COLORADO
Division of Reclamation, Mining and Safety
Department of Natural Resources

1313 Sherman Street, Room 215
Denver, CO 80203

February 20, 2018

J. Curtis Marvel
Brannan Sand and Gravel Company, LLC
2500 E. Brannan Way
Denver, CO 80229

RE: Trout Valley Ranch; DRMS File No. M-2016-080; Notice of Complaint Against Mining Operation

Dear Mr. Marvel,

The Division of Reclamation, Mining and Safety (Division) received a complaint against the above referenced operation on February 13, 2018. A copy of the complaint letter has been enclosed for your records. The Division is currently reviewing the permit and will contact you if it is determined that an inspection is warranted.

If you have any questions, please contact me at (303)866-3567 x8116.

Sincerely,

Michael A. Cunningham
Environmental Protection Specialist

Enclosure: Complaint Letter

CC: Wally Erickson, DRMS
Trevor Messa, Save South Park

AU Placer Gold Mine – Fairplay, CO
Fall 2017

SAVING SOUTH PARK COLORADO

A collection of research and recommendations to limit the health and ecological impact of remobilizing mercury contained within historic mine tailings located in and around Fairplay, CO

February 2018

Save South Park Colorado 501(c)(3)

FORWARD

When I was teaching environmental geology at Northern Illinois University in the early 1970s, there were `no text books for this area of geology. I included in my course a section on heavy metal pollution. For example, arsenic has long been known as a poison, even in Egyptian times. From the 16th century onward, arsenic was the murder weapon of choice in the deaths of many prominent persons. Lead was another suspected heavy-metal poison, but it wasn't until the last half to the 20th century that a definite link to deleterious effects in children was established, and a ban on its use as a pigment in white paint was enacted. Mercury is another heavy metal whose effects on living animals have long been suspected, but undocumented.

Mercury is the only metal that is a liquid at standard temperature and pressure. Historically, it has many uses, but uses in the medical profession such as sphygmomanometers (blood pressure measurers) and thermometers have been phased out because of mercury's toxicity. The deleterious effects of mercury on the human organs, such as the brain, have long been known, but not understood. For example, persons making hats and handling beaver pelts treated with mercury for preservation often had mental problems; hence the phrase "mad hatter". It should also be noted that like other heavy metal poisons, the toxic effects are most severe for the unborn, and then to a lessening degree for infants, children and finally adults.

Like all heavy metals, mercury, when present, becomes increasingly concentrated as it moves up the food chain.   Mercury in its metallic state is largely inert and therefore, not harmful to members of the animal kingdom. Unfortunately, when mercury is exposed to the atmosphere, it can undergo several reactions that create very mobile and highly toxic compounds. In Minamata, Japan several years of study has finally identified methylmercury as the cause of central nervous-system disorders and death. A full description of the cause and effect of this pollution can be found at https://en.wikipedia.org/wiki/Minamata_disease.

The following report will outline some of the historic mining near Fairplay, Colorado, review studies in California where secondary recovery of mercury has created dangerous pollution problems, and examine the current situation near Fairplay.

Dr. John S. Stuckless

Introduction

In 1859, several significant gold discoveries kicked off the Colorado Gold Rush. Prospectors flooded the mountains of Colorado in search of their fortunes. Due to the rough terrain, mining was a difficult task for manual laborers, and as a result, many small claims were abandoned or sold to larger, well organized corporations, capable of supporting major mining operations. Rarely did these large-scale operations consider the damage inflicted on the landscape. Instead, they prioritized the gold content of their claims and the ability to process an abundance of ore at low costs. As a result, many mining practices were implemented using toxic mercury (Hg) that resulted in devastating ecological effects which still impact the environment today.

Mercury's ability to dissolve and bond with precious metals through the process of amalgamation has been known for thousands of years. Mining operations as recently as the 1960's used mercury extensively in gold recovery. It's historic use in placer mining, specifically hydraulic placer mining and large dredge boat operations, left mercury contaminated sediments and cobble piles that remain much the same as when the mines ceased operations decades ago. Left undisturbed, these sediments and cobble piles entomb the mercury lost in past operations, limiting its impact on the environment. However, when disturbed by mining activity and then exposed to erosion or flooding events, the formerly entombed and relatively safe mercury deposits are released into the surrounding landscape and the environment.

