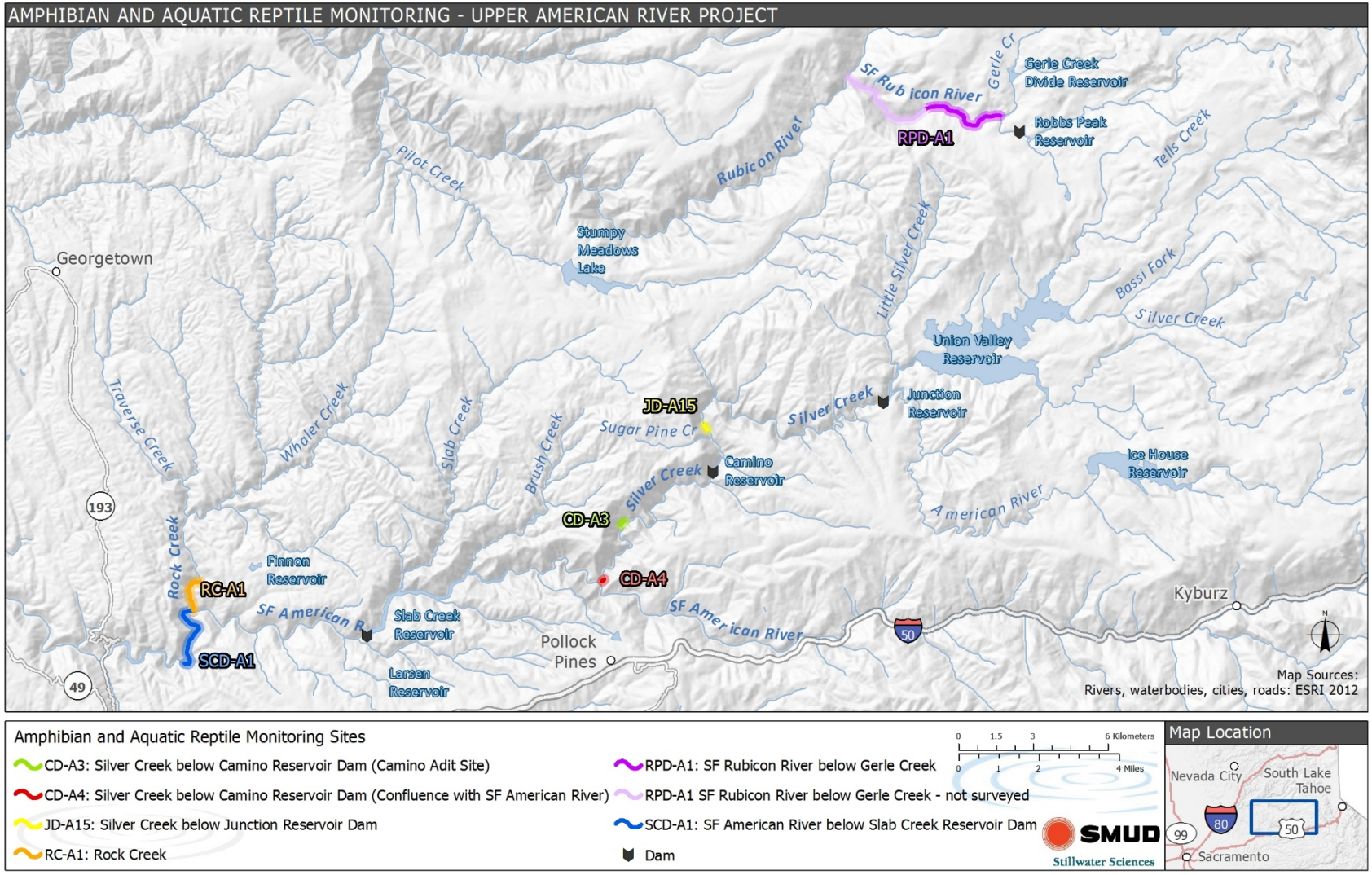

Figure 1. Amphibian and Aquatic Reptile Monitoring Sites and Study Area Overview

FYLF were documented along the Camino Dam Reach at CD-A3 and CD-A4 during relicensing studies in 2003 and 2004 (SMUD and PG&E 2005). Relicensing studies did not document species presence at JD-A15 and SCD-A1, though they contain FYLF habitat and are therefore included in the Plan. A one-time investigative survey was conducted along the Robbs Peak Dam Reach (RPD-A1) as required by the Plan. Rock Creek is being included in the Plan as a new monitoring site to provide information on whether FYLFs are using this major tributary of the reach below Slab Creek Dam.

3.2 MONITORING FREQUENCY

The Plan specifies that surveys will be conducted at each site over the term of the License during specific years (SMUD 2016). Table 2 outlines the monitoring schedule for each site over the term of the license. Surveys can also be triggered by flow fluctuations and spill events (see Section 4.1.3).

Table 2. Monitoring Schedule for Each Amphibian/Aquatic Reptile Monitoring Site Over Term of License

Site Description	License Years 1 through 25																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Silver Creek below Junction Reservoir Dam		X	X		X					X					X					X					X
Silver Creek below Camino Reservoir Dam		X	X	X	X	X				X	X				X	X				X	X				X
SF American River below Slab Creek Reservoir Dam		X	X	X	X	X	X			X	X				X	X				X	X				X
Rock Creek		X	X	X																					
SF Rubicon River below Gerle Creek[1]		X																							
Site Description	**License Years 26 through 50**																								
	26	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**
Silver Creek below Junction Reservoir Dam					X					X					X					X					X
Silver Creek below Camino Reservoir Dam	X				X	X				X	X				X	X				X	X				X
SF American River below Slab Creek Reservoir Dam	X				X	X				X	X				X	X				X	X				X
Rock Creek																									
SF Rubicon River below Gerle Creek[1]																									

X = Amphibian and aquatic reptile monitoring years

[1] Requirements for subsequent monitoring will depend on results of first year of monitoring

4.0 METHODS

Visual Encounter Surveys (VESs) were performed in all safely accessible[2] and permissible areas within each site, following protocols outlined in the Draft Visual Encounter Survey Protocol for *Rana boylii* in Lotic Environments (Yarnell et al. 2014), as well as protocols similar to those outlined in Heyer et al. (1994), Lind (1997), and Pacific Gas and Electric Company (PG&E) (2002a, 2002b). In addition to FYLF, all other amphibian and reptile species observed during the surveys were recorded, as well as any observed potential predators (e.g., fish, crayfish, and bullfrogs). The specific survey methodology for each species is addressed below, as are methods for adaptive management monitoring.

4.1 FOOTHILL YELLOW-LEGGED FROG

4.1.1 Visual Encounter Surveys

At least four focused VESs were conducted at each site, as follows:

- at least two egg mass surveys during the breeding period (between mid-April and late June),
- one tadpole survey during the tadpole development period (August), and
- one survey for newly metamorphosed (young-of-year) FYLF in the fall (September).

Survey dates for each site are listed in Table 3. The Camino Dam reach amphibian survey sites were used as sentinel sites to help determine the onset of the breeding season, since they were the two sites with previously documented breeding. Therefore, additional egg mass surveys at these sites (three at CD-A3 and two at CD-A4) were conducted to help pinpoint the beginning of egg-laying (oviposition) and to avoid missing the egg-laying window as a result of yearly variation in flows and water temperature (Table 3).

[2] The lower section of the SF Rubicon River, from the confluence with the Rubicon River to 2.5 mi upstream, was not surveyed because of unsafe access due to steep canyon banks that were unstable from recent forest fires, and a high-gradient river section dominated by cascades.

Table 3. Amphibian and Aquatic Reptile Monitoring Survey Dates

Site Code	Site Description	Survey Date (2016)						
		Sentinel Sites			All Sites			
		VES i[a]	VES ii[a, b]	VES iii[a]	VES 1	VES 2	VES 3[c]	VES 4
JD-A15	Silver Creek below Junction Reservoir Dam	--	--	--	6/14	6/27	8/8	9/22
CD-A3	Silver Creek below Camino Reservoir Dam (near Camino Adit)	4/19	5/26	6/8	6/17	6/28	8/10	9/20
CD-A4	Silver Creek below Camino Reservoir Dam (near confluence with SF American River)	4/20	5/25	--	6/7	6/28	8/10	9/20
SCD-A1	SF American River below Slab Creek Reservoir Dam	--	--	--	6/16	6/29	8/9	9/21
RC-A1	Rock Creek	--	--	--	6/15	6/30	8/11	9/19
RPD-A1	SF Rubicon River below Gerle Creek	--	--	--	8/2–8/3	--	--	--

[a] These surveys were conducted at CD-A3 and CD-A4 to help determine the onset of breeding.
[b] This adaptive management survey was conducted at CD-A3 and CD-A4 after a Camino Dam spill event.
[c] Focused western pond turtle surveys were conducted during VES 3.

The dates for the beginning of egg mass surveys for 2016 at the sentinel sites were based on the directive in the Plan that surveys begin once either: (1) there is a mean daily temperature of 10°C for a three-day running average at any of the FYLF monitoring sites, as correlated to temperatures at nearby existing telemetered gaging stations, or (2) after April 15th, whichever comes last. Since there was a three-day average mean daily temperature of 10°C prior to April 15th, surveys began after April 15th.

Two to three surveyors initiated each VES at the downstream end of the site and surveyed upstream, except for Site SCD-A1, where all four surveys were performed upstream to downstream (due to the larger river channel and flow and increased difficulty surveying against the current). When wading in near-shore habitat, surveyors used a carefully gauged zig-zag pattern to search the shallows in one pass. Data from the surveys was recorded on a field form adapted from Yarnell et al. 2014 (Attachment 1). Water and air temperatures were recorded at the beginning of every VES. Start and

end times were recorded, as well as the actual time spent exclusively searching for FYLF.

During egg mass surveys, each team included one snorkeler to survey deeper areas where safe and feasible[3] (e.g., in water 1.6–9 ft deep in and adjacent to suitable breeding habitat). Surveyors carefully used their hands to feel in areas where they could not see, including under bedrock, under boulder ledges, and in deep pockets beneath large cobble in low-velocity areas.

Surveys for post-metamorphic individuals focused on the surface of the ground, on rocks, or at the water's edge. Data collected for each post-metamorphic individual captured included sex[4] and snout-to-vent length. An individual was classified as adult if it possessed secondary sexual characteristics (such as enlarged nuptial pads in males) or was equal to or greater than 2 inch (in) (37 millimeter [mm]) snout-to-vent length (Storer 1925, Zweifel 1955). An individual would be classified as a young-of-year based on size (which can measure from 0.8 to 1 in [22 to 27 mm] snout-to-vent length, but typically from 0.8 to 0.9 in [22 to 24 mm] [Nussbaum et al. 1983, Zeiner et al. 1988, PG&E 2002a]) and possible evidence of tail absorption; in addition, young-of-year are present in fall only.

