



January 9, 2018

To: Richard Marovich, Putah Creek Streamkeeper  
Chris Lee, SCWA

**Subject: General Update on Scarification, Salmon and other Assorted Projects**

### **REPORT**

The following is a general report on numerous subjects germane to ongoing and current events in the Putah Creek watershed. Subjects include:

1. 2017 scarification Project (Comparison images) Full report to follow.
2. Conditions left by 2017 flood event
3. Benthic Macroinvertebrate Community (BMI) - Condition
4. 2017 Salmon Spawn in Lower Putah Creek
5. UCD salmon carcass survey (images)
6. Putah South Canal - Invasive Species Surveys
7. Lake Berryessa - Eurasian Mussel Surveys



2017 Chinook salmon on edge of 2014 Scarification Ridge.





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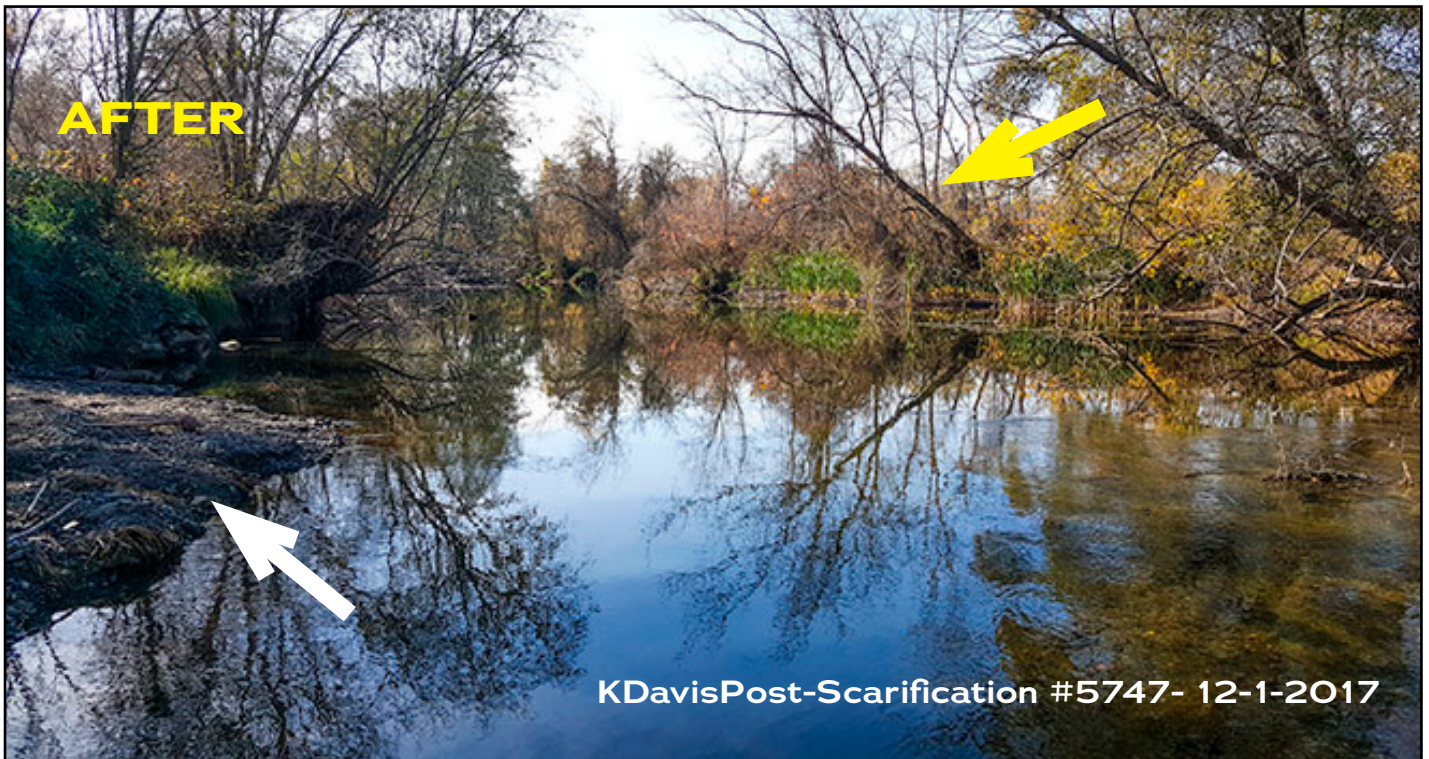
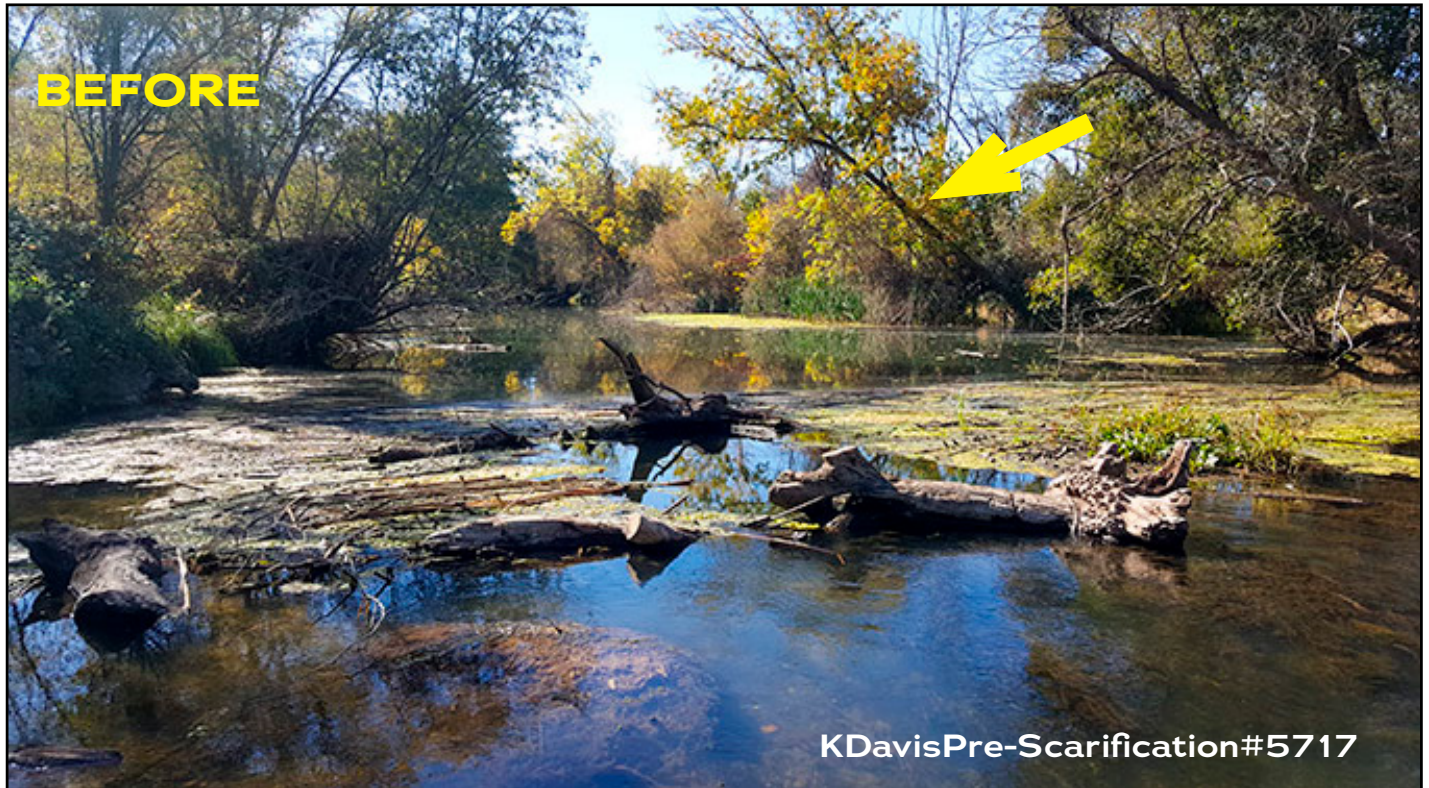
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**REPORT 5753**