Extensive U.S. Geological Survey (USGS) studies have identified disturbances of historic hydraulic and dredge mining sediments as the primary cause of methylmercury contamination within the watersheds below historic mining operations. Methylmercury is a potent neurotoxin created by a complex biologic process after elemental mercury is released from contaminated sites and enters an anaerobic aquatic environment, such as lakes, streams, and wetlands. The methylmercury then bioaccumulates in the environment and can reach levels of devastating toxicity to animals and humans. Relevant examples include San Francisco Bay, CA, and many of the 96 Superfund sites across CA. In other states, like Colorado, many of these operations were not identified as Superfund sites for cleanup, probably because our mountainous mines are not concentrated around large populated centers. Moreover, most of the mountainous mines were dormant sites.

Recently, several new mining operations began reprocessing historic dredge piles and hydraulic mining sediments on existing mercury contaminated sites along the Middle Fork of the South Platte River, above and below Fairplay, CO. Permitting for these operations does not address or even acknowledge the presence of mercury within the newly permitted operations. Significant evidence exists that such operations could dramatically increase the possibility of widespread methylmercury production and contamination within the headwaters of the Middle Fork of the South Platte River, potentially impacting the ecology for up to 100 miles downstream.

The South Platte serves as a major water source for Denver, Aurora and Colorado Springs. The river sustains large cattle grazing operations and is considered a popular tourist destination for fishing and outdoor recreation. Extreme precautions must be taken to ensure that the river and its tributaries are not contaminated by the release of legacy mercury from newly permitted mining operations. It is critical that Colorado regulatory agencies investigate and address any potential for methylmercury contamination, as well as, effectively address any residual problems created by past operations.

We cannot risk sacrificing our water, our future and our children's health to the environmentally damaging operations of some miners and the hazardous fallout of their ventures.

We cannot risk sacrificing our water, our future and our children's health to the environmentally damaging operations of some miners and the hazardous fallout of their ventures.

The decisions to rezone residential areas to mining and issue permits on existing mercury contaminated sites were done without the full knowledge of the potential dangers. We understand this information was not presented to the officials making those decisions, but it was available. The purpose of this document is to collect and consolidate that information to inform the community of the significant and irreversible risks posed to public health, the environment, and our local economy by these operations.

This document presents facts based on proven science and research of similar sites across the U.S. As you read the public evidence of mercury use in the South Platte River area mines, you will see an unmistakable parallel. If sites just like these were named Superfund cleanup sites by the EPA in highly populated areas of California and elsewhere due to the significant health and environmental risks, don't our communities also deserve to be protected?

This document will inform you of the issues, research, and frightening possibilities, plus offer a plan to limit the damage. For those who wish to be on the right side of history, this is a call to action, with specific recommendations to monitor and understand the extent of the contamination. Then, armed with this data, we can together implement appropriate measures to preserve our way of life, our resources, our community's health, and economic well-being for generations to come.

Thank You!

The Founders and Supporters of *Save South Park Colorado*

To learn more, join this effort, follow our progress, or donate, please visit: www.savesouthparkco.org

Key Findings and Recommendations

Due to the extensive historical evidence of mercury use in South Park area mining, and the proven devastating health and ecological impact on similar mining operations across the U.S., we are providing the following findings and recommendations to spur action toward mitigating mercury's impact.

1-Mercury was used extensively in historic area mining.

Irrefutable evidence exists of toxic mercury use in historic area mining operations near Fairplay. Considerable data was gathered from federal studies, public records and newspaper articles. Original equipment design specifications were located, state historians consulted, and local miners interviewed. The resulting data verified the presence and use of elemental mercury in local mining operations.

2-Disturbing existing mercury piles is proven to pose considerable risk to health and fragile ecosystems.

The impact of disturbances and erosion on the mercury piles in similar mining operations across California and the Western United States was deemed the primary cause of methylmercury contamination in the tailwaters of many former placer mining operations. USGS studies have identified numerous factors contributing to the likely methylation of mercury, most of which exists within regional operations. Such operations and sites, including San Francisco Bay and the Carson River, have resulted in mercury toxicity advisories being issued for fish consumption within the regions.

3-Recently permitted operations did not consider these risks or take adequate precautions.

Colorado Division of Reclamation Mining and Safety has issued numerous mining permits for operations on the identified sites without acknowledging the presence of mercury. No protocols have been established or put in place should these recently permitted operations encounter historic deposits of mercury. Large acreages adjacent to the Middle Fork of the South Platte River have recently been rezoned by the Park County Board of County Commissioners from residential to mining, opening the door for additional contamination through the disturbance and release of mercury. Should these operations contribute to mercury methylation, the waters of the Middle Fork, which include Gold Medal fishing, Spinney Mountain Reservoir, The Dream Stream, and Eleven Mile State Park could become contaminated.