Habitat data collected as part of the post-metamorphic frog surveys includes perch substrate, dominant riparian type, and geomorphic unit. Chin photographs were taken to use for comparison with future FYLF captures, allowing potential identification of individual frogs and potential tracking of movement by individual frogs. Chin patterns are hypothesized to be unique to each frog and persist throughout the life of the frog (Marlow et al., in prep).

4.1.2 Water Temperature Monitoring

The approved Plan requires temperature monitoring as an indicator of FYLF breeding initiation at the two sites below Camino Reservoir Dam (historical breeding sites CD-A3 and CD-A4) and below Slab Creek Reservoir Dam (suitable breeding Site SCD-A1) during years 2 through 6 of the new License. Six Onset Hobo© Pro v2 water temperature loggers were deployed at each site to ensure an adequate sample size and for redundancy in the case of equipment failure (Figures 2–4).

[3] It was not feasible to snorkel a large proportion of the survey area during egg mass survey VES 1 and VES 2 at SCD-A1 and RC-A1 due to relatively strong currents and long survey distances

[4] For size classes of juvenile and younger, when determination of sex is not feasible, sex was recorded as "unknown"

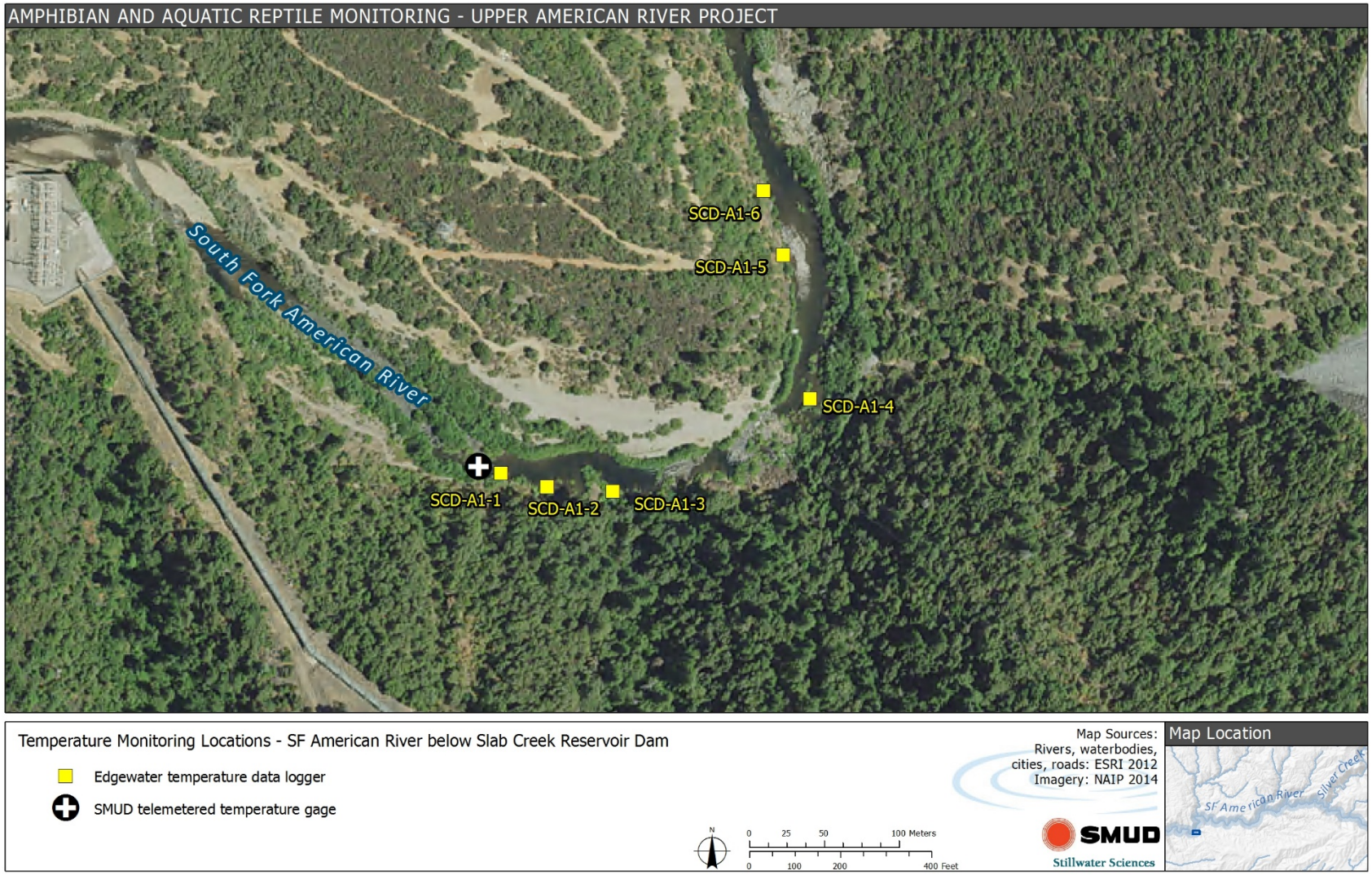

Figure 2. Temperature Logger Locations at Amphibian and Aquatic Reptile Monitoring Site SCD-A1, 2016

Figure 3. Temperature Logger Locations at Amphibian and Aquatic Reptile Monitoring Site CD-A3, 2016

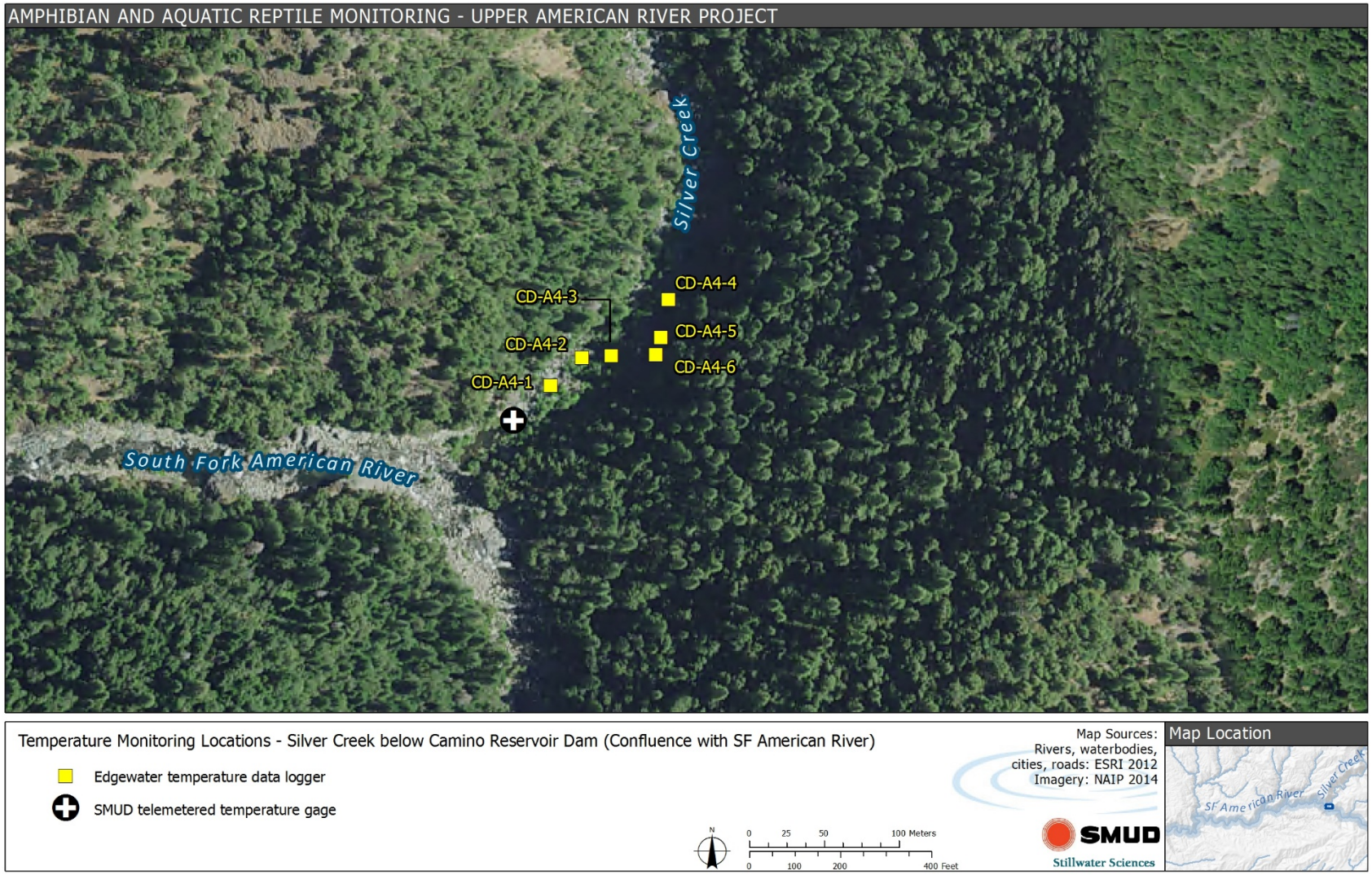

Figure 4. Temperature Logger Locations at Amphibian and Aquatic Reptile Monitoring Site CD-A4, 2016

The areas targeted for temperature logger installation generally included relatively shallow and slow-moving edgewater locations, though monitoring sites were of varying velocities, depths, and substrates to represent areas with a variety of potential breeding habitats. All six temperature loggers were deployed during April at Sites CD-A3 and CD-A4; at Site SCD-A1, three data loggers were deployed in April and three were deployed in June. The temperature loggers were deployed when flows were still relatively high; therefore, loggers were positioned in areas that were expected to remain submerged during anticipated lower summer flows. All temperature loggers were deployed in water less than 3 ft deep (an estimated average of 2 ft deep) and within 9 ft of the shoreline. Temperature loggers were retrieved during the September VESs. At the time of retrieval, temperature loggers were situated between 0.2 and 2.3 ft deep, and usually within 3 ft of the shoreline.

The temperature loggers were housed within metal cylinders (Figure 5), and anchored to alder trees using 1/8th-in stainless steel cable; cable loops were secured with aluminum crimping sleeves. Loggers were secured inside the housing using two (redundant) brightly colored nylon zip ties with the excess zip tie material left in place to help relocate the logger in the event of burial of the housing. Loggers were periodically checked on during VESs and cleaned of any debris or gravel around the cylinders.

