6/12/07 Workshop
Suction Dredge
Deadline: 6/22/07 Noon

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June 21, 2007

Subject: **SUCTION DREDGE MINING**

Dear Board Members,

The discussion of mercury, during your recent June 12 workshop, was brought to my attention and I have been asked to comment. Specifically, there was concern expressed regarding a paper published from your Board's Water Quality Division (Humphreys, 2005). This paper discussed mercury losses and recovery during small-scale suction dredging.

The Water Board has spent a lot of time and money on mercury remediation projects with limited success. In 2001 EPA, Region 9 located in San Francisco, California did collect mercury from miners very effectively. Collections of mercury are currently happening in Oregon and Washington through the states respective Division's of Ecology and with even greater success at miner's rallies.

The suction dredge community could provide the State with a source of help that is willing to do what they do best. Prospect for GOLD! In the event that they run across a hot spot of mercury miners would be willing to hand it over to a collection facility if such a facility existed. The idea you mentioned in your Board's Water Quality Division report (Humphreys, 2005) of paying the miner's for their efforts would help facilitate this plan.

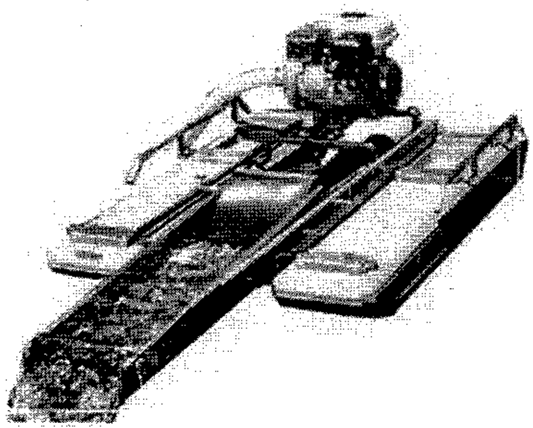
In reviewing your comments regarding possible problems associated with collecting mercury via suction dredging methods, I believe you are right to look to the suction dredge community for help locating hotspots and removing mercury from the river systems. The data provided in the report by Humphreys (2005) did not demonstrate any clear conclusions that would prohibit the State from allowing this activity. On the contrary, in the discussion of results it was stated that a suction dredge in the American River was able to collect **98 percent** of the measured mercury processed through the dredge. The results would have been much closer to 100 percent if the investigators had been using a dredge with the modern jet flare design. Even 98 percent is a huge plus for the environment and it would be irresponsible to not allow mercury to be removed from the rivers and streams whenever it is found.

DESIGN OF NEW SMALL-SCALE SUCTION GOLD DREDGES

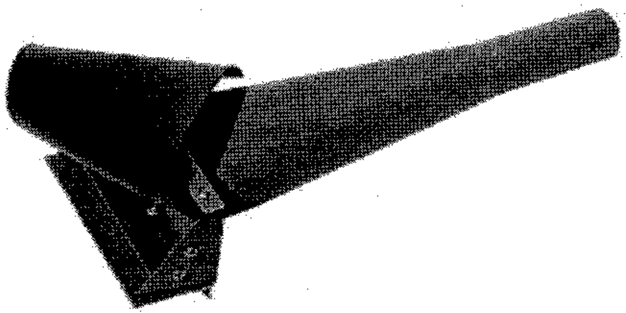
Before delving into the publication itself I would like to discuss new dredge technology that was overlooked in the planning of this study. The dredge style used in this study

has, at the head of the sluice, a "crash box". In the photograph below it is the black box to the right of the yellow engine (Ralph, 2003). I must also point out that this photograph does not illustrate normal operation of a dredge. Look at the wave of water in the sluice box. Running any dredge, using this water velocity, will surely wash the gold out of the sluice along with all the other bottom material.

Crashbox technology was replaced on the market 15 or more years ago. A jet flare now replaces the crashbox. An example of a modern Keene dredge using jet flare technology is illustrated below. You will notice that the crashbox has been removed (Keene, 2007a).



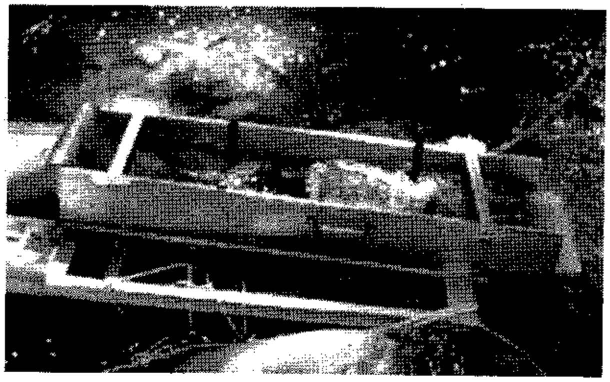
It has been replaced with a Jet flare (Keene, 2007b). The theory behind jet flare technology is that the water velocity drops off as the water and dredged materials leave



the 4-inch tube and enter the flared area that about 4-times the area of the intake. Therefore, it is unlikely that any flouring of elemental mercury would occur during the operation of the suction dredge.