4-Immediate action must be taken to protect the health and well-being of nearby and downstream communities.

Testing methodologies for Mercury contamination on historic mine sites must be implemented immediately. Testing should include all mined or processed gravels, associated settlement ponds, historical dredge ponds, downstream fisheries, and area plant life in order to determine and understand the impact of area mining. These tests will enable experts to then determine proper courses of action.

Research studies of similar mining operation cleanups should be considered when designing recommendations.

SECTION 1:

Historic "Quicksilver" Mercury Use in Mining Operations

With the discovery of gold at Sutter's Mill in California in 1848, the Western Gold Rush began. Large numbers of miners, prospectors and anyone looking to capitalize on the newfound gold bonanza began moving west.

As a new country, the United States issued land grants to those willing to move west and risk their well-being to pursue the dream of finding gold and at the same time building wealth for the US Government. As a result, the number one priority of the Gold Rush, was to extract gold from the lands of the United States. Little thought was given to the future legacy of the gold operations. More important were the development of practices and methods to extract gold efficiently and at the lowest cost.

These practices, more often than not, never considered (or marginalized) the dangers associated with the methods of extraction. As a need arose, new processes were developed to meet the needs. In California, the need was the ability to process tens of thousands of cubic yards of gold rich alluvial soils at a minimum of cost. The answer was a new process called Hydraulic Placer Mining.

Above: Placer mining in California

Hydraulic placer mining involves the use of hydraulic water cannons shooting high pressure water at the banks of rivers, hills, or anywhere gold rich soil could be eroded with water and collected for processing below. As the eroded soils were blasted by the monitors (water cannons), it would create a slurry of soil, rock and gravel that were washed down the hillside and collected by sluice boxes running through the mining site. Large networks of sluices, tunnels and ditches were constructed to move the slurry for processing. These sluices contained ripples along the bottom, designed to catch the heavier than water, gold. Most notably, each sluice contained hundreds of pounds of liquid mercury, put in place to aid in the recovery of fine gold through a process known as mercury amalgamation. Mercury amalgamation is the process of combining mercury with another metal such as gold, creating an alloy of two, i.e., gold mercury amalgam.

After processing, the sediments would continue down the sluice, and all the waste materials would then flow out of the sluice and into the environment below. This often created large areas of sediment downstream and rendered the stream unusable for those below the operations. It is estimated that areas below the Malakoff Hydraulic Diggings in California, are more than a hundred feet deep with silt created by the hydraulic mining operations from the 1850's to the 1880's.

Above: Elaborate sluice and trough system

In 1884, The Sawyer Decision, an important California judicial judgement that prohibited the discharge of mining debris into the Sierra Nevada region, took effect, thereby protecting the downstream users from the sediments deposited by the upstream hydraulic operations. However, the practice of hydraulic mining continued in other parts of California, and gained widespread use throughout the western United States.

Mercury Use in Placer Mining[1]

Mercury's abilities to bind with precious metals has been known for thousands of years. As a result, it was used extensively to aid in the recovery of fine gold particles throughout the western United States, in both placer and hard rock mine operations. Although used extensively in hard rock mines and large mechanical dredge operations, historic records indicate that more mercury was used and lost at hydraulic mines than any other types of mines. From the 1860's through the early 1900's, it is estimated that 10,000,000 pounds of liquid mercury were lost in California alone.

Hydraulic Mining

In hydraulic mining, the typical sluice box was charged with hundreds of pounds of liquid mercury to start the season. The mercury—quicksilver—was poured into the ripples and troughs on the bottom of the sluice. As water, dirt, and cobbles washed through the sluice, the quicksilver would combine with

[1] Information compiled from a USGS fact sheet labeled: *Mercury Contamination from Historical Gold Mining in California* by Charles N. Alpers, Michael P. Hunerlach, Jason T. May and Roger L. Hothem[20]

the fine gold and settle into the ripples, while the slurry would continue down the sluice and ultimately wash out and into the environment. Gold and gold amalgam would settle into the ripples and be collected at a later time.

Turbulent, fast moving water, combined with gravel and cobble entering the system, would cause the mercury to “flour”, break into small particles, and avoid collection in the ripples. The mercury loss problem was further aggravated by agitation, exposure of elemental mercury to air, and other chemical reactions. This resulted in the fine gold and mercury particles avoiding mechanical collection and washing out of the system completely. As the season continued, additional mercury was added to the sluices on a weekly to monthly basis. Seventy-six pound flasks of liquid mercury were poured into the sluices and operations would continue. Eventually sluices would become completely lined with liquid mercury. Some mercury was lost from the sluice, either by leaking into the underlying soils and bedrock or being transported downstream with the placer tailings. Minute particles of quicksilver could be found floating on the water surface as far as 20 miles downstream of mining operations.