Figure 5. Temperature Data Logger Set-up at Amphibian Monitoring Site CD-A4 (April 19, 2016)

Temperature monitoring in stream margin habitats was conducted concurrently with stream thalweg water temperature monitoring performed under SMUD's Water Temperature Monitoring Plan (SMUD 2015). Adapted statistical analysis will be performed to establish data relationships between edgewater temperatures and thalweg temperatures at the end of the 5-year monitoring period. The thalweg temperatures will

be eventually be used to initiate egg-mass VESs based on reach-specific temperature thresholds identified from results of this initial five-year investigation.

4.1.3 Adaptive Management Monitoring

As part of an adaptive management effort, the approved Plan outline requirements for SMUD to monitor amphibians and aquatic reptiles following spill events at Camino and Slab Creek reservoirs, and during flow fluctuations from Camino Dam. Monitoring for effects to FYLF include looking for evidence of damage, displacement, or scouring of egg mass or larvae, as well as evidence of egg mass or larval stranding/desiccation.

4.1.3.1 Following Spill Events at Camino and Slab Creek Reservoirs

For spill events at Camino Dam, VES Sites CD-A3 and CD-A4 are to be monitored for effects on FYLF as soon as possible after the decline of spill flows that occur after water temperatures rise above a daily mean of 12°C for a seven-day running average at Water Temperature Monitoring Site 8.I.14 (located on Silver Creek immediately upstream of the SF American River) (Figure 4).

For spill events at Slab Creek Dam, VES Site SCD-A1 is to be monitored for effects on FYLF as soon as possible after the decline of spill flows that occur after water temperatures rise above a daily mean of 12°C for a seven-day running average at Water Temperature Monitoring Site 8.I.18 (located approximately ½ -mile upstream of White Rock Powerhouse) (Figure 2).

4.1.3.2 During Flow Fluctuations from Camino Reservoir Dam

As required under the approved Plan, VESs for FYLF are to be conducted in Silver Creek below Camino Reservoir Dam at any time during June through September when the following criteria are triggered:

- the streamflows are 100 cubic feet per second (cfs) or less; and
- the flows fluctuate more than 40 cfs over one week's time.

4.2 WESTERN POND TURTLE

4.2.1 Visual Encounter Surveys

WPT surveys were conducted concurrently with the mid-summer FYLF survey (see Section 4.1.1), where one additional dedicated surveyor independently looked for WPT (for the survey on the SF American River, this increased to two surveyors due to the larger river channel).

The surveyor(s) typically walked in an upstream direction[5], first scanning ahead and searching from a distance to identify potential basking locations, such as sunlit rocks, logs, exposed banks, floating vegetation, and for WPT at the surface of the water. The surveyor(s) also searched for skeletal remains and evidence of WPT nests, such as the scrapes produced by females when digging nest-holes, signs of nests opened by predators, and remnants of hatched eggshells. Surveyors also searched for WPT while snorkeling in deep pools and backwaters. Key attributes of a WPT site (e.g., vegetation, habitat type, and the presence and nature of basking sites) were characterized and recorded, along with global positioning system (GPS) coordinates (where possible) and corresponding photographs. Captured WPTs were measured, categorized by sex (if determinable), and photographed in dorsal (carapace) and ventral (plastron) view.

4.2.2 Habitat Mapping

Surveyors identified and mapped suitable WPT habitat within each survey reach. Habitat suitability was based on qualitative characteristics such as relative stream depth and velocity, presence of suitable basking areas, and presence of canopy/vegetation.

Habitat mapping units were delineated on aerial photos by outlining polygons along distinctive habitat types (e.g., run/glide, pools, riffles, cascades) in GIS. To qualify as suitable (i.e., either moderate or high suitability), stream habitat needed to include slow-moving water (e.g., pools or runs/glides). If no slow-moving water was present in the unit (e.g., the unit was exclusively riffle or cascades), then habitat suitability was ranked as low, even if suitable basking habitat was present.

The following habitat attributes were evaluated in the field for each map unit, and the following general scoring guidelines were applied:

- The frequency or size of relatively deep (generally >1.6 ft deep) connected or isolated side pools was qualitatively described as:
    - None (0)
    - Few or moderately sized (1)
    - Many or large-sized (2)
- The relative number or size of basking sites with ample sun exposure (typically bedrock, boulders, or large woody debris without a dense riparian canopy) was qualitatively described as:
    - None (0)
    - Few or moderately sized (1)
    - Many or large-sized (2)

[5] Except for site SCD-A1, where all four surveys were performed upstream to downstream, due to the larger river channel and flow and increased difficulty surveying against the current.

Each score for these two habitat attributes was summed for a total habitat quality score, and then the WPT habitat suitability for each map unit was ranked as follows based on the sum:

- 0–1 = Low
- 2 = Moderate
- 3–4 = High

Habitat quality ranking could increase or decrease a category if other WPT habitat elements were either abundant or absent in the field, such as aquatic refugia (e.g., boulders or, submerged woody debris), streamside refugia, or upland nesting habitat.

Surveyors took representative WPT habitat photographs for each reach.

5.0 RESULTS

5.1 FOOTHILL YELLOW-LEGGED FROG

5.1.1 Visual Encounter Surveys

Table 4 provides water and air temperatures recorded during VESs at each site, along with start and end times. Representative habitat photos are included in Attachment 2.

Table 4. Foothill Yellow-legged Frog and Western Pond Turtle Survey Conditions, 2016

Site Code	Survey Date (2016)	VES #	Start time (hours)	End Time (hours)	Temperature Range	
					Water Temp. (°C)	Air Temp. (°C)
JD-A15	6/14	1	1342	1440	13–13.5	21
	6/27	2	1220	1354	15.5–16	31.5
	8/8	3	1350	1429	16–17	27–30
	9/22	4	935	1010	10	11–13
CD-A3	4/19	i	1055	1135	9	21.5–24.5
	5/26	ii	1015	1100	9.5	21
	6/8	iii	1256	1446	13–14	26.2–31
	6/17	1	1011	1112	9.5–10	21–23.5
	6/28	2	1500	1630	15.5–16	33–33.5
	8/10	3	1300	1400	17	29-30
	9/20	4	1440	1600	17.5	29

Site Code	Survey Date (2016)	VES #	Start time (hours)	End Time (hours)	Temperature Range	
					Water Temp. (°C)	Air Temp. (°C)
CD-A4	4/20	i	1040	1130	11–11.5	21–23
	5/25	ii	1200	1305	10–10.5	18–19
	6/7	iii	1300	1555	15.5-16.5	29
	6/28	2	930	1100	15	22–22.5
	8/10	3	950	1034	17	18–20
	9/20	4	945	1107	16	18–21.5
SCD-A1	6/16	1	930	1452	12	16–21
	6/29	2	1000	1610	15.5–19.5	21–31.5
	8/9	3	1000	1705	15–19	23–28
	9/21	4	1020	1611	14–15.5	19–21.5
RC-A1	6/15	1	945	1437	14–15	15–16.5
	6/30	2	925	1435	18–20	21.5–26.5
	8/11	3	940	1325	17–19	22–28
	9/19	4	1125	1430	15.5–16	26.5–30.5
RPD-A1	8/2	1[a]	1145	1245	16	29
	8/2		1430	1635	18–19	28–29.5
	8/3		945	1302	15.5–17.5	19–30

° C = degrees Celsius
[a] VES 1 was conducted in three segments over two days (8/2/2016 and 8/3/2016)

5.1.1.1 Foothill Yellow-legged Frog Observations

Postmetamorphic FYLF were found in five general locations within the Project area (Table 5, Figure 6); only one of these locations, CD-A3 (Silver Creek below Camino Reservoir Dam near Camino Adit), was within a formal VES site. The remaining locations were in wet off-channel or tributary areas informally surveyed for FYLF en route to the main channel site. No egg masses or tadpoles were found during 2016.

Table 5. Foothill Yellow-legged Frog Observation Locations in the UARP, 2016

Site Description	UTM Coordinates[a]		Date (2016)	Foothill Yellow-legged Frog Observations
	Northing	Easting		
Site CD-A3 along Silver Creek	4298643	710234	6/8	One adult female at the upstream end of Site CD-A3 during egg mass surveys
Camino Adit	4298881	710142	8/10	Two postmetamorphs in standing water behind adit gate
			9/20	Three postmetamorphs in standing water in front of adit gate
Seep next to access road to Camino Adit	4298286	709810	6/8	Three postmetamorphs in seep
			6/17	Three postmetamorphs in seep
			6/28	Three postmetamorphs in seep
Tributary to Silver Creek, upstream of access road near Camino Adit.	4298898	710082	6/8	One adult female in small tributary
Tributary to Silver Creek, downstream of access road and adjacent to foot trail to Silver Creek	4298732	710262	6/8	One juvenile in small tributary
			6/28	Two postmetamorphs in small tributary
			8/10	One adult in small tributary

