Pope Creek Aquatic Habitat Assessment
Napa County, California

Technical Memorandum

JUNE, 2014

PREPARED FOR:

TULEYOME

PREPARED BY:

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Introduction

Tuleyome, a non-profit organization dedicated to protecting the wild and agricultural heritage of the inner coast range, received two grants in 2013 from the Mead Foundation and the Napa County Wildlife Conservation Commission to conduct restoration planning and habitat assessments for a reach of Pope Creek near Lake Berryessa. The project reach spans approximately three miles, extending between the Pope Canyon Road Bridge and the high water mark of the lake (Attachment 1). Tuleyome contracted with the Napa County Resource Conservation District (RCD) to complete the aquatic habitat assessment component of this effort, which included a stream habitat survey and a snorkel survey during low-flow conditions. This technical memorandum discusses the results of these two surveys.

Stream Habitat Survey

A stream habitat survey was conducted using methodology outlined in the California Salmonid Stream Habitat Restoration Manual (Flosi et al. 1998). The survey was conducted on May 13 and 14, 2014 by a two-person crew (Jonathan Koehler and Paul Blank, Napa RCD) trained in standardized habitat inventory methods developed by the California Department of Fish and Wildlife.

Beginning at the downstream end of the reach and wading upstream, the crew divided the creek into a series of habitat units according to the following habitat types:

- Riffle – shallow, swift moving water with visible surface disturbance
- Glide – shallow, slow moving water with a relatively flat, homogenous bed topography
- Run – deep, swift moving water with little surface disturbance
- Pool – deep, slow moving water with a well-defined bed depression or scour hole

The lengths of all units were measured with a field tape and/or handheld GPS. Habitat unit types encountered for the first time were measured for all the parameters on the field form (Attachment 5). Additionally, from the ten habitat units on each field form page, one unit was randomly selected for complete measurement to ensure that at least 10% of all units were fully measured.

Snorkel Survey

A snorkel survey was conducted by a two-person crew (Jonathan Koehler and Paul Blank) trained in fish identification. The survey proceeded in an upstream to downstream direction and covered approximately 80% of the project reach. A few short sections were excluded due to lack of landowner access and insufficient depth for diving. The survey was intended to

document the fish assemblage within the reach as well as the relative abundance and general habitat associations of each species.

Results

The Pope Creek study reach was characterized by a low-gradient pool-riffle morphology with frequent areas of multi-thread (i.e. braided) channel. A total of 14,531 feet (2.75 miles) of channel length were surveyed using the methodology described above. Results of this survey are overlaid on an aerial photo map in Attachment 2, which shows the geographic location and relative frequency of each habitat type within the study reach.

The study reach was comprised primarily of long pools and glides with a total of 5,843 feet of pools, 3,782 feet of glides, 3,127 feet of riffles, and 1,779 feet of runs (Figure 1). Photographs of representative habitat types are shown in Attachment 3. The average maximum pool depth was 5.3 feet; however several pools were only accessible by swimming and had estimated depths of over ten feet. The dominant substrate throughout the surveyed reach was gravel followed by boulders and sand.

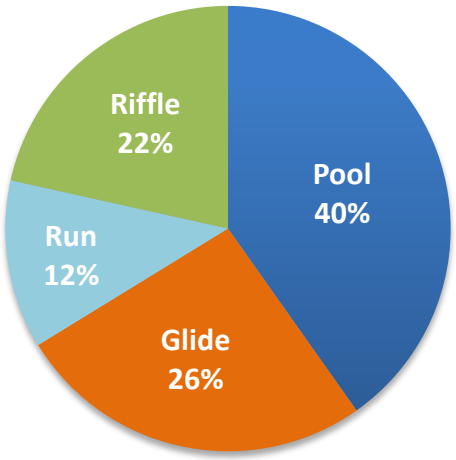

Figure 1. Percentage of each major stream habitat type by length within the study reach