During the 1800’s, under the best operating conditions, sluices lost about 10 percent of the added mercury per year. Under normal operating conditions, the annual loss was 25 percent. Assuming a 10 to 30 percent annual loss rate, a typical sluice likely lost several hundred pounds of liquid mercury during the operating season. As mercury laden slurry exited the sluice, it would often run down a hand dug earthen ditch and into the water system below. The entire operation resulted in highly contaminated mining sediments and cobble, both at operating sites and large areas downstream.[20]

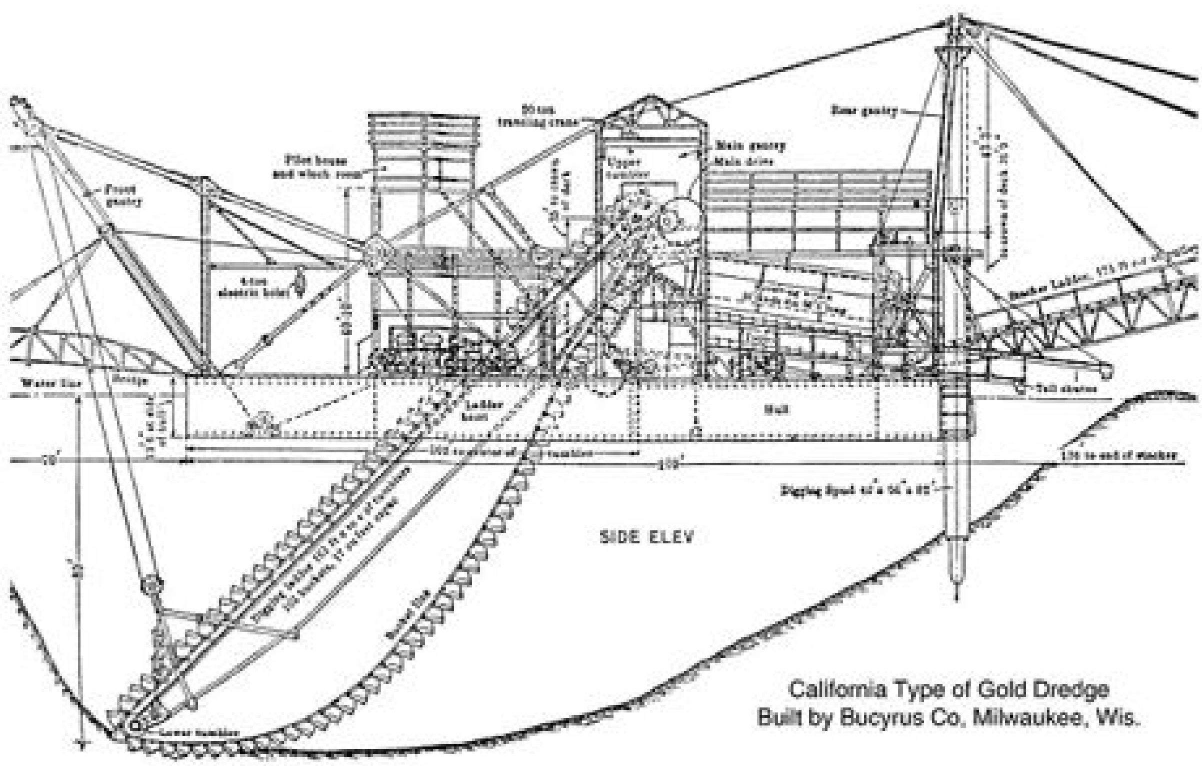
Mechanical Dredge Mining

Beginning in the later half of the 19th century, a new process of placer mining began to take hold. Modeled after units working in New Zealand, large floating processing plants known as dredges began to rework the historic hydraulic tailings and unmined alluvial deposits in the western United States. These dredges were modest in size to begin. However, a new design known as "The California Type Dredge" changed everything. Massive machines, consisting of a continuous turning bucket line, an internal processing plant, large water pumps, and a stacker unit, began to churn through the river valleys, processing areas that were previously unattainable.