[a] Projection: NAD83 UTM Zone 10 North

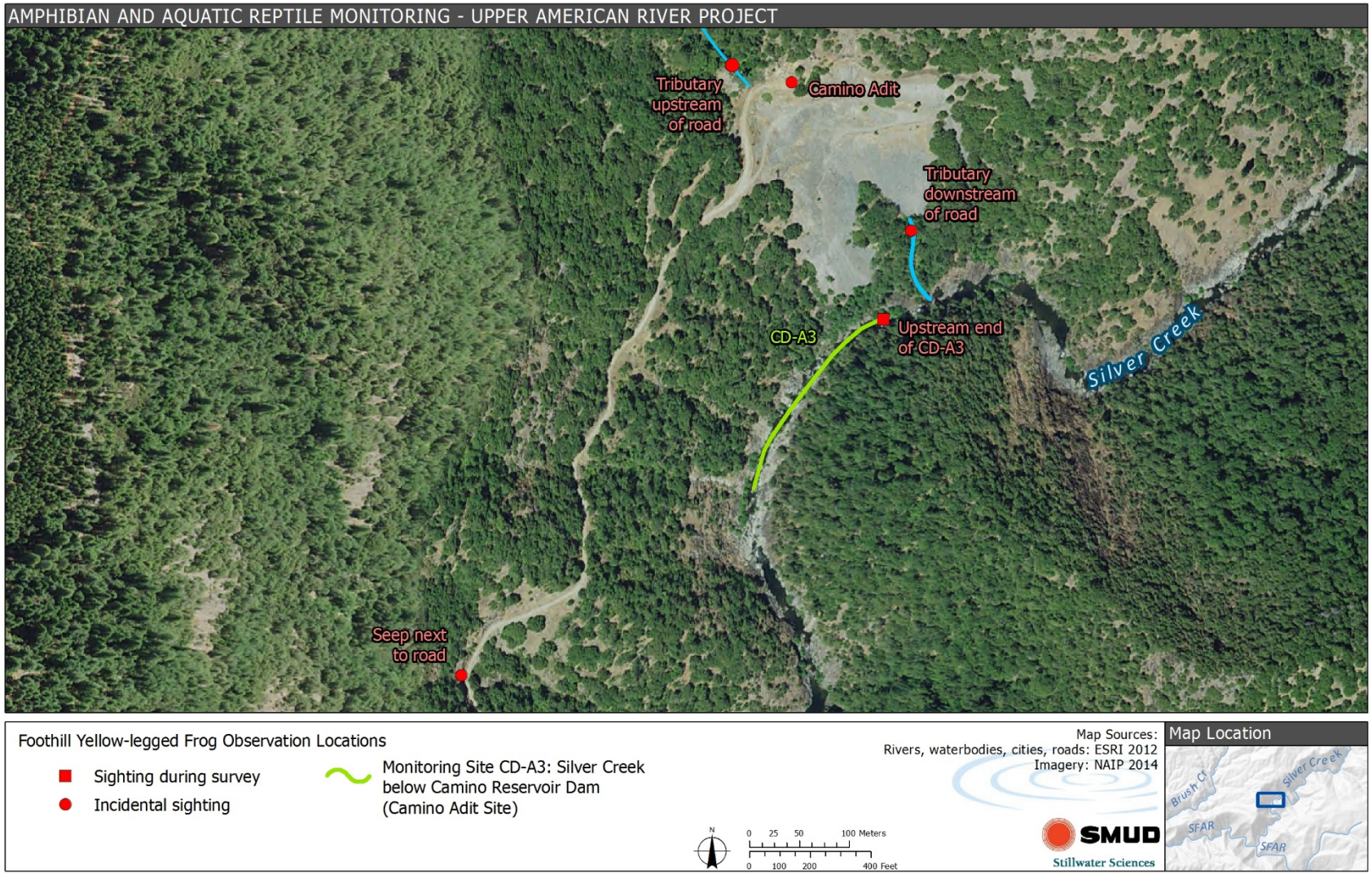

Figure 6. Foothill Yellow-legged Frog Observation Locations, 2016

Only one foothill yellow-legged frog was documented within the study sites during formal VESs; an adult female was detected at the upstream end of CD-A3 on June 8 (Table 5, Figures 6–7). The female was observed in a connected side pool using slackwater/edgewater habitat. Dominant riparian vegetation was alder. This female may have recently laid eggs, since it was a large female (snout-vent length 65 mm [2.6 in]) that was clearly not gravid, and had relatively loose skin around the mid-section. In an attempt to locate the associated egg mass, additional searches were conducted upstream of the monitoring site; no egg mass was found.

Figure 7. Adult Female Foothill Yellow-legged Frog (Left) Found in Connected Side Pool Habitat (Right) at Site CD-A3 on June 8, 2016

Post-metamorphs were also found in four general areas close to Site CD-A3 that were informally searched for FYLF, including: (1) Camino Adit[6] (Figure 8); (2) a wet roadside ditch associated with a seep along a bedrock cliff face, located on the west side of the access road to and approximately 0.5 miles before Camino Adit; (3) a small tributary upstream of the unpaved access road, west of Camino Adit; (4) and in a small tributary to Silver Creek, downstream of the unpaved access road and parallel to the small trail used to access Silver Creek (Table 5, Figure 6). These sites were visited several times throughout the monitoring season, since FYLFs were first observed using these habitats in early summer (during the June 8 surveys). Additionally, a large pool upstream of Site CD-A3, at the confluence of the tributary inhabited by FYLF with Silver Creek, was informally snorkeled during the June 28 and August 10 VESs. No FYLF were found in this pool.

[6] FYLF adults, juveniles, and tadpoles were also detected in the Camino adit during relicensing surveys in 2003 and 2004.

Figure 8. Foothill Yellow-legged Frog Detected Near the Camino Adit on September 20, 2016

5.1.1.2 Habitat Conditions

A few notable site conditions may indicate changes in habitat within small portions of two reaches, CD-A3 and JD-A15, since the relicensing studies were conducted during 2003–2004. At Site CD-A3, there was evidence of a rockslide near the top of and along the west slope of Site CD-A3, which resulted in sediment, gravel, and jagged cobble-sized debris deposits into a small section of the amphibian monitoring site (Figure 10). At Site JD-A15, silt and small burned woody debris was noted in the stream margins and within the low-gradient sections of the streambed (Figure 10). At both sites, the source of debris flow is almost certainly the 2014 King Fire.

Figure 9. Photo of Rock Slide Evidence at CD-A3 (at Left), August 10, 2016

Figure 10. Photo of Silt and Burn Debris at JD-A15, June 14, 2016

Rock Creek Site RC-A1 extends from the confluence with the SF American River to approximately 1 mi upstream, and was surveyed for the first time in 2016. The site

averaged 26-ft wetted width. Lower Rock Creek, from the confluence with the SF American River to approximate 2,000 ft upstream, is high gradient, with substrate dominated by large boulders and bedrock; this section is characterized by cascade/step pools and high-gradient riffles. The riparian canopy, dominated by alders, was restricted to the banks; low-growing vegetation (e.g., forbs and sedges) within the wetted channel was sparse. Above 2,000 ft, there is a considerable transition in habitat. The upper reach is lower gradient, the substrate is dominated by small to medium boulders and cobbles, and the reach is characterized by low and high gradient riffles and shallow pools. Riparian forest cover and low-growing vegetation (e.g., *Darmera peltata* [Indian rhubarb] and sedges) within the wetted channel and along channel margins provided substantial amounts of shade. Low-gradient areas that could provide shallow areas with low-velocity flows and boulder and cobble substrate suitable for FYLF breeding were found in Rock Creek. However, steep banks and dense riparian forest cover in upper Rock Creek resulted in large amounts of shade; therefore, many of these areas are not optimal due for FYLF due to limited basking opportunities. Fish were observed at this site; crayfish were present as well.

Site RPD-A1 extends approximately 2.25 mi down the SF Rubicon River from the Gerle Creek confluence, and was surveyed for the first time in 2016. This section of the SF Rubicon River is high gradient, with substrate dominated by bedrock and large boulders; the site is characterized by large cascades, pools, and high-gradient riffles. The predominantly granite banks offered little riparian canopy or low-growing vegetation (e.g., forbs and sedges). Moving upstream, the habitat gradually transitions, alternating between high gradient riffles dominated by bedrock and large boulders with little vegetation, and low gradient riffles and pools with moderate riparian and low-growing vegetation. Overall, low-gradient areas that could provide shallow areas with low-velocity flows and boulder and cobble substrate appropriate for FYLF frog breeding were limited. Fish were observed in the reach.

5.1.2 Water Temperature Monitoring

Table 6 provides edgewater temperature data recorded at water monitoring locations, summarized by month. The mean monthly edgewater temperatures for all three sites ranged from 12.9°C to 18.7°C, during the primary foothill yellow-legged frog breeding and rearing months of June through August, with maximum daily averages of 14.3°C to 19.9°C (Table 6). Mean monthly temperatures for Silver Creek were roughly 1°C to 2°C warmer at CD-A4 (near the confluence with SF American River) than at CD-A3 (near Camino Adit Site).

Figures 11–13 provide plots of mean daily edgewater temperatures for all three sites, alongside the associated thalweg Water Temperature Monitoring Site data. Note that the Silver Creek thalweg data is from CD-A4, which is why the thalweg and edgewater temperature trends are congruous with one another at that location. Thalweg temperartures are noticeably warmer than edgewater temps at CD-A3, which is approximately 2.3 miles upstream of CD-A4 and closer to Camino Dam.

Table 6. Edgewater Temperature Data Summarized by Month, 2016

Temperature Monitoring Site	Month	Mean Monthly Temperature (°C)	Maximum Daily Average Temperature (°C)
Silver Creek Near Camino Adit (CD-A3)	May	10.1	12.6
	June	12.9	14.3
	July	15.2	16.5
	August	16.7	17.8
Silver Creek at Confluence with SF American River (CD-A4)	May	11.2	14.0
	June	14.5	16.1
	July	17.2	18.6
	August	18.7	19.9
SF American River Upstream of White Rock Powerhouse (SCD-A1)	May	12.1	14.2
	June	16.1	18.4
	July	18.1	19.7
	August	18.0	19.7

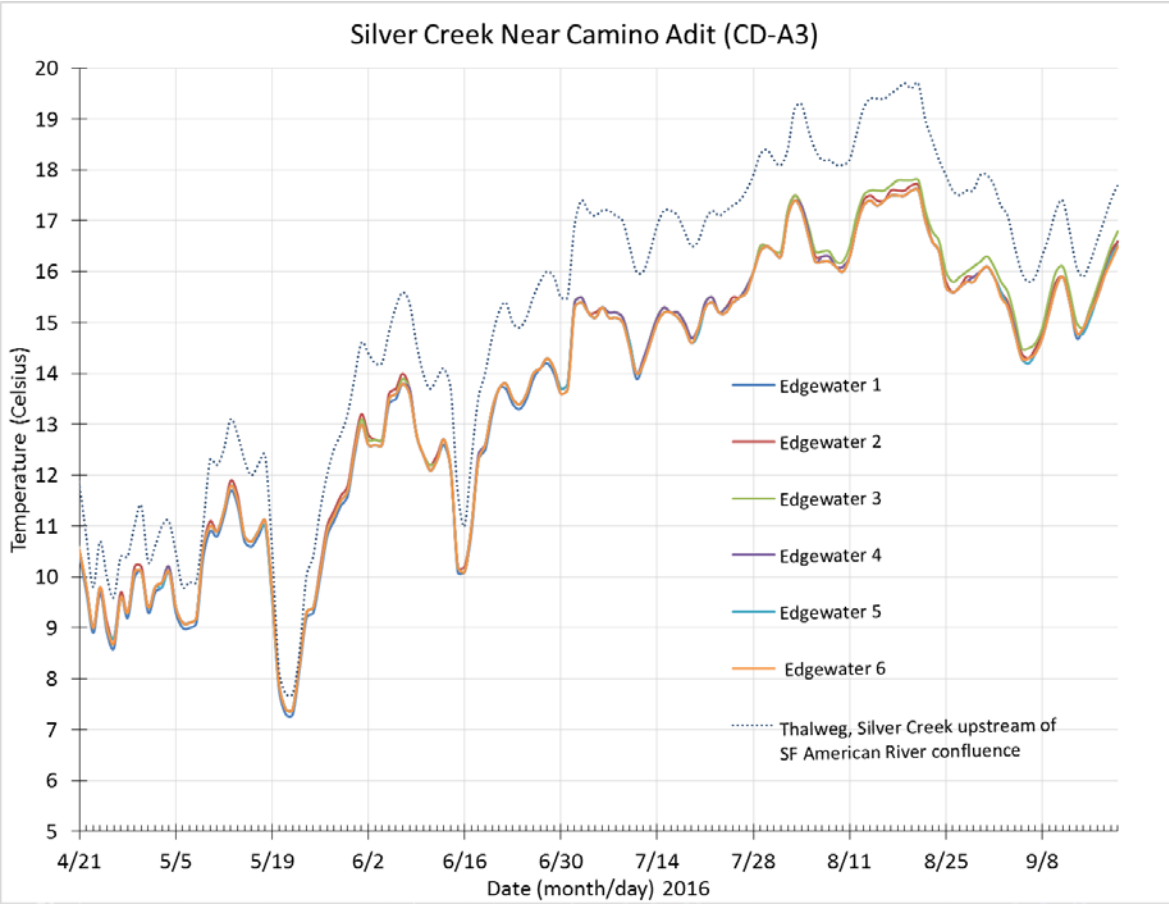

Figure 11. Mean Daily Edgewater Temperature Data for Silver Creek Near Camino Adit (CD-A3)