Riparian canopy cover, as measured with a spherical densitometer, had an average value of 33% in the study reach. This measurement, which is the inverse of "percent open sky", describes the amount of physical canopy cover (e.g. branches, leaves, trunks, etc.) that is able to cast a shadow onto the center of the stream at the point measured. Several units had a canopy cover of 100% (completely shaded) and several had a value of 0% (completely open). In most units, the actual amount of stream shading varies throughout the day, depending on the sun angle – typically, the stream is most shaded in morning and evening, and exposed in

midday when the sun is overhead. Areas of dense low-growing willows, tamarisk (non-native and invasive), and other riparian vegetation were common in riffles, and these thickets often completely engulfed (and shaded) the low-flow channel. However, much of the channel was characterized by open gravel bars with few mature trees or other vegetation providing shade to the low-flow channel.

A total of eleven fish species were observed during the snorkel survey, including five natives and six non-natives. A list of fishes and other aquatic species observed during the snorkel survey is presented in Table 1. Photographs of select species are presented in Attachment 4.

Common Name	Scientific Name	Origin	Age Class (or Size)	Relative Abundance[1]	Habitat Associations
Rainbow trout	*Oncorhynchus mykiss*	Native	yoy - 2+	Low	riffles, runs
Unidentified lamprey sp.[2]		Native	ammocete	Low	glide
Sacramento pikeminnow	*Ptychocheilus grandis*	Native	juvenile - adult	High	all types
Sacramento sucker	*Catostomus occidentalis*	Native	juvenile - adult	High	all types
Three-spine stickleback	*Gasterosteus aculeatus*	Native	adult	Low	pool
Bluegill	*Lepomis macrochirus*	Introduced	juvenile - adult	Moderate	pools, glides
Redear sunfish	*Lepomis microlophus*	Introduced	juvenile - adult	Low	pool
Green sunfish	*Lepomis cyanellus*	Introduced	adult	Moderate	pools, glides
Largemouth bass	*Micropterus salmoides*	Introduced	juvenile	Low	pools, glides
Smallmouth bass	*Micropterus dolomieu*	Introduced	juvenile - adult	Moderate	pools, glides
Western mosquitofish	*Gambusia affinis*	Introduced	juvenile - adult	Moderate	pools, glides
Bullfrog	*Rana catesbeiana*	Introduced	larvae - adult	High	pools, glides
Signal crayfish	*Pacifastacus leniusculus*	Introduced	adult	Low	pools, glides
Red swamp crayfish	*Procambarus clarkii*	Introduced	adult	Low	pools, glides
Western pond turtle	*Actinemys marmorata*	Native	adult	Low	pools, glides

1. Relative abundance was determined by professional judgment using the following categories: high=observed in nearly all units sampled; moderate= observed in greater than half of the units sampled; low=observed in less than half of the units sampled

2. A single larval lamprey (ammocete) was observed during the snorkel survey but was unable to be captured for positive identification – this specimen was likely a brook lamprey (*Lampetra cf. pacifica*) based on historical records for the upper Putah Creek watershed.

Table 1. Fishes and other aquatic species observed in the Pope Creek study reach.

Streamflow was not measured during this study but was visually estimated at approximately one cubic feet per second. The average water temperature measured during the habitat survey was 20°C (68°F) with a maximum recorded value of 22.5°C (72.5°F). Air temperatures during the survey ranged from 23°C (73.4°F) to 35°C (95°F). During the snorkel survey, stratification of pools was apparent with noticeably cooler water being present approximately two to three feet

below the surface. The temperature differential was measured with a hand-held thermometer in two pools and was approximately 4°C (~7°F) between the surface layer and the cooler sub-surface layer.

Long free-flowing masses of filamentous algae were very abundant throughout the study reach. The algae strands were attached to the streambed, and several pool and glide units were filled with algae mats to the point that the substrate was not visible. Two relatively short sections (~1,000 feet or less) of the reach had little or no algae despite heavy infestations just upstream and downstream. Photographs of both conditions are presented in Attachment 3.

