FLOW FLUCUATION MONITORING FOR FOOTHILL YELLOW-LEGGED FROG *(Rana boylii)* ON THE SOUTH FORK AMERICAN RIVER, EL DORADO COUNTY, CALIFORNIA FOR THE EL DORADO HYDROELECTRIC PROJECT (FERC NO. 184)

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TABLE OF CONTENTS

FIGURES:

TABLES:

APPENDICES:

1.0 INTRODUCTION

1.1 Monitoring Requirements

The El Dorado Irrigation District (District) owns and operates the El Dorado Hydroelectric Project (Project) in El Dorado County, California. The Project is licensed by the Federal Energy Regulatory Commission (Project 184). The District, in coordination with the U.S. Forest Service (FS), the California State Water Resources Control Board (SWRCB), and the Ecological Resources Committee, developed the Project 184 Foothill Yellow-legged Frog Monitoring Plan (Plan; EID 2007) as required by the Project 184 License[1].

The Plan requires monitoring for foothill yellow-legged frog (*Rana boylii*; FYLF) be conducted at four sites "June through September at any time the SFAR [South Fork American River] flow is 100 cfs [cubic feet per second] or less and the reach between Kyburz Diversion Dam and Silver Creek changes 50 cfs or more in 1 day." A flow fluctuation occurred on August 14, 2020, which triggered FYLF monitoring.

On August 14, 2020, at approximately 7:00 p.m., the El Dorado Powerhouse was shut down without notice, and as a result of widespread and unanticipated rolling power outages in the region as ordered by the California Independent System Operator. This condition was due to having inadequate power supply to meet demands, and with the shutdown of the electric transmission and distribution system, it was not possible to continue power generation and releases from the powerhouse.

The District was also not able to store additional water in the El Dorado Forebay due to another unique condition. After recent modifications to the dam, the District is currently filling El Dorado Forebay to its new operating elevation under a schedule dictated by the Federal Energy Regulatory Commission and California Division of Safety of Dams. This schedule requires the reservoir level to be increased in one-foot increments and maintained at that level over a period of time in order for seepage monitoring to be conducted.

With Forebay at its maximum capacity allowed for under the refill schedule, the District had to utilize El Dorado Canal spillways to shutoff inflow to the Forebay in response to the power outage. The District made releases from spillways 42 and 44, both of which are identified as preferred spillways in the Project 184 Preferred Canal Drainage Structure and Release Point Plan. The total combined release from both spillways was approximately 89 cfs. Both spillways were closed by 10:00 p.m. after power was restored and normal operations resumed.

[1] United States Forest Service Section 4(e) Conditions 37 and 38; State Water Resources Control Board 401 Water Quality Certification Condition 13; Project 184 Settlement Agreement Sections 7 and 8.

Both of these spillways release water into the SFAR near Pollock Pines approximately 20 miles west of the Kyburz Diversion Dam. Flows measured below Kyburz Diversion Dam (gage A-12) during this event were approximately 20 cfs. The maximum release from spillways 42 and 44 was 89 cfs and greater than the defined threshold of 50 cfs. Therefore, a flow fluctuation, as defined by the Project No. 184 license occurred.

The Project No. 184 license conditions (FS 4(e) Conditions 37 and 38; SWRCB Water Quality Certification Condition 13; Project 184 Settlement Agreement Sections 7 and 8) call for the District to conduct Foothill Yellow-legged Frog (FYLF) monitoring in the SFAR following a flow fluctuation. The District contracted with GANDA to perform FYLF surveys at four monitoring sites located downstream of where releases from spillways 42 and 44 enter the SFAR. These sites include 120a, 120b, 120c located upstream of Silver Creek and 124R at confluence with Soldier Creek (Figure 1).