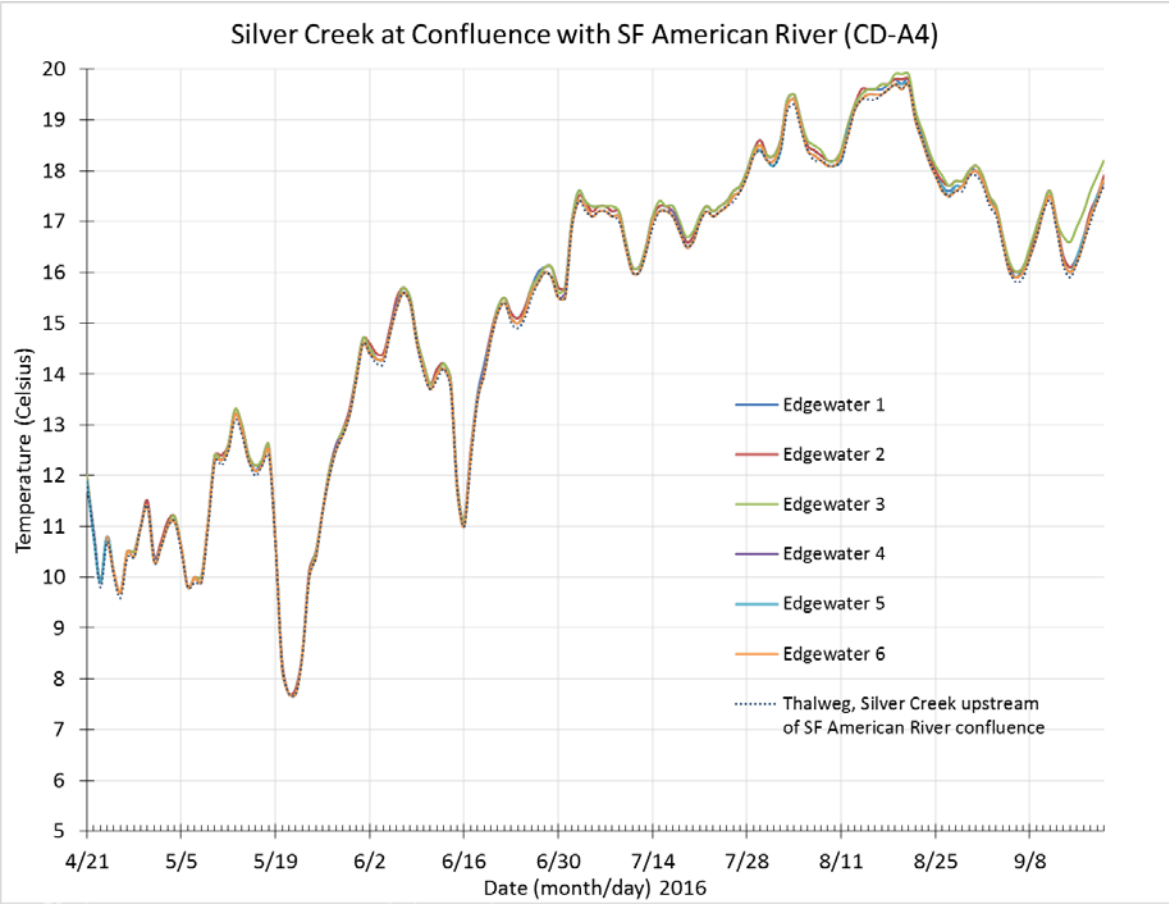

Figure 12. Mean Daily Edgewater Temperature Data for Silver Creek Upstream of SF American River Confluence (CD-A4)

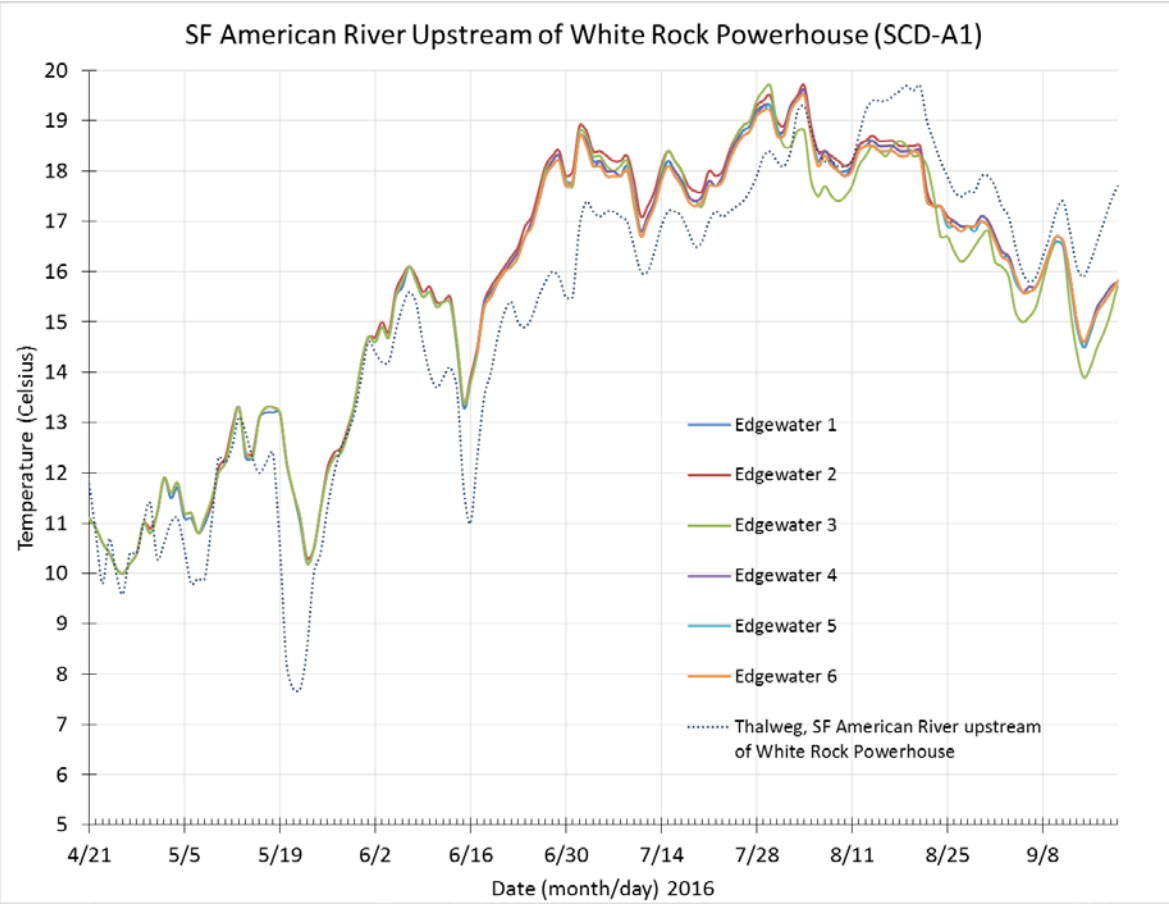

Figure 13. Mean Daily Edgewater Temperature Data for SF American River Upstream of White Rock Powerhouse (SCD-A1)

5.1.3 Adaptive Management Monitoring

5.1.1.3 Following Spill Events at Camino and Slab Creek Reservoirs

There was one spill event at Camino Dam that occurred May 19–23, 2016 after water temperatures rose above a daily mean of 12°C for a seven-day running average at the Water Temperature Monitoring Site located on Silver Creek immediately upstream of the SF American River (SC8). Monitoring was required at the two sites at Silver Creek below Camino Dam (CD-A3 and CD-A4) for effects on FYLF. CD-A4 was surveyed on May 25 and CD-A3 was surveyed on May 26, as soon as possible after the decline of spill flows. No FYLFs or egg masses were found, so there was no evidence of damaged, displaced, or scoured egg masses.

There were no spill events at Slab Creek Dam during 2016 that required monitoring.

5.1.2.3 During Flow Fluctuations from Camino Reservoir Dam

Flow fluctuation criteria in Silver Creek below Camino Reservoir Dam to trigger FYLF monitoring were not met in 2016, and therefore no associated adaptive management surveys were conducted.

5.2 WESTERN POND TURTLE

5.2.1 Visual Encounter Surveys

Conditions for WPT surveys (with one or more dedicated WPT surveyors) can be found under those listed for VES 3 in Table 4. Weather conditions were good to ideal during all WPT surveys, with warm temperatures, sunny/clear or partly cloudy skies, and no wind to a light breeze.

One WPT was detected during 2016 VESs (UTM coordinates 692480E, 4294895N, NAD83, Zone 10S). One adult male WPT was observed basking on exposed bedrock near a disconnected backwater pool on June 16 at Site SDC-A1 (Figures 14 and 15). The basking habitat is a very large area of exposed bedrock at an acute bend along the SF American River below Slab Creek Dam, where the river changes from flowing west to flowing south. Sparse riparian vegetation was present, dominated by *Cephalanthus occidentalis* (California button willow). The aquatic habitat was a standing pool of water, approximately 40 ft from the mainstem. The water in the pool was 20°C, relatively warm compared with the SF American River mainstem at 12°C.