Discussion and Conclusions

The study reach of Pope Creek offers favorable habitat conditions for several native and non-native fishes. Sacramento sucker (*Catostomus occidentalis)* and Sacramento pikeminnow (*Ptychocheilus grandis)* were by far the two most abundant fish species observed. Approximately 10-15 rainbow trout (*Oncorhynchus mykiss*) of various age classes were observed throughout the reach, suggesting that a relatively small population is present despite what appears to be an unfavorably warm summer temperature regime. It is likely these resident trout seek refuge in the deeper stratified pools during the hottest periods.

A single lamprey ammocete (larvae) was observed swimming in a glide during the snorkel survey. The specimen hid under a rock and we were unable to capture it for positive identification. Given that there are records of brook lamprey occurring in the upper Putah Creek watershed near Middletown and that no link to the ocean exists for anadromous species (e.g. Pacific lamprey or river lamprey), it is highly likely that the observed fish was a larval brook lamprey. Further sampling via electrofishing or targeted dip-netting could confirm the presence of this species if deemed important.

Most of the non-native species observed including largemouth bass (*Micropterus salmoides),* smallmouth bass *(Micropterus dolomieu*), bluegill (*Lepomis macrochirus),* redear sunfish *(Lepomis microlophus*), and green sunfish (*Lepomis cyanellus)* were historically introduced into California waterways, including Lake Berryessa, for recreational fishing. Self-propagating populations of these species have become established in the lake, and presumably act as a source population for the study reach. Additionally, Western moquitofish (*Gambusia affinis)* was introduced to California in an attempt to control mosquito populations by predating upon their aquatic larval stage. Mosquitofish are still commonly “stocked” into ponds and other wetlands for vector control, although it is likely that a self-propagating population may also be established in Pope Creek, since it contains relatively favorable habitat conditions for this species.

The native western pond turtle (*Actinemys marmorata)* was observed in several locations throughout the study reach and appears to be fairly common. Additionally, a mandible from a North American beaver (*Castor canadensis*) was found near the bottom of the study reach. No other evidence of beaver presence (e.g. dams, gnaw marks, etc.) were observed, so it is not known whether beavers still occur within Pope Creek. Beaver colonization of the adjacent Napa River watershed during the past decade has been well documented, and Pope Creek is within the historical range for this species. Therefore, it is possible that the study reach has supported beavers within the recent past as well. Photographs of both species are included in Attachment 4.

Thick mats of filamentous algae were present throughout most of the study reach. The density of this algae is likely detrimental to fishes and other aquatic organisms within the Pope Creek ecosystem in several ways: (1) when flows decline in summer, algae respiration and decomposition can deplete dissolved oxygen within the water; (2) the thick mats reduce the benthic macroinvertebrate community by physically covering the streambed; and (3) algae physically reduces the amount of open water habitat available to fishes and other aquatic species swimming in the water column. Interestingly, we observed at least two sections of stream that had little or no algae, despite an open canopy and heavy infestations upstream and downstream. The reason for this absence was not apparent, but presumably some environmental factor such as localized geology may prevent algae from establishing. Photographs showing heavy algal infestation as well as habitat units with little to no algae are presented in Attachment 3.

Literature Cited

Flosi, G., S. Downie, J. Hopelain, M. Bird, R. Coey, and B. Collins. 1998. California Salmonid Stream Habitat Restoration Manual, 3rd edition. California Department of Fish and Wildlife, Sacramento, CA.

Attachments

Attachment 1 – Study reach map
Attachment 2 – Habitat type map
Attachment 3 – Photographs of representative habitat types and conditions
Attachment 4 – Photographs of fish and wildlife species observed
Attachment 5 – Habitat survey field form

POPE CREEK AQUATIC HABITAT ASSESSMENT

Attachment 1 - Study Reach Map

Pope Creek Study Reach

Stream

0 0.1 0.2 0.3 0.4 0.5 1 Miles

0 0.5 1 Km

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MAP LOCATION

Data Sources:
ESRI aerial imagery
1:24K USGS hydrography
RCD digitized study reach

Map prepared by Jonathan Koehler
June, 2014

POPE CREEK AQUATIC HABITAT ASSESSMENT

Attachment 2 - Habitat Type Map

Data Sources:
ESRI aerial imagery
RCD habitat survey (5-2014)