General Update

### 2017 Scarification Project:

The existing DFW Permit that covers the Scarification Project requires that a biologist be on site before and during the scarification actions. It also requires an effective wildlife survey prior to the scarification and follow up with an array of other surveys including benthic macroinvertebrates, salmon, and quality of salmon redds. All conditions of the permit have been followed. The “matched” images below were taken at the Dry Creek







Confluence. Dry Creek is on the right out of sight. The YELLOW arrows point to trees that provide match for the images. The WHITE arrow points to a gravel bar that was exposed by lower water level created when the flood debris was removed in the area selected for scarification. The scarification area has been used extensively by spawning salmon. NO gravel, cobble or other material was placed or moved into the creek during the scarification process.

**2017 Flood Event - Sand Deposition:**

The extensive floods in 2017 deposited several feet (more in some areas) of sand in the main stem of Lower Putah Creek. Example below, shows a school of salmon moving across an area that was a Scarification Control site since 2014. The area now has approximately three feet of sand over the former base of cemented benthic material. The area has proved essentially worthless for use by salmon, benthic macroinvertebrates and probably native mussels which require more plankton than is available below the Putah Diversion Dam.



**Salmon moving across the Harris Scarification Control Site on 11-10-2017.**



**2017 Flood Event: continued:**

Images below continue to demonstrate the massive amount of sand that was relocated downstream. Images are important to document the reason why benthic macroinvertebrate density and diversity has severely diminished.



Sand mound on the Morales property, approximately 1/4 mile below the Putah Diversion Dam. Mounds such as this one are common in some areas of the lower creek.



Interdam Reach at Cold Creek confluence. Canyon Creek RV Park on left. 3-15-2016 image shows the massive amount of sediment that was expelled from Cold Creek. The sediment effectively covered the streambed cobble and appeared to carry nutrients responsible for a filamentous algae bloom and increased density of New Zealand mudsnails.





*Epeorus sp.*

### **Benthic Macroinvertebrate Community**

Aquatic benthic macroinvertebrates (BMIs) are used to demonstrate ecological health of waterways. Unfortunately, long-term and recent historical events, such as floods, sediment and fire residue are not sufficiently considered in the results when the such events have the potential to directly kill or bury the invertebrates.

Invertebrate diversity and density was increasing prior to the 2014, 2015 and 2016 wildfires near Monticello Dam. Wildfire debris has negatively affected the BMI population. The floods of 2017 continued the negative impacts on the BMI community in the IDR and in Lower Putah Creek.

BMI surveys will continue, with the primary focus on species diversity and the recruitment of sensitive species from Miller Creek and other tributaries. Of high interest is the BMI response to the Scarification Project and determining the species and density of species that serve as prey species for juvenile Chinook salmon.

### **Miller Creek:**

The BMI community in Miller Creek is significant and represents possibly the best invertebrate community that can recruit into Lower Putah Creek. Several species have moved down into Pleasant Creek near the Putah Creek road bridge.



*Ameletus sp.*

Prior to the wildfires, the IDR has had significant populations of *Epeorus sp.* including the specimen on the top left. The *Ameletus sp.* is common in Miller Creek.

### **Ecological Importance:**

It should be noted that BMI recruitment into restoration areas is possibly the most important factor in watershed restoration. Aquatic and riparian wildlife can depend heavily on both phases of the BMI life cycle. Monitoring the scarification areas is crucial to the overall project as many BMI taxa and salmon require the same conditions.