Above: Yuba Gold Dredge No. 17

The largest of the dredges operating in 1948, was the Yuba dredge No.20. It was 540 feet in length, weighed 3,700 tons and had upwards of 135 large buckets. It could reach depths of 124 feet and process 125,000 cubic yards of gravel each week.[16]

A typical large bucket-line dredge consisted of an endless chain of buckets, to excavate materials. The buckets would be lowered into the pond where they would dig into the alluvium, lift the material and deposit it within the hull of the dredge. From there, the processing equipment would go to work.



California Type of Gold Dredge
Built by Bucyrus Co, Milwaukee, Wis.

Early versions would deposit the excavated material onto a shaker screen, later to be replaced by revolving screens that became industry standard by the 1930's. As the material entered the screen, it was sprayed with powerful, high volumes of water, helping to break up mud and wash large volumes of sifted and sorted sediments through the screens and into the processing equipment. Larger cobble and debris, including stumps and anything else the dredge would dig up, were rejected by the screen and sent to the stacker, a long conveyor belt, that would carry the rejected material out the back of the dredge where it was deposited into the piles we see today near Fairplay.

The screened sediments, often less than 3/4" in diameter, would then run over a large sluice/processing table, further separating the larger materials from the gold bearing "fines". Once again, the larger material was separated and sent to the stacker for disposal. The fines were then processed on shaker tables and in later more efficient models, sent to jigs where the very fine gold was captured. To aid in the capture of gold, the ribs on the tables were charged with liquid mercury, or the fines were run over mercury coated copper plates, resulting in the gold binding to the mercury coating. The machinery would be shutdown weekly, and during this time, the gold amalgam was scraped off and sent out for refining. Improved separating practices would use amalgam traps to help capture the finer particles of gold amalgam. Depending on the complexity of the dredge operation, many dredges retorted the mercury within the dredge and reused the recovered mercury.

Many of the same design issues that plagued the hydraulic mining sluices were encountered by the massive dredges. Large amounts of water, sand and gravel would cause the mercury to flour, break up into small particles, and once again avoid capture by the processing equipment. It was believed that mercury was safe if buried deep within the tailings piles, so the fine tailings chutes were the lowest chutes on the back of the dredge. The stacker would then deposit the larger stones on top of the fines, thus creating highly contaminated sediments and rock piles.

> *"Problem - mercury in old tailings. As recently as the last few decades, it was customary to use mercury in on-board sluices to assist in gold recovery. Historically huge amounts of mercury were discharged with the slurry issuing from the rear of bucket-line dredges, This mercury is now entombed in old dredge sites, residing in the undersize tailings buried deep within the rock piles. Re-mining of such sites is possible, but precautions are essential against mercury poisoning of operatives, or releasing mercury to contaminate the environment."*[16]

Evidence of Mercury Use in South Park Area Historic Dredge and Hydraulic Mining

Hydraulic Mining in the 1800's Cited in USGS Fact Sheet Under the Heading: *"Mercury contamination from Historical Gold Mining in California"* [20]

- "To enhance gold recovery from hydraulic mining, hundreds of pounds of liquid mercury (several 76-lb flasks) were added to riffles and troughs in a typical sluice. Large volumes of turbulent water flowing through the sluice caused many of the finer gold and mercury particles to wash through and out of the sluice before they could settle in the mercury-laden ripples. The average annual loss was around 25 percent. Assuming a 10-30 percent annual loss rate, a typical sluice likely lost several hundred pounds of mercury during the operating season."

Mining Historian Eric Twitty of Mountain States Historical

- Mr. Twitty is a leading state mining historian recommended to us by the Colorado History Museum. A long conversation with him confirmed the widespread use of elemental mercury in hydraulic placer and dredge mining operations in the Fairplay/Alma region as well as Breckenridge.

Hydraulic mining at the Snow Storm Mine. Note the sluice running through the middle of the site

Hydraulic mining the Alma Placer, Alma, CO

Mechanical Dredge Mining in South Park Area - Early 1940’s

Trout Valley Ranch dredge piles and ponds, east of US Hwy 285 Fairplay, CO.

Photo of the South Platte Dredge   Circa 1940’s

Dredge Design Specifications for the South Platte Dredge [24]

- Engineering and Mining Journal article from 1941, Exhibit 2. *"Colorado Attracts Another Large Bucket-Line Dredge."* Article discusses the new dredge being built in Fairplay, and its design specifications. On page 3, the amalgamation process is mentioned as follows: *"From the distributor box the fines travel over short amalgam traps and distributor ladders, arranged to control the flow of water and fines over each jig"*

Gold Dredge Operations by the South Platte Dredging Company.