Map prepared by Jonathan Koehler
June, 2014

Habitat Type (labeled by unit number)

- Riffle
- Glide
- Run
- Pool
- Not Surveyed - No Access

N

0 0.1 0.2 0.3 0.4 0.5 Miles

0 0.5 Km

NAPA COUNTY RCD Resource Conservation District

MAP LOCATION

Attachment 3 - Photographs of representative habitat types and conditions

Pool (Habitat unit 1, 5/13/2014)

Riffle (Habitat unit 5, 5/13/2014)

Run (Habitat unit 42, 5/14/2014)

Glide (Habitat unit 50, 5/14/2014)

Run with heavy algae infestation (Habitat unit 58, 5/14/2014)

Pool with heavy algae infestation (Habitat unit 45, 5/14/2014)

Pool tailout completely filled with algae (Habitat unit 66, 5/14/2014)

Underwater view of algae mats (5/14/2014)

Algae present during snorkel survey (5/22/2014)

Glide with no filamentous algae (Habitat unit 38, 5/14/2014)

Deep pool at top of survey reach (Habitat unit 66, 5/14/2014)

High quality run/pool sequence where trout were observed (Habitat unit 17, 5/13/2014)

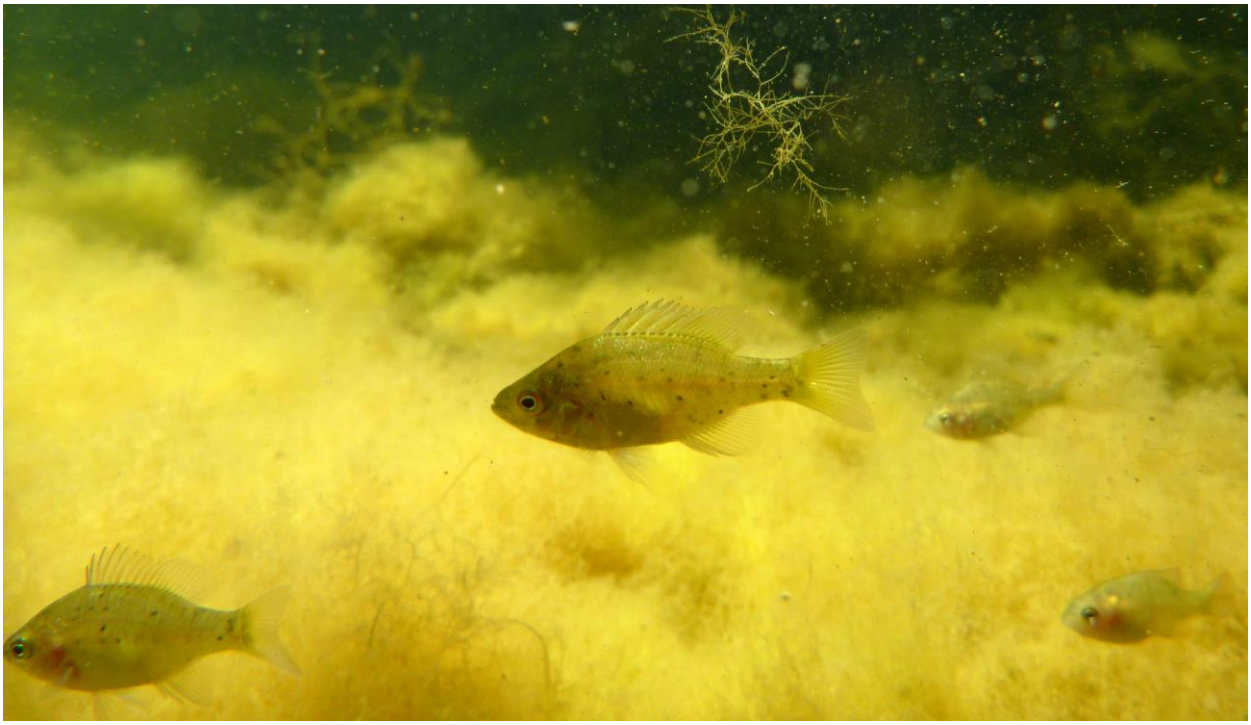
Thick vegetation completely covering the low-flow channel (Habitat unit 2, 5/13/2014)