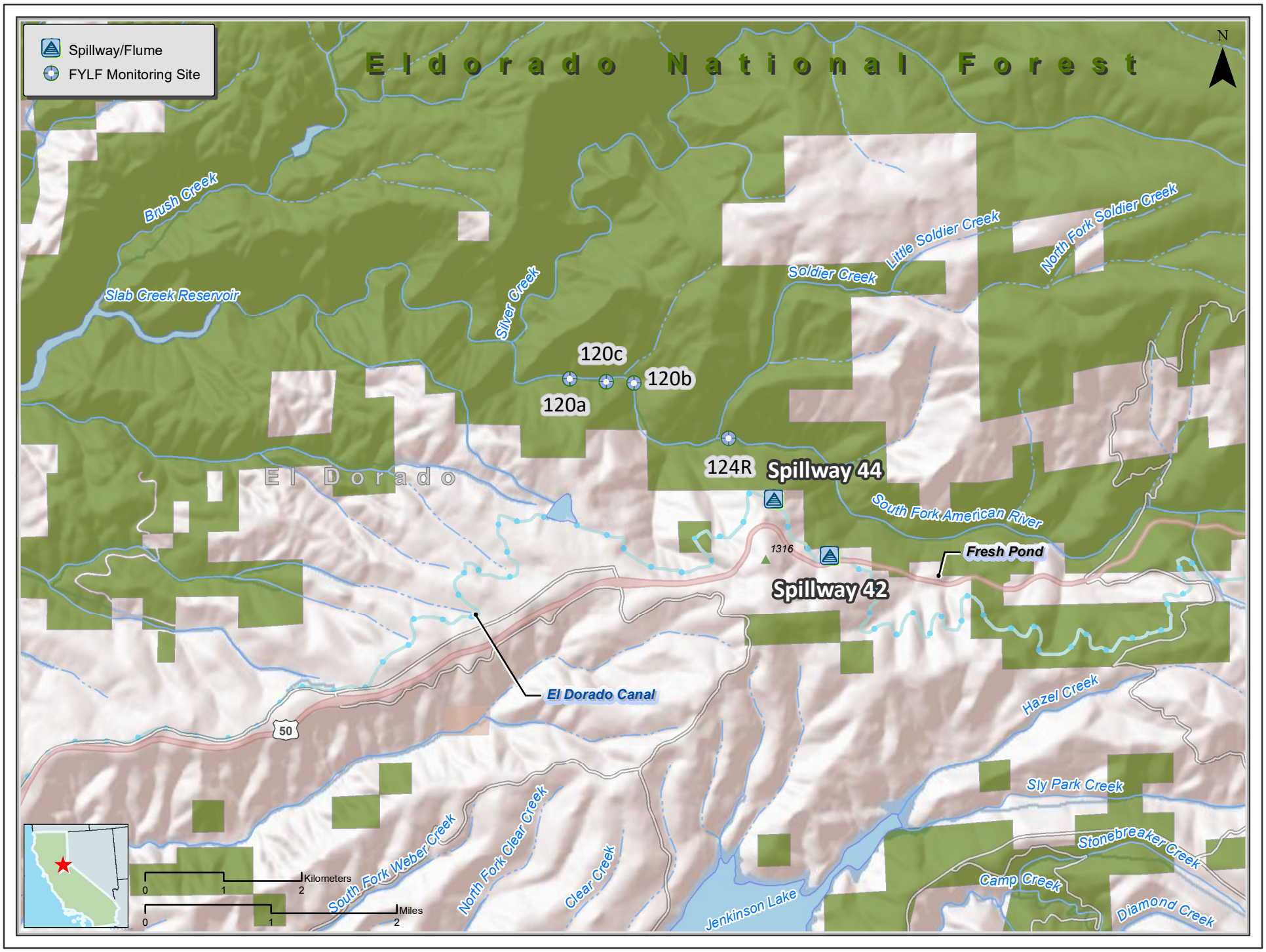

Figure 1. Flow Fluctuation Monitoring Sites and Spillway Locations.

1.2 FYLF Status, Distribution, and Current Threats to Populations

The foothill yellow-legged frog is designated as a Federal Species of Concern and a Forest Service Sensitive species, and in the South Fork American River, is part of the Southern Sierra genetic clade (McCartney-Melstad et al. 2018) which is Endangered in the State of California (CDFW 2019). Foothill yellow-legged frogs are highly aquatic amphibians, spending most or all of their life in, or near, streams and rivers with rocky substrate and open, sunny banks, in forests, chaparral, and woodlands (CDFW 2019). They typically lay egg masses which are attached to rocky substrates in open, sunny microhabitats with flowing water. Adult FYLF are primarily diurnal with strong site fidelity and typically occupy small home ranges, but adults and juveniles may move several hundred meters or more to access breeding sites or refugia during the non-breeding season (CDFW 2019).

FYLF occur in the Coast Ranges from the Santiam River in Oregon south to the San Gabriel River in Los Angeles County and along the west slopes of the Sierra/Cascade crest in most of central and northern California. Other isolated populations have been reported in Baja California Norte (Loomis 1965), in southern California, and at Sutter Buttes in Butte County, California (Stebbins 2003). The elevational range of FYLF extends from sea level to 2,042 meters (m) (6,700 feet [ft.]) in Baja California Norte. In California, FYLF have been recorded in the Sierra Nevadas as high as 1,830 m (6,000 ft.) near McKessick Peak in Plumas County and 1,940 m (6,365 ft.) at Snow Mountain in Trinity County (Stebbins 2003). In the Project Area, FYLF are currently known to occur along the mainstem SFAR and associated tributaries from the upstream end of Slab Creek Reservoir upstream to Riverton at 975 m (3,200 ft.) elevation (GANDA 2011).

In the Sierra Nevada, FYLF have disappeared from an estimated 66 percent of their former range (Stebbins 2003). Non-native predators, land use conversion, pesticide use, and modification of hydrology are considered the main threats to FYLF populations (Jennings and Hayes 1994, Davidson et al. 2002). Non-native bullfrogs (*Lithobates catesbeianus*) negatively affect FYLF populations via larval competition and direct predation (Moyle 1973, Kupferberg 1997, Crayon 1998). Signal crayfish (*Pacifastacus leniusculus*) feed on FYLF eggs and tadpoles (Rombough and Hayes 2005, Wiseman et al. 2005) and have been shown to negatively affect other amphibians through direct predation and egg mass displacement in ponds (Nyström et al. 2001). Invasive fish, particularly centrarchids, are suspected to feed upon FYLF (Werschkul and Christensen 1977, Van Wagner 1996). Construction of dams and altered hydrological systems continue to threaten FYLF populations by reducing breeding habitat and scouring of egg masses from untimely water releases (Lind et al. 1996, GANDA 2005).