Figure 14. Adult Male Western Pond Turtle Photographed in Dorsal (Carapace) and Ventral (Plastron) View

Figure 15. Western Pond Turtle Habitat at Site SCD-A1 on the SF American River, June 16, 2016

5.2.2 Habitat Mapping

Attachment 3 provides maps of the WPT habitat mapping results for Sites JD-A15, CD-A3, CD-A4, SCD-A1, and RC-A1. Attachment 2 includes representative habitat photos.

WPT habitat suitability at Site RC-A1 was low due to dominance of relatively fast-moving water and few deep pools. There were a few small pools with basking opportunities between cascade and high-gradient riffles, but these areas were generally surrounded by steep banks, fast-moving water, and were heavily shaded. Suitability of upland nesting habitat was also low because of relatively steep and densely forested stream margins and uplands.

WPT habitat was low to moderate at Sites JD-A15, CD-A3, and CD-A4. The downstream half of Site JD-A15 had moderate habitat suitability with slow-moving water, ample sun exposure, a few boulder and log basking sites, and a few moderately deep areas. The upstream half was low habitat suitability due to fast-moving water within a high-gradient riffle, though there were available basking sites. Site CD-A3 included three areas of moderate habitat suitability with relatively deep pools, few basking sites, and moderate sun exposure. A majority of the site was low habitat suitability because of shallow depth, riffles with high high-velocity water flows, and shade from the overhead riparian canopy. Site CD-A4 included some moderately suitable habitat with a few small-sized pools, some boulder basking sites, gradually sloped granite banks, and ample exposure to sunlight. Areas at this site with low habitat suitability included areas with fast moving and shallow water. Upland nesting opportunities were generally limited at these three sites because of relatively steep and densely forested stream margins and uplands.

SCD-A1 was the only site with high habitat suitability for WPTs (Figure 16). Throughout the survey reach there were large sections of deep pools with slow-moving water, many boulder basking sites within the pools, gradual granite banks, and submerged aquatic refugia (aquatic vegetation). There were many backwater areas that were slow moving with dense aquatic vegetation. Moderate habitat suitability was usually lacking basking sites or had moderate flow. In general, low habitat suitability areas were due to due to fast-moving water in high-gradient riffles and steep granite banks providing little streamside refugia. As noted above, this high habitat suitability site was the one location where WPT were documented. Upland nesting suitability at SCD-A1 was generally moderate along the upper third of the site, with occasional openings in the forested uplands with shorter grasses/forbes and south- or west-facing slopes.

Figure 16. High-suitability Western Pond Turtle Habitat at Site SCD-A1 on the SF American River

5.3 OTHER AMPHIBIAN AND AQUATIC REPTILE SPECIES

Nine non-special-status amphibian and reptile species were observed throughout the study area during VESs, listed in Table 7 by species, life stage, and location(s) where the species was/were documented. Sierra newts, Sierran treefrog, and Sierra garter snakes were the most abundant and widely distributed herpetofauna species observed in the study area.

Table 7. Additional Herpetofauna Species Observed, by Life Stage, 2016

Species Common Name *(Scientific name)*	Life Stage				Location(s) Where Species Documented
	Egg Mass	Larvae	Young-of-Year	Juv/ Adult	
Amphibians					
American bullfrog (*Lithobates catesbeianus*)		X		X	SCD-A1
Sierra newt (*Taricha sierrae*)	X			X	CD-A3, JD-A15 (egg masses only), RPD-A1 (adults only)
Sierran treefrog (*Pseudacris sierra*)		X		X	CD-A3 (larvae only), SCD-A1
Western toad (*Anaxyrus boreas*)		X	X		SCD-A1
Reptiles					
Northern alligator lizard (*Elgaria coerulea*)				X	RC-A1
Northwestern fence lizard (*Sceloperus occidentalis*)				X	RC-A1
Sierra garter snake (*Thamnophis couchii*)				X	CD-A3, CD-A4, RC-A1, SCD-A1
Unknown garter snake (*Thamnophis* sp.)				X	RPD-A1
Valley garter snake (*Thamnophis sirtalis fitchi*)				X	CD-A3[a]
Western rattlesnake (*Crotalus oreganus*)				X	CD-A4[b], JD-A15[b], SCD-A1[b]

Juv = Juvenile
X = Observed during 2016 surveys
[a] An individual Valley garter snake was observed incidentally near Camino adit, outside of the VES
[b] Individual western rattlesnakes were observed incidentally on access trails, outside of the VES

6.0 INCIDENTAL SIGHTINGS

Twenty freshwater mussels were incidentally sighted on June 14, 2016 (UTM coordinates 713546E, 4302361N, NAD83, Zone 10S). They are likely a western pearlshell freshwater mussel (*Margaritifera falcata*).

Figure 17. Freshwater Mussel Detected in Silver Creek Below Junction Reservoir Dam on June 14, 2016

7.0 DISCUSSION

Results of the 2016 amphibian and aquatic reptile monitoring suggest that FYLF frog breeding is uncommon in the UARP area. Breeding FYLF that were previously documented during 2003–2004 relicensing surveys in the current CD-A3 survey reach may have been absent in 2016 for a number of reasons, including (1) displacement due to a rock slide that may have altered habitat conditions where they once may have been breeding, (2) changes in minimum or peak flows, (3) associated changes in water temperature, or (4) other changes in the hydrograph that affected one or more life stages. The incidental detection of adult FYLFs in the surrounding area, and an adult female who appeared to have just laid eggs, suggests that FYLF continue to successfully breed along Silver Creek, but possibly outside of the main channel survey area.

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Attachment 1
Amphibian and Aquatic Reptile Survey Data Form

Project Name: _____ Page ___ of ____

FYLF Survey Data Sheet

Date: _____ Site :_____ VES#: 1 2 3 4 Surveyors:_____ Location/Reach:_____

Start UTM:_____/_____ Error: _____ WayPoint#: _____ End UTM:_____/_____ Error: _____ WayPoint#: _____

Start Time: _____ End Time: _____ Total Survey Time: _____ Air Temp (C°): (start)_____ (end)_____ Water Temp (C°): (start)_____ (end)_____

Current Wx: (Sky) Overcast / Drizzle / Showers / Clear (Wind) Calm / Light / Moderate / Strong Total Site Length (m): _____ Width (m):_____

Photos: Camera #_____ Bottom (looking U/S):_____ (looking D/S):_____ Top (looking U/S):_____ (looking D/S)_____

Photo Notes: _____

UTM E	UTM N	GPS error (m)	Lifestage/ Sex[1]	#Obs	Gosner Stage	Length (mm)[2]	Total Depth (m)[3]	Mid-Col Velocity (m/s)[3]	EM/Perch Sub[4]	Dominant Riparian Type[5]	Geom Unit[6]	Nearest Bank[7]	Photo Numbers	Notes

[1]Lifestage/Sex-(L)arvae, (E)gg Mass, (Y)oung-of-year, (J)uvenile, (AM) adult male, (AF) adult female, (AU) adult unknown; Adult >= 37 mm SVL; YOY = 22-27 SVL [2]Length in mm- SVL-Snout Vent for A, J, Y; Total Length for Tadpoles

[3]Eggs/Tads: Total depth at obs. location. Velocity avg for 30 sec (m/s) at location [4]Substrate Attachment/Perch Substrate- SLT, SND, GRV, COB, BLD, BDX (Bedrock), WOOD, VEG

[5]Dominant Riparian Type- (1) Grav/ Cobb Bar, (2) Willow, (3) Willow-Alder, (4) Alder, (5) Mature Riparian/Forest, (6) Bedrock

[6]Geomorphic Unit- RIF, BAR, POOL, STEP, RUN, RAP, BDX

[7]Bank nearest Obs (looking downstream): (RB) right bank, (LB), (MC) Center Channel

Crayfish Present (circle)? Yes / No

Fish Present: Yes / No Type: Salmonid Centrarchid Cyprinid Catastomids Other: _____

Other Herpetofauna: Yes / No Species (Lifestage, Number): _____

QA/QC (initials):_____ Date:_____

Attachment 2
Representative Habitat Photos

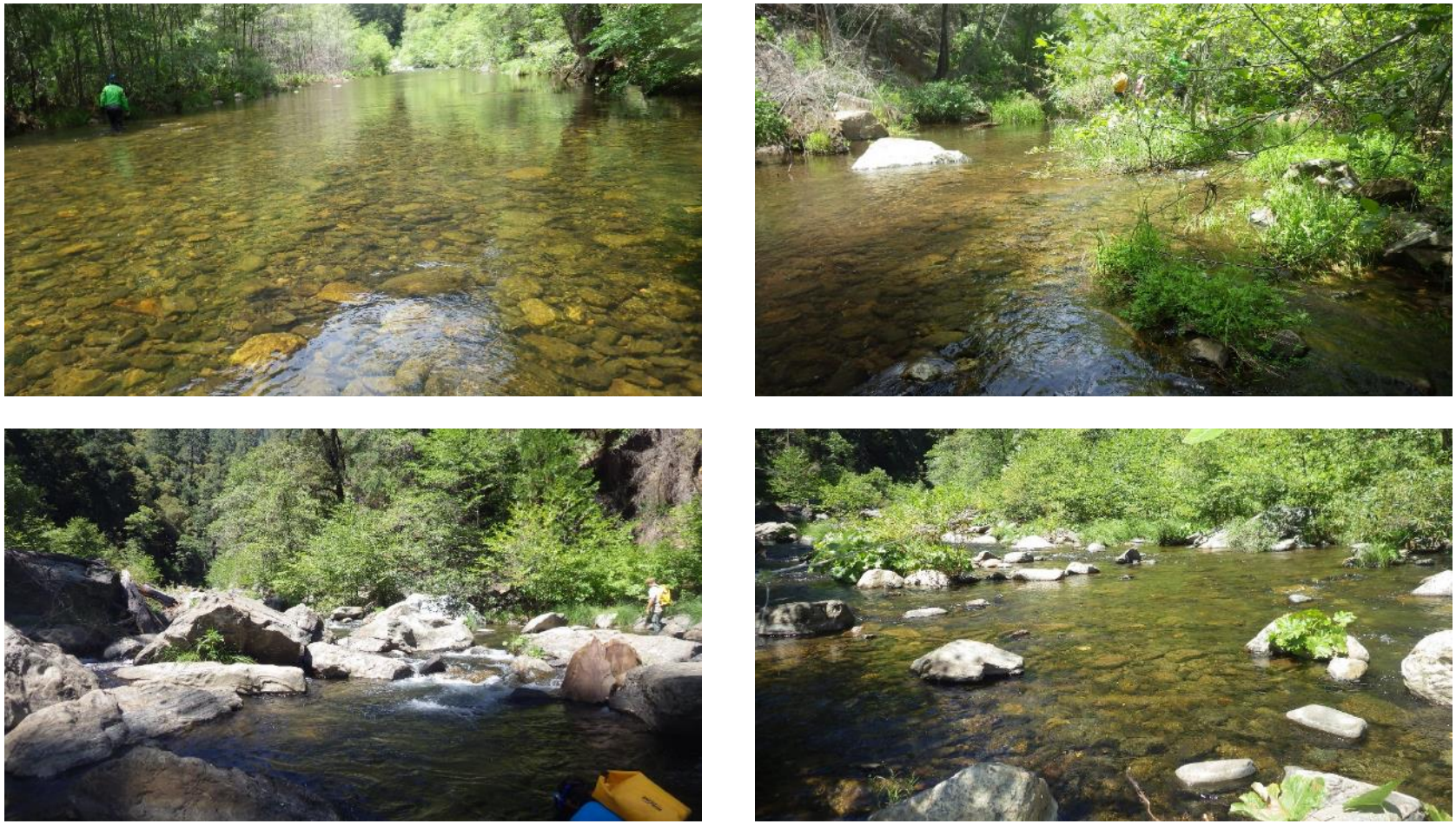


Figure 1. Silver Creek below Junction Reservoir Dam (JD-A15) amphibian and aquatic reptile monitoring site habitat photographs.