- Bayou Salado, written by Virginia McConnell in 1966. On page 160, the South Platte Dredging Company operations are addressed, and the gold recovered is noted as follows: *"At its peak the dredge sent enough amalgam each week to Fairplay to retort one $6,500 ingot."*

Conclusions

Many South Park area mines are sites with evidence of considerable historic mercury usage.

- Historic hydraulic mining used (and lost) massive amounts of elemental mercury to the environment, creating highly contaminated sediments.

- Hydraulic mining sediments along the Middle Fork of the South Platte River and above Fairplay Beach are most likely contaminated with legacy mercury.

- Large dredge boat operations used (and lost) massive amount of elemental mercury. As a result, high levels of Hg are contained within historic dredge piles.

- Historical publications have confirmed the South Platte Dredge operated at (and created) the dredge rock piles at the Trout Valley Ranch south of Fairplay.

- Historical publications have confirmed the South Platte Dredge specifically used the amalgamation process to capture gold.

SECTION 2:

Associated Dangers of Disturbing Legacy Mercury

As late as the 1970's, scientists began to better understand the dangers associated with historical mining's past. California watersheds containing legacy hydraulic mining operations began attracting the attention of scientists and environmentalists when water, fish and biota tested positive for mercury. Further studies revealed that the mercury from mining operations high in the Sierras had traveled down the watersheds and entered San Francisco Bay, where it began contaminating the entire ecosystem, through a process known as bioaccumulation.

Mercury in its elemental form remains relatively harmless to the environment until a process known as "methylation" occurs. Methylmercury:([meth-*uh* l-**mur**-ky*uh*-ree] *any of several extremely toxic organometallic compounds,* $Hg(CH_3)_2$*, formed from metallic mercury by the action of microorganisms and capable of entering the food chain)* is a potent neurotoxin that impairs the nervous system, begins to bioaccumulate in the ecosystem, working its way up the food chain until every living entity within the system is contaminated. Children and fetuses are more sensitive than adults. Methylmercury can cause many types of problems in children, including brain and nervous system damage, retardation of development, mental impairment, seizures, abnormal muscle tone, and problems with coordination.

Why is this a concern? Mining practices from the 1800's through the 1960's generated huge amounts of mercury contaminated sediments. As discussed earlier, the three forms of mining most noted for the use of elemental Hg were lode mining, hydraulic placer mining and mechanical dredge placer mining. In today's world, sediments left over from these operations pose a very real threat to the environment and human health.

Large regions of historic gold mining are left with massive scars created by past practices. In some regions, mined more than 150 years ago, these scars have never healed. Large barren piles of hydraulic mining debris look much the same as they did when mining ended. Massive piles of dredge rock stretch across river bottoms, devoid of organic matter, resist revegetation and stand as a reminder of mining's destructive past.

Although barren on top, what lies within is the cause for the most concern. The mercury and other toxic chemicals lost during the original operation have now been entombed for more than a hundred years. Surrounded by dry stable environments, mercury remains fairly stable and contained within the debris. Although appearing much the same as a hundred years ago, erosion by the elements have scoured the sites of most of the surface mercury. Events such as flooding and weather-related erosion, continue to slowly release the internal contents. Without costly mitigation, it is estimated this will continue for the next 10,000 years.

Why is there renewed interest in these deposits, and why does it matter?

Due to the inefficient nature of historic hydraulic mining, new and efficient mining technologies have once again targeted the regions of past mining. Much of the gold lost during original processing can now be recovered by new processes. Massive stockpiles of old dredge workings are viewed for their aggregate value in construction, as well as the residual gold missed by the dredges. As efficient as dredges were, calculated design criteria lead to the loss of significant gold. Why spend tens of thousands of dollars to collect a few extra gold nuggets that were valued less than the upgrades required to collect them?

For years, little thought was given to the use of tailings as fill, crushed rock or any other use deemed appropriate. As the process of mercury methylation became better understood, studies were undertaken to help identify the sources of the methylating mercury in California and other western states. In Nevada's Carson River watershed it was found that mercury concentrations were increasing with time, and pools of liquid mercury were observed to shift from a solid phase to an aqueous phase thus signaling deteriorating ecological conditions with respect to mercury contamination (Morway, 2017). It was also found that mercury is selectively dissolved out of mercury-gold amalgam deposits and into fine grained sediments, which are then deposited downstream (Lechler, 1996). Bonzongo, 1995, found an increase of 4 ng/l of mercury upstream from mine tailings while there was an increase of 1500-2100 ng/l downstream from tailing piles. He also found that concentrations of total mercury were enhanced by contaminated particles during snowmelt events.