Willow thicket completely covering the low-flow channel (Habitat unit 61, 5/14/2014)

Attachment 4 - Photographs of fish and wildlife observed

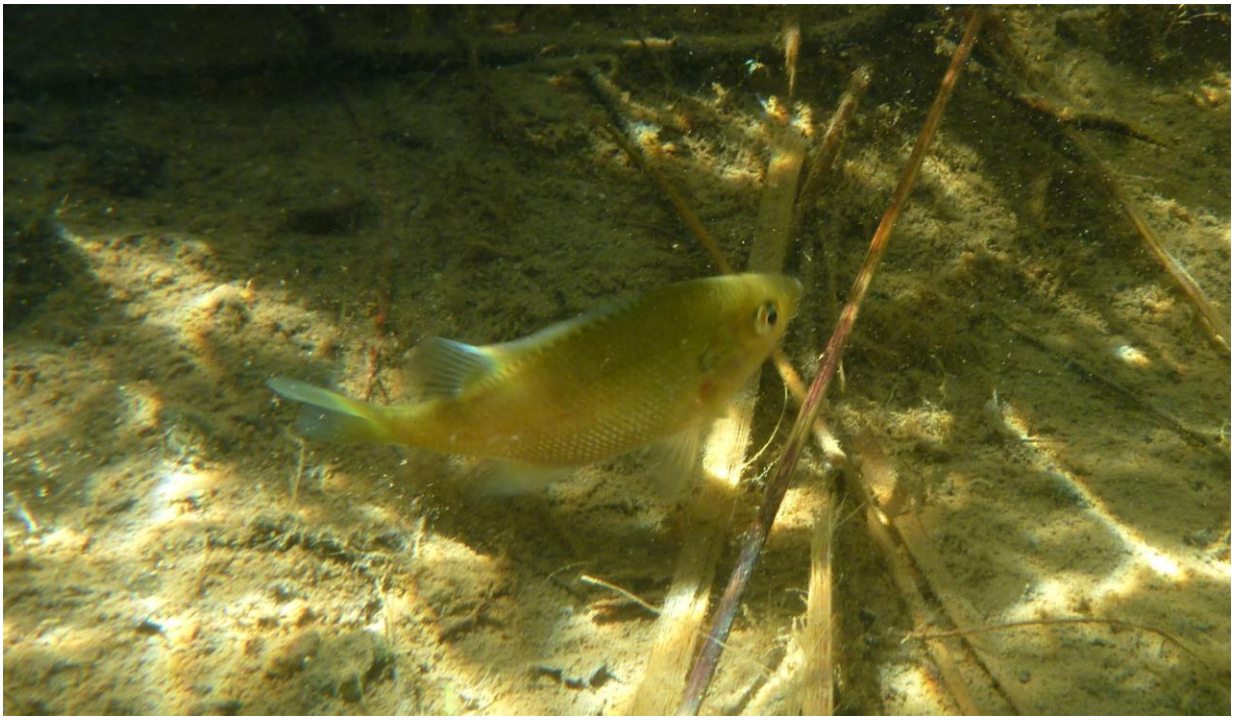
Juvenile Sacramento sucker (5/22/2014)

Juvenile rainbow trout (5/22/2014)