Figure 2. Silver Creek below Camino Reservoir Dam (near Camino Adit) (CD-A3) amphibian and aquatic reptile monitoring site habitat photographs.

Figure 3. Silver Creek below Camino Reservoir Dam (near confluence with SF American River) (CD-A4) amphibian and aquatic reptile monitoring site habitat photographs.

Figure 4. Rock Creek (RC-A1) amphibian and aquatic reptile monitoring site habitat photographs.

Figure 5: SF American River below Slab Creek Reservoir Dam (SCD-A1) amphibian and aquatic reptile monitoring site habitat photographs.

Figure 6: South Fork Rubicon River amphibian and aquatic reptile monitoring site habitat photographs.


Silver Creek below Camino Reservoir Dam (near confluence with SF American River) on May 25, 2016.


Silver Creek below Camino Reservoir Dam (near Camino Adit) on May 26, 2016.

Figure 7: Photographs from surveys after the the spill event at Camino Dam, May 25–26, 2016.

Camino Adit on September 20, 2016

Tributary on June 8, 2016.

Seep on June 28, 2016.

Pool upstream of Silver Creek below Camino Reservoir Dam (near Camino Adit) on August 9, 2016.

Figure 8: Informal survey site habitat photographs.

Moderate quality habitat at Silver Creek below Camino Reservoir Dam (near confluence with SF American River) on August 10, 2016.

Moderate quality habitat at Silver Creek below Camino Reservoir Dam (near Camino Adit) on August 10, 2016.

Moderate quality habitat at Silver Creek below Junction Reservoir Dam on August 8, 2016.

Moderate quality habitat at SF American River below Slab Creek Reservoir Dam on August 9, 2016.

Figure 9: Western pond turtle habitat photographs (1 of 2).

High quality habitat SF American River below Slab Creek Reservoir Dam on August 9, 2016 (top and bottom photographs).

Figure 10: Western pond turtle habitat photographs (2 of 2).

Edgewater 1 (at gage and telemetered station)

Edgewater 2

Edgewater 3

Edgewater 4 (logger on left of photo)

Figure 11. Edgewater thermograph habitat photographs at SF American River below Slab Creek Reservoir Dam (SCD-A1), September 9, 2016 (1 of 2).

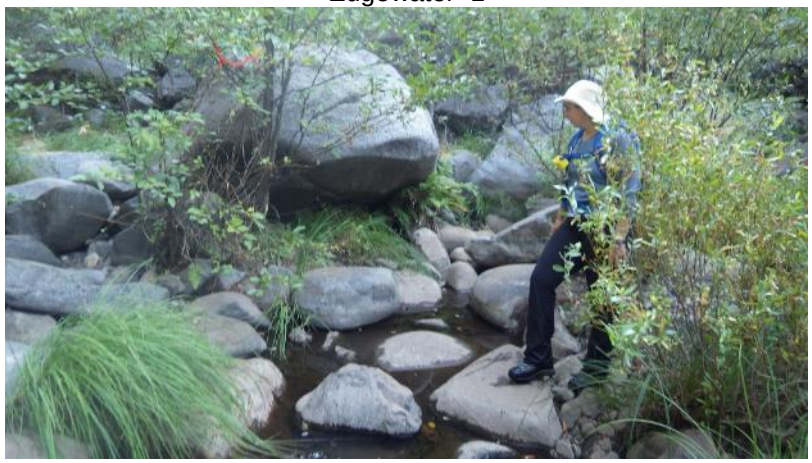
Edgewater 5, looking downstream

Edgewater 6, looking downstream

Figure 12. Edgewater thermograph habitat photographs at SF American River below Slab Creek Reservoir Dam (SCD-A1), September 9, 2016 (2 of 2).

Edgewater 1

Edgewater 2



Edgewater 3

Edgewater 4

Figure 13. Edgewater thermograph habitat photographs at Silver Creek below Camino Reservoir Dam (near confluence with SF American River) (CD-A4), September 20, 2016 (1 of 2).

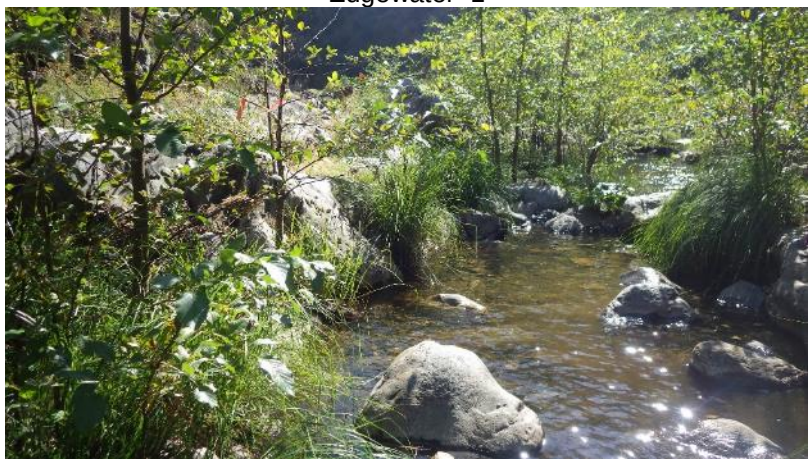
Edgewater 5

Edgewater 6

Figure 14. Edgewater thermograph habitat photographs at Silver Creek below Camino Reservoir Dam (near confluence with SF American River) (CD-A4), September 20, 2016 (2 of 2).

Edgewater 1

Edgewater 2



Edgewater 3

Edgewater 4

Figure 15. Edgewater thermograph habitat photographs at Silver Creek below Camino Reservoir Dam (near Camino Adit) (CD-A3), September 20, 2016 (1 of 2).

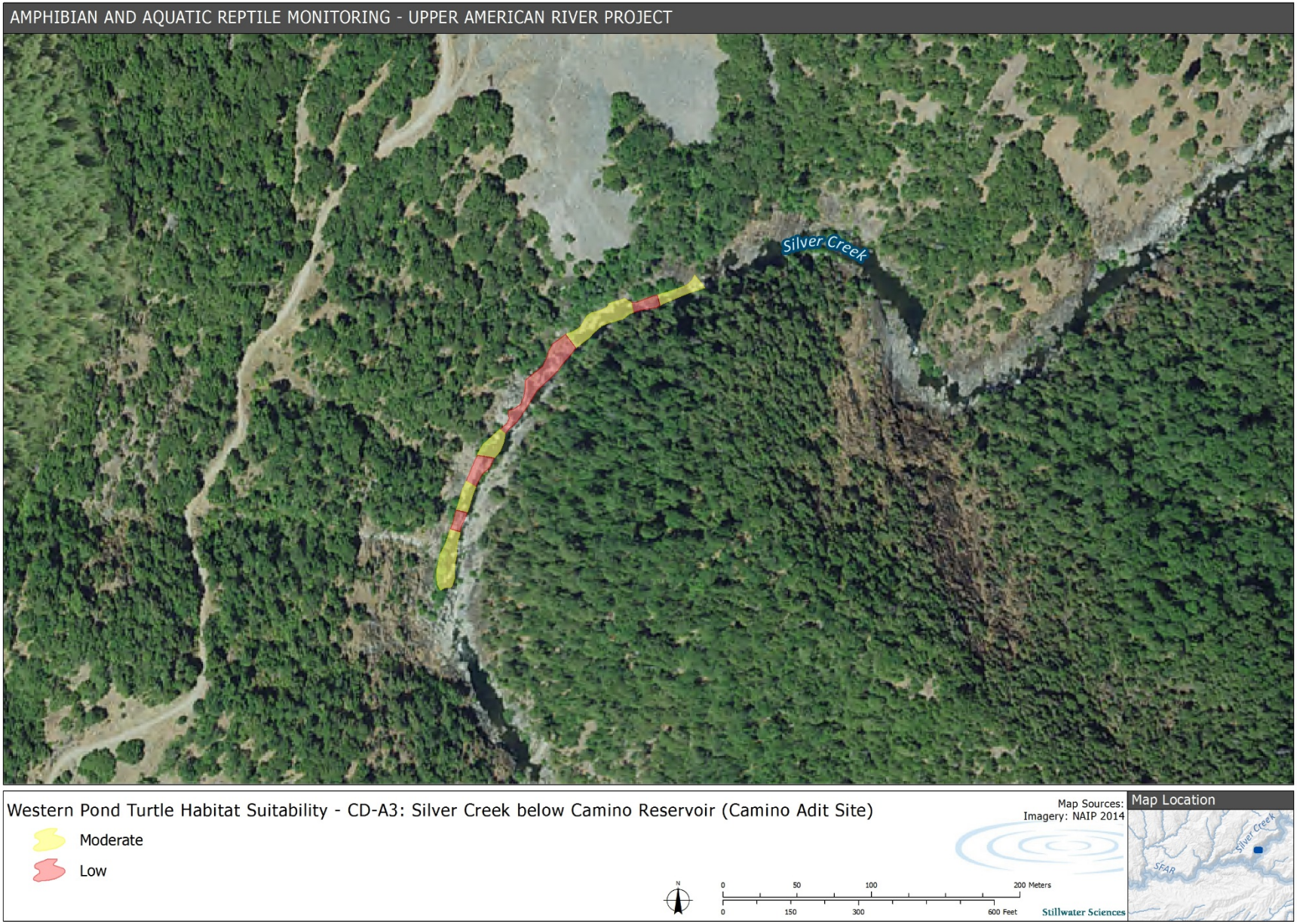
Edgewater 5

Edgewater 6

Figure 16. Edgewater thermograph habitat photographs at Silver Creek below Camino Reservoir Dam (near Camino Adit) (CD-A3), September 20, 2016 (2 of 2).