Research conducted by the USGS and many federal and State agencies identified the release of elemental mercury from eroding historic hydraulic and dredge mining tailings as one the problems. Additional concern was raised that human related activities such as dredging operations, conducted in or near the river, raised the risk of further contamination. The following two abstracts provide the summation of information presented in the studies.

A. The effects of sediment and mercury mobilization in the South Yuba River and Humbug Creek Confluence Area, Nevada County, California: Concentrations, speciation, and environmental fate-Part 1: Field characterization Open-File Report 2010-1325-A

Millions of pounds of mercury (Hg) were deposited in the river and stream channels of the Sierra Nevada from placer and hard-rock mining operations in the late 1800s and early 1900s. The resulting contaminated sediments are relatively harmless when buried and isolated from the overlying aquatic environment. The entrained Hg in the sediment constitutes a potential risk to human and ecosystem health should it be reintroduced to the actively cycling portion of the aquatic system, where it can become methylated and subsequently bioaccumulate in the food web. Each year, sediment is mobilized within these fluvial systems during high storm flows, transporting hundreds of tons of Hg-laden sediment downstream.

The State of California and resource-management agencies, including the Bureau of Land Management (BLM) and the U.S. Forest Service, are concerned about additional disturbances, such as from suction gold dredging activities, which have the potential to mobilize Hg associated with buried sediment layers elevated in Hg that are otherwise likely to remain buried under normal storm conditions. The BLM initiated a study looking at the feasibility of removing Hg-contaminated sediment at the confluence of the South Yuba River and Humbug Creek in the northern Sierra Nevada of California by using standard suction-dredge technology. Additionally, the California State Water Resources Control Board (SWRCB) supported a comprehensive characterization of the intended dredge site. Together, the BLM and SWRCB supported a comprehensive characterization of Hg contamination at the site and the potential effects of sediment disturbance at locations with historical hydraulic mining debris on downstream environments.

B. USGS: The Effects of Sediment and Mercury Mobilization in the South Yuba River and Humbug Creek Confluence Area, Nevada County, California: Concentrations, Speciation, and Environmental Fate–Parts 1 and 2 http://pubs.usgs.gov/of/2010/1325A, http://pubs.usgs.gov/of/2010/1325B[21]

The USGS made several important findings in their reports, published in January 2011:

1. Fine-grained sediment (silt and clay) contains higher concentrations of Hg than coarse-grained sediment (sand) in the main channel of the South Yuba River and in nearby stream-bank deposits. Suction dredging disturbs the sediment in the stream bed. Although dredging may remove heavy minerals (including gold, gold-mercury amalgam, and free elemental Hg) from coarse-grained sediment (sand and possibly also coarse silt), it does not remove them from fine-grained sediment (fine silt and clay), nor does it remove Hg-bearing particles of lighter density. Fine-grained, Hg-laden sediment that passes through a dredge is likely to be mobilized and transported downstream, causing increased concentrations of mercury that can potentially become methylated and then bioaccumulate in the food web.
2. In lab experiments simulating the transport and deposition of Hg-bearing particles, fine-grained sediment from various locations in the South Yuba River / Humbug Creek confluence area was mixed with fine-grained material from two downstream areas, Englebright Lake and Delta Meadows. Some of these experiments resulted in increased methylmercury concentration.
3. The USGS study included three excavations – two above the water line and one in the stream bed. The study found that mining above the water line (high-banking) is potentially more harmful than in-stream mining because the exposed Hg is more reactive (more likely to methylate). Suction dredging of in-stream deposits appeared to be potentially less harmful than high-banking because the Hg in the stream-bed deposits is relatively less reactive in water-saturated conditions. However, Hg-bearing particles are exposed to oxygen during downstream transport, which tends to make the transported Hg relatively more reactive and more likely to become methylated and bioaccumulated.
4. Small beads of elemental Hg (less than 0.01 millimeter in diameter) were found on the surface of gold-mercury amalgam grains which had been recovered by hand panning of material from one of the excavations above the water line. There is potential for small beads of elemental Hg

to be released to the water column when this kind of material is processed through a suction dredge or sluice box. Grains of gold-mercury amalgam recovered from the sluice box of a suction dredge that processed bed sediment from the South Yuba River did not have beads of elemental Hg on their surface.