### Salmon Run in Lower Putah Creek:

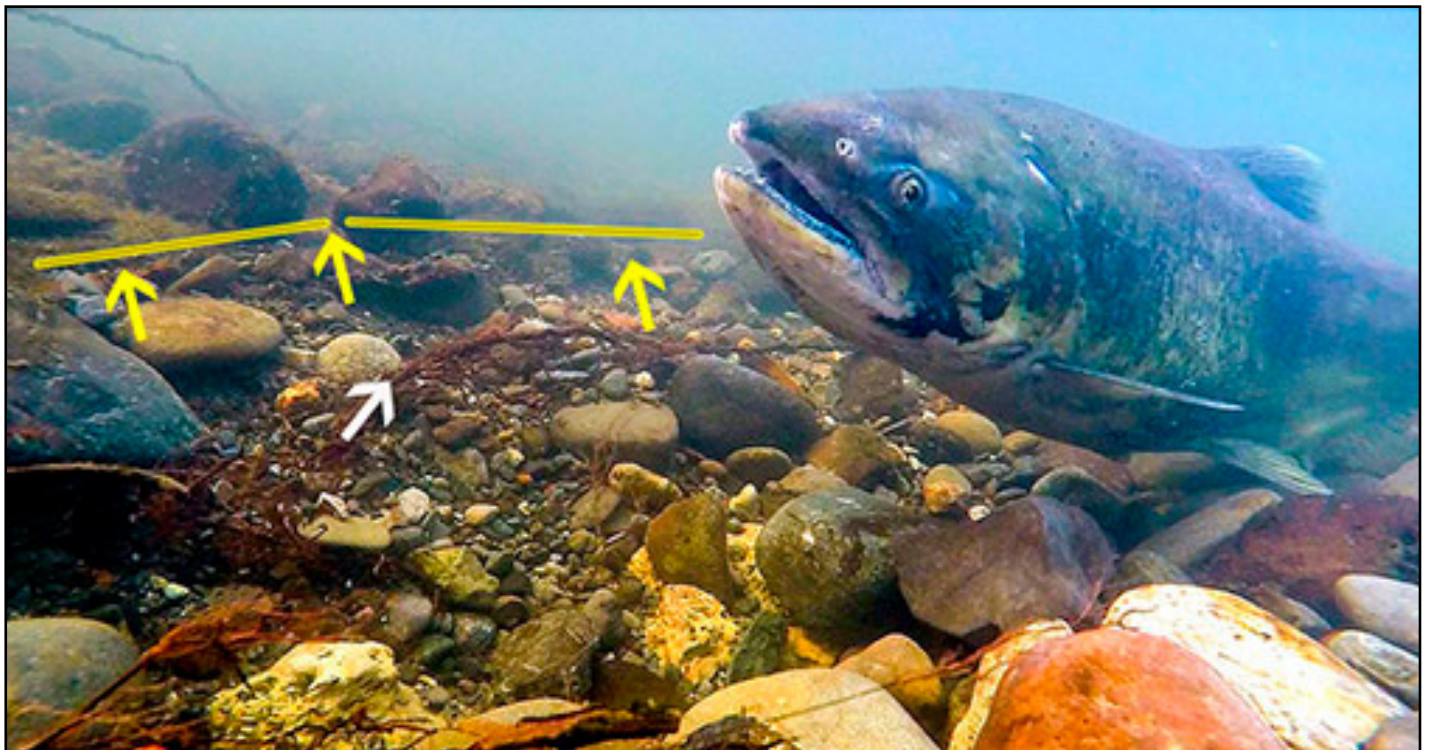
All 2017 Scarification Sites were used by spawning salmon. Per the DFW permit, I am required to monitor the salmon, the subsequent redds, and the BMI population in the scarification areas. I am also interested in the BMI species that are known to be essential prey species for juvenile salmonids. Of particular importance is the continued use of the 2014 Scarification Test site that has been used and enlarged every year by spawning salmon. Accurate measurements will be made of the enlarged areas in the near future.



**Superimposition:** Superimposition does not appear to occur at least at the number of salmon estimated to spawning in 2017. The females appear to prefer to open the edges of the scarified areas rather than spawning on existing redds.