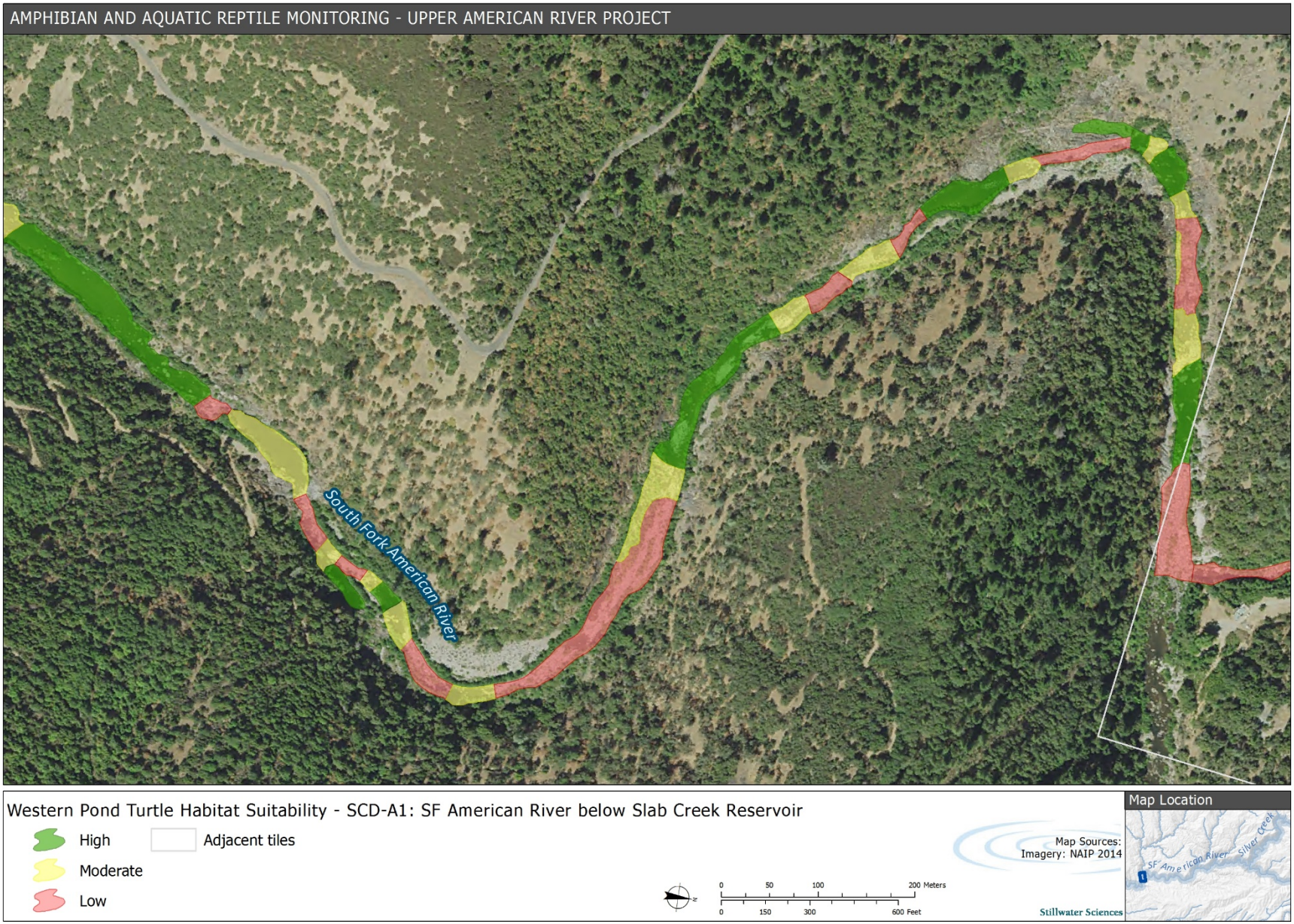
Attachment 3
Western Pond Turtle Habitat Mapping Results

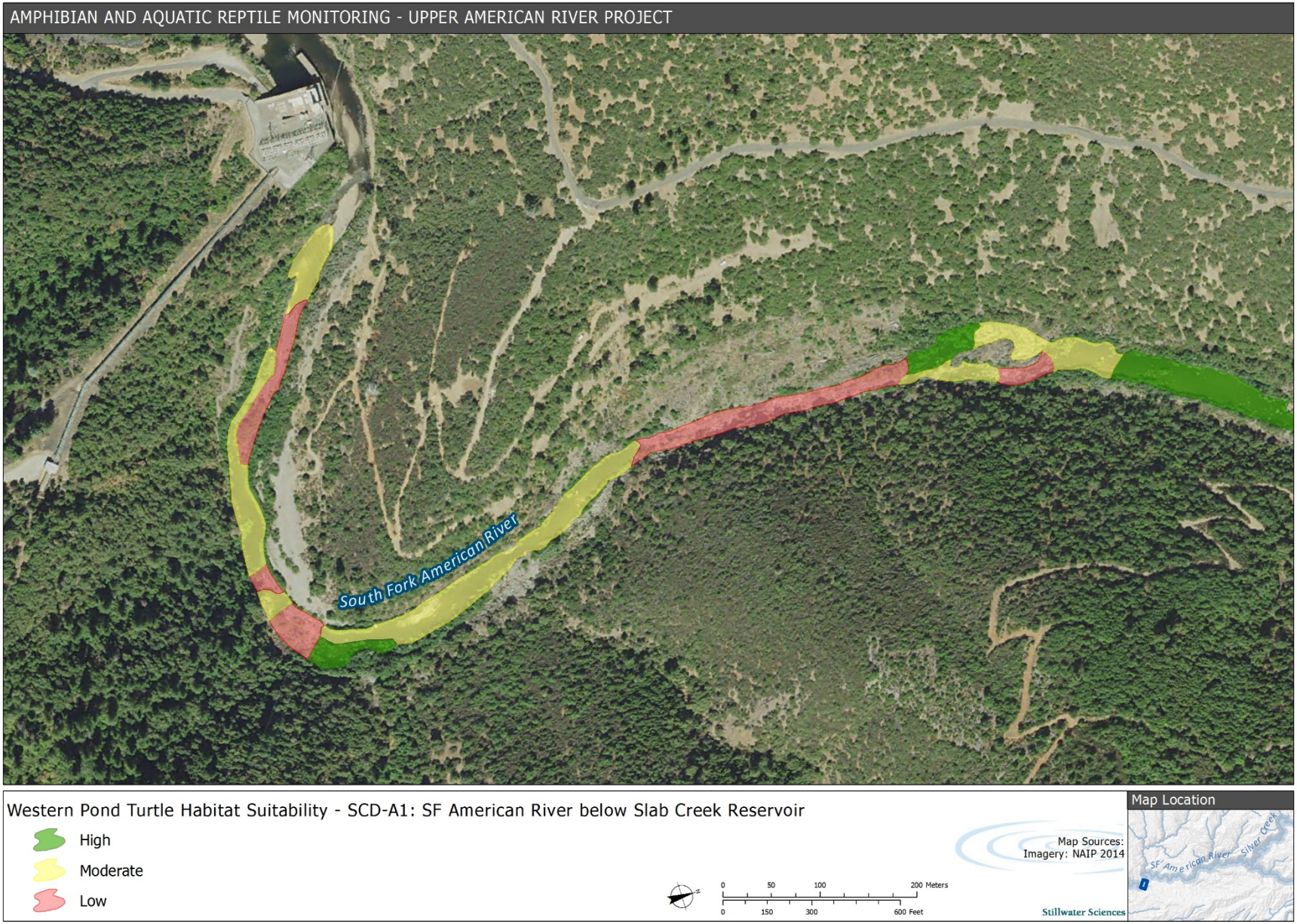

AMPHIBIAN AND AQUATIC REPTILE MONITORING - UPPER AMERICAN RIVER PROJECT
Silver Creek
Western Pond Turtle Habitat Suitability - JD-A15: Silver Creek below Junction Reservoir Dam
Moderate
Low
Map Sources:
Imagery: NAIP 2014
N
0 50 100 200 Meters
0 150 300 600 Feet
Stillwater Sciences
Map Location
Silver Creek
SFAR


AMPHIBIAN AND AQUATIC REPTILE MONITORING - UPPER AMERICAN RIVER PROJECT
Silver Creek
Western Pond Turtle Habitat Suitability - CD-A3: Silver Creek below Camino Reservoir (Camino Adit Site)
Moderate
Low
Map Sources:
Imagery: NAIP 2014
N
0 50 100 200 Meters
0 150 300 600 Feet
Stillwater Sciences
Map Location
Silver Creek
SFAR


AMPHIBIAN AND AQUATIC REPTILE MONITORING - UPPER AMERICAN RIVER PROJECT
Silver Creek
South Fork American River
Western Pond Turtle Habitat Suitability - CD-A4: Silver Creek below Camino Reservoir (Confluence with SF American River)
Moderate
Low
Map Sources:
Imagery: NAIP 2014
N
0 50 100 200 Meters
0 150 300 600 Feet
Stillwater Sciences
Map Location
SF American River
Silver Creek


AMPHIBIAN AND AQUATIC REPTILE MONITORING - UPPER AMERICAN RIVER PROJECT
Rock Creek
Western Pond Turtle Habitat Suitability - RC-A1: Rock Creek
High
Adjacent tiles
Low
Map Sources:
Imagery: NAIP 2014
0 50 100 200 Meters
0 150 300 600 Feet
Stillwater Sciences
Map Location
Silver Creek
SFAR


AMPHIBIAN AND AQUATIC REPTILE MONITORING - UPPER AMERICAN RIVER PROJECT
South Fork American River
Western Pond Turtle Habitat Suitability - SCD-A1: SF American River below Slab Creek Reservoir
High
Moderate
Low
Adjacent tiles
Map Sources:
Imagery: NAIP 2014
0 50 100 200 Meters
0 150 300 600 Feet
Stillwater Sciences
Map Location
SF American River
Silver Creek


AMPHIBIAN AND AQUATIC REPTILE MONITORING - UPPER AMERICAN RIVER PROJECT
South Fork American River
Western Pond Turtle Habitat Suitability - SCD-A1: SF American River below Slab Creek Reservoir
High
Moderate
Low
Map Sources:
Imagery: NAIP 2014
0 50 100 200 Meters
0 150 300 600 Feet
Stillwater Sciences
Map Location
SF American River
Silver Creek