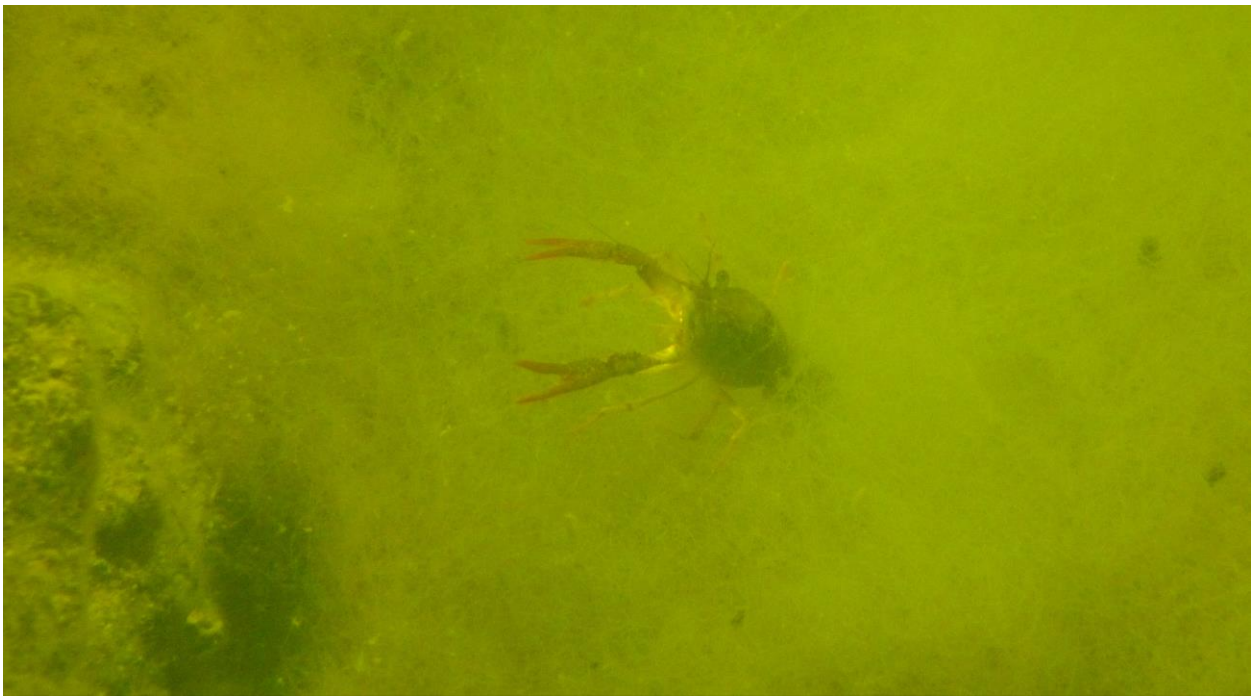
Juvenile redear sunfish (5/22/2014)

Adult smallmouth bass (5/22/2014)



Adult bluegill (5/22/2014)

Adult green sunfish (5/22/2014)



Red swamp crayfish (5/22/2014)

Western pond turtle (5/14/2014)

Beaver mandible (5/13/2014)

California kingsnake (5/13/2014)

Attachment 5 – Habitat Survey Field Form

Napa County RCD Habitat Assessment Form #_____ of _____				
Date:	Time:	Stream Name:		
Surveyors:		BFW:	@HU#	Reach:
Water Temp:	Air Temp:	Flow:	Page Length:	Total Length:

Habitat Unit Number											
Habitat Unit Type											
Mean Length											
Mean Width											
Mean Depth											
Maximum Depth											
Shelter Rating	Shelter Value										
	% Unit Covered										
	% undercut bank										
	% swd (d<12")										
	% lwd (d>12")										
	% root mass										
	% terr. vegetation										
	% aqua. vegetation										
	% bubble curtain										
	% boulders										
	% bedrock ledges										
Substrate Composition 2 Most Dominant	A) Silt/Clay										
	B) Sand										
	C) Gravel (0.08-2.5")										
	D) Sm Cobble										
	E) Lg Cobble (5-10")										
	F) Boulder (>10")										
	G) Bedrock										
Percent Total Canopy											
% Hardwood Trees											
% Coniferous Trees											
Bank Composition & Vegetation	Rt Bk Composition										
	Rt Bk Dominant Vg										
	% Rt Bk Vegetated										
	Lft Bk Composition										
	Lft Bk Dominant Vg										
	% Lft Bk Vegetated										
Photos											

Bank Composition Types

1) Bedrock
2) Boulder
3) Cobble /Gravel
4) Silt/Clay/Sand

Vegetation Types

5) Grass
6) Brush
7) Hardwood Trees
8) Coniferous Trees
9) No Vegetation

Comments:

Hab Unit #	Comments

Diagrams