**Image on Left:** This site is at the Dry Creek confluence. Note the ridge (yellow arrow) that shows the edge of the scarification project due to the limited reach of the excavator.

The image below shows a female salmon on 11-11-2017 in the 2014 Scarification Control site. The arrows show the upstream edge of the scarification area that was also enlarged in 2015 and 2016. It appears that the area was enlarged by at least 25 feet (2017) on the upstream side. I will elaborate more on this site in the 2017 Scarification Report.







**Spawning Salmon & Redd Conditions:**

It appears in most cases, the salmon managed to remove the sand (2017 floods) from the spawning beds. The 2017 scarification sites included new sites, former sites that were given a minor adjustment (minor scarification due to sand deposition from floods), control sites and sites that were left with no alterations. All sites will be listed in the 2017 Scarification Report.



Female salmon in the Pickerel Run Scarification area that was scarified in 2016. The site has some ideal cobble and large amounts of sand.



Pair of salmon in a 2016 Scarification site near I-505.



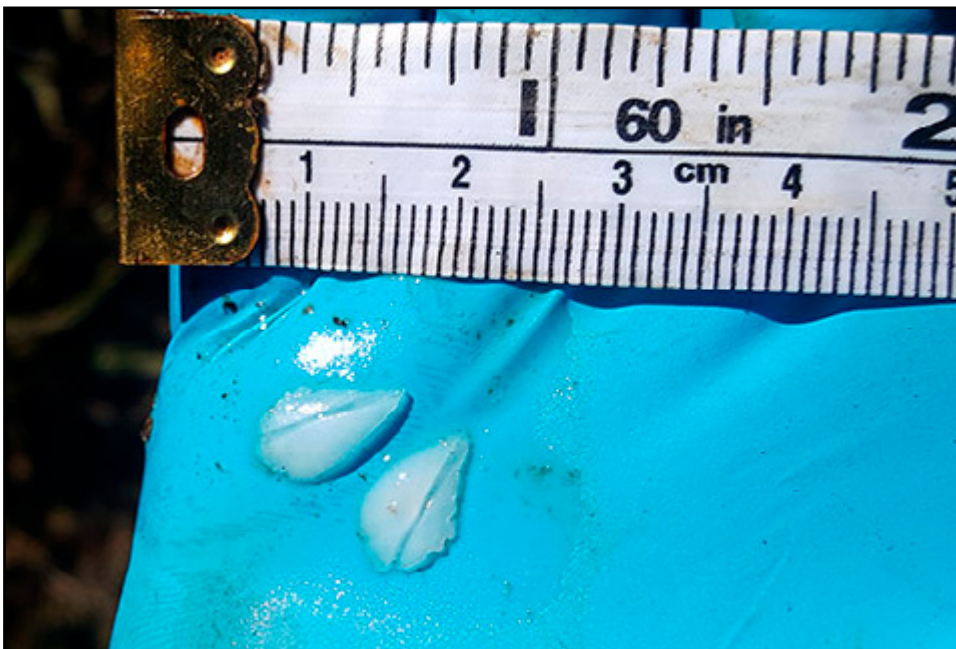
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## REPORT 5753 General Update

### UCD Salmon Carcass Survey:

I accompanied Eric Chapman and his assistant to better understand the project and obtain images. All images are available on request.



Salmon otoliths





**Putah South Canal:**

Invasive species Surveys continue in the PSC. All sediment and debris removed during the 2017 canal cleaning will be examined. Image shows a debris pool near Allendale.



**Putah South Canal:**

Infrastructure is examined from the bank.



**Lake Berryessa Eurasian Mussel Surveys:**

Mussel Surveys continue in the lake. Surveys include plankton, infrastructure and colonization trees as shown on the left. All colonization devices are examined and cleaned once per month.





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### **New Zealand Mudsnails:**

Mudsnail density is increasing in some areas. Like most other aquatic invertebrates, mudsnails were buried by sand mobilized during the 2017 floods.

Submitted via e-mail on January 9, 2018

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