2.0 METHODS

2.1 Visual Encounter Surveys

Visual Encounter Surveys (VES) were conducted at a total of four subsites on the SFAR including subsites 120a, 120b, 120c, and 124R (Figure 1). Surveys were conducted according to *A Standardized Approach for Habitat Assessments and Visual Encounter Surveys for the Foothill Yellow-Legged Frog* (*Rana boylii*) (Seltenrich and Pool 2002). All VES were conducted by GANDA biologists Kevin Wiseman and Ian Chan on August 27, 2020.

Survey data were recorded onto VES Data Sheets for each subsite surveyed. Separate data sheets were completed for tadpoles and for juveniles/adults. Juvenile and subadult frogs were defined as frogs from previous years' cohorts, ranging approximately 30-40 mm snout-urostyle length (SUL), but not considered of adult size. Adults were defined as frogs $\geq$ 40 mm SUL.

Data parameters collected for tadpoles included: tadpole group location within site; number of tadpoles in each group; distance from the shore; velocity; total length; substrate; percent algae and detritus; and, water depth. The data parameters collected for juvenile and adult FYLF included: number of frogs observed; frog location within the site; sex; age; SUL; habitat type; activity; percent cover of vegetation; percent shade; and, substrate.

3.0 RESULTS

3.1 Visual Encounter Survey Results

Results for the visual encounter surveys are summarized in Table 1. Copies of survey data sheets are provided in Appendix A, and site photographs are located in Appendix B.

Table 1. Survey results for the flow fluctuation monitoring.

Subsite #	Date	Beg. Time	End Time	Actual VES time (min.)	Beg. Air Temp. (°C)	End Air Temp. (°C)	Water Temp. (edgew.) (°C)	Water Temp. (channel) (°C)	# Egg Masses	# Tadpoles/ # groups	# Juvenile /YOY Frogs	# Adult Frogs
120a	8/27/20	1230	1245	15	29.5	29.5	23.5	22	0	0	0	0
120b	8/27/20	1320	1340	20	30	30	23	22	0	0	0	0
120c	8/27/20	1255	1315	20	30	30	23	22	0	0	0	0
124R	8/27/20	1435	1450	15	26.5	26.5	24	22	0	0	0	0

3.1.1 Site 120R – SFAR upstream of Silver Creek

Site 120R is located on the SFAR approximately 1.0 kilometer (km) upstream of the confluence with Silver Creek at an elevation of 685 m (2,240 ft). The total site length is 352 m and includes three subsites: 120a, 120b, and 120c. Within all three subsites at 120R, there was no evidence of recent increased flows, siltation, or other noticeable effects of the flow fluctuation that occurred on August 14th, 2020.

Subsite 120a (Photos 1-2, App. B) contained four small (approximately 1-3 square meter [m^2]) isolated pools along the lateral cobble bar near the river margin. Cyprinid fish and rainbow trout (*Oncorhynchus mykiss*) young-of-the-year (YOY) were observed. No FYLF life stages were observed during the survey.

Subsite 120b was largely dry during the survey, except for several isolated pools (2-20 m^2) and a few connected side pools located at the top 50 m of the subsite (Photos 3-4, App. B). Cyprinid fish and rainbow trout were observed. No FYLF life stages were observed during the survey.

Subsite 120c was largely dry at the upstream portion of the site, consisting of several small, isolated pools (Photos 5-6, App. B). Cyprinid fish and rainbow trout were observed. One juvenile Sierra garter snake (*Thamnophis couchii*) was incidentally observed between subsites 120a and 120c. No FYLF life stages were observed at this subsite.

3.1.2 Site 124R – SFAR at confluence with Soldier Creek

Site 124R is located on the left bank of the SFAR across from the confluence with Soldier Creek at an elevation of 755 m (2,480 ft) (Photos 7-8, App. B). Cyprinid fish and rainbow trout were observed. One juvenile Sierra garter snake was incidentally observed downstream of Site 124R. No FYLF life stages were observed at this site. Within Site 124R, there was no evidence of recent increased flows, siltation, or other noticeable effects of the flow fluctuation that occurred on August 14th, 2020.

4.0 LITERATURE CITED

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Appendix A: Visual Encounter Survey Data Sheets

Appendix B: Site Photographs

Photo 1. Bottom of site 120a, view upstream. 8/27/20

Photo 2. Top of site 120a, view downstream. 8/27/20

Photo 3. Bottom of site 120b, view upstream. 8/27/20

Photo 4. Isolated pool near the top of site 120b, view downstream. 8/27/20

Photo 5. Bottom of site 120c, view upstream. 8/27/20

Photo 6. Top of site 120c, view downstream. 8/27/20

Photo 7. Bottom of site 124R, view upstream. 8/27/20

Photo 8. Top of site 124R, view upstream. 8/27/20