In addition to using an obsolete dredge design, there was no discussion of the field crew's knowledge of proper operation of a suction dredge. These machines are not designed to start the engine, push the motor to maximum power (maximum suction) and begin mining. An experienced operator will check the water flow over the riffles in the sluice box to determine if the velocity is too high. If that is the case the operator will reduce the engine speed to adjust the water flow to a more acceptable velocity. Dredge motors are never run at maximum speed. It reduces engine life and in every case would put too much material and water through the sluice box.

The author of the site from which I borrowed the picture of the dredge with a crashbox was aware that it was operating poorly. So he removed the crash box and added a jet flare. Operation of the jet flare, on the same sluice box shown in the first illustration, is illustrated below (Ralph, 2003).

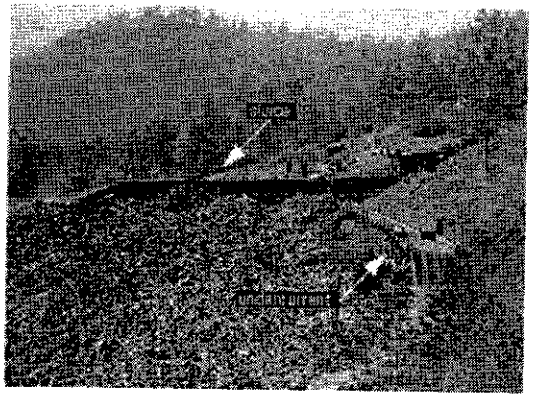


COMMENTS ON THE "MERCURY LOSSES AND RECOVERY" STAFF REPORT

In Humphreys report (2005), the author expressed concern for the loss of a small portion (2%) of the mercury from the back end of the sluice box. In the conclusions it was stated that the amount lost constituted a concentration more than ten times higher than that needed to classify it as hazardous waste. Yet 98 percent of the mercury was now secured and the process did not add any mercury to the system that was not already present. The small fraction lost, because of its density, would relocated back onto the river floor buried in the sediment close to were it was removed while dredging.

Mercury is continuously moved every winter in high storm events. Since the cessation of hydraulic mining, accumulated sediment from hydraulic placer mining has been transported to the Sacramento–San Joaquin Delta and San Francisco Bay by sustained remobilization (James, 1991). Providing a program to collect mercury from miners would aid the Water Board's mission of reducing mercury contamination in the deltas and bays where mercury methylation is a large concern.

Mercury can become floured. Alpers (2005) described this as, "gravel and cobbles that entered the sluice at high velocity caused the mercury to flour, or break into tiny particles. Flouring was aggravated by agitation, exposure of mercury to air, and other chemical reactions". In this case he was referring to a hydraulic mining sluice that contained materials that were roaring down a mountainside and fed by giant water cannons (monitors) that were used to breakup the gold bearing deposits.



(Alpers, 2005)

In the test described by Humphreys (2005) a small portion of floured mercury was collected in the sediments as they escaped the sluice box. This mercury whether floured before it entered the sluice box or not would still be in elemental form. No less toxic then the other 98 percent you are suggesting should be left in place. Aside from grossly polluted environments, mercury is normally a problem only where the rate of natural formation of methyl mercury from inorganic mercury is greater than the reverse reaction. Methyl mercury is the only form of mercury that accumulates appreciably in macroinvertebrates and fish. Environments that are known to favor the production of methyl mercury include <u>certain types of wetlands, dilute low-pH lakes in the Northeast and North central United States, parts of the Florida Everglades, newly flooded reservoirs, and coastal wetlands, particularly along the Gulf of Mexico, Atlantic Ocean, and San Francisco Bay</u> (USGS 2000).

If not collected the mercury is guaranteed to end up farther down stream, and eventually in the delta or the bay, where methylation is a real environmental problem.

It would be a highly irresponsible management practice to leave a large portion of mercury in the rivers and streams because of unrealistic concerns for the lesser amount moving only a short distance away from an operating dredge. Most likely the movement of fine mercury would extend no farther than 50-feet off the end of the sluice box. That would relate to the distance a turbidity plume might extend downstream from a small-scale suction dredge. However, if the mercury was left in place the next storm event would move it downstream closer to, and eventually into, the bay and delta.

It is unclear from reading the report whether, or not, the floured mercury was already present in the river sediments. If one were to study the picture in the report that showed the results of panning materials from a nearby creek it does appear that was the case. Because the study was conducted in a seriously contaminated area if is impossible to determine what portion of flouring of mercury, if any, was caused by the crash box design of the suction dredge in use. If indeed the crash box caused the flouring then using a jet fare type suction dredge would eliminate the problem.

Reducing the amount of floured mercury, if it is in fact occurring, would be an easily eliminated problem by operating a modern jet flare style suction. The jet flare which is widely in use today, in the suction dredge mining community, is the best equipment available for collecting fine gold and because of this design and the density of mercury it would be extremely effective in collecting mercury particles with little disturbance that would result in further breaking the mercury particles down.

It is most important to reduce the total amount of mercury in the streams and rivers and its transported downstream into the bays and deltas. This is defined as a part of TMDL goals.

We know for certain that mercury is transported downstream throughout the winter season during high water events. Therefore, anytime there is the possibility for the removal of mercury by miners it should be undertaken and supported.

I hope the comments I have provided will be helpful in your efforts regarding suction dredge mining and water quality. I thank you for this opportunity to submit this data.

Respectfully,

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