5. An unconsolidated deposit of hydraulic mining debris is eroding into the South Yuba River, releasing fine-grained particles with elevated concentrations of reactive Hg that is already oxidized and ready for methylation. Once methylated, the Hg is highly bioavailable and accumulates in sport fish, especially in top predator fish such as largemouth and smallmouth bass. There is a fish-consumption advisory for Englebright Lake (located about 15 miles downstream of the study area) and several other water bodies affected by historical mining in the Sierra Nevada. For more information, see: http://www.oehha.ca.gov/fish/so_cal/
6. An experiment to test the efficacy of zero-discharge dredging, by recirculating water through a 300-gallon tank in a closed circuit by using a venturi pump, resulted in fine-grained sediment remaining in suspension more than 40 hours after the cessation of pumping. Although the total concentration of suspended Hg declined over time as particles settled out, both the concentration of Hg on the suspended particles and the Hg reactivity increased over time as the suspended material became finer grained.
7. The USGS found higher levels of methylmercury in macroinvertebrates collected during 2007 (the most recent year that suction dredging was permitted in the South Yuba River) compared with 2008 (when suction dredging was not permitted in that area). More monitoring would be needed to determine whether the observed year-to-year variation was caused primarily by suction dredging or by other factors.

What happens when elemental mercury mobilizes into a stream?

As presented earlier, USGS research on elemental mercury buried and isolated from an aquatic environment, remains relatively harmless until it is reintroduced into the environment. Disturbances created by mining activities have been demonstrated to mobilize the contained Hg, resulting in the likely methylation of mercury when the sediments are introduced into a cycling aquatic system. This methylated mercury represents a clear danger to the environment and humans.

The following study presents the findings of a USGS study on mercury in the Nation's streams. The photos presented represent identified mining activities in the region of Fairplay, Colorado. These operations are above the Middle Fork of the South Platte River, and are located on or adjacent to historical hydraulic and dredge mining operations.

USGS, Mercury in the Nation's Streams—Levels, Trends, and Implications
By Dennis A. Wentz, Mark E. Brigham, Lia C. Chasar, Michelle A. Lutz, and David P. Krabbenhoft [17]

Mercury occurs in several different geochemical forms, including elemental mercury, ionic mercury, and a suite of organic forms, the most important of which is methylmercury. Methylmercury is the form most readily incorporated into biological tissues and the most toxic to humans. The transformation from elemental mercury to methylmercury is a complex biogeochemical process and is controlled by sulfate-reducing bacteria and other microbes that tend to thrive in conditions of low dissolved oxygen, such as the sediment in lakes, wetlands and river banks.

Methylmercury enters the aquatic food web when it's taken up from water by algae or other aquatic microorganisms. The concentration of methylmercury generally increases by a factor of ten or less with each step up the food chain, a process known as biomagnification. Therefore, even though the concentrations of mercury in water may be very low and deemed safe for human consumption as drinking water, concentration levels in fish, especially predatory fish, may reach levels that are considered potentially harmful to humans and fish-eating wildlife, such as bald eagles and osprey.

The USGS fact sheet labeled: "Mercury contamination from Historical Gold Mining in California", states the following:[20]

"Mercury contamination from historical gold mines represents a potential risk to human health and the environment" it goes on the say, "This fact sheet provides background information on the use of mercury in historical gold mining and processing operations in California, with emphasis on historical hydraulic mining areas." "Miners used mercury (quicksilver) to recover gold throughout the western United States. Loss of mercury during processing was estimated to be 10-30 percent per season. Resulting in highly contaminated sediments at the mine sites, especially in sluices and drainage tunnels."

Five Disturbing Facts Concerning the Dangers of Mercury Contamination

FACT #1: Mercury contamination lasts a very long time. [17]
Fish methylmercury concentrations in streams are typically highest in wetland dominated landscapes, particularly in the coastal plains regions of the Southeastern United States. Methylmercury concentrations are also high in the Western United States, but only in streams that were historically mined for mercury or gold. Methylmercury concentrations in fish tend to be low in major urban and agricultural areas. The large amounts of mercury in mined ecosystems still contaminate fish decades after mining activity has ceased and without costly remediation, will likely continue to contaminate fish into the future. [17]

Left: JRS and Gloria Z mining operations next to the Middle Fork of the South Platte River. Note the wetlands along the river.

Left: Google earth view of mining operations taking place on hydraulic waste piles, adjacent to Fairplay, CO. Note wetlands from below mine down to and below Fairplay Beach.

<u>FACT #2: Wetlands, like those in South Park, are the most vulnerable environments for mercury contamination.</u>[17]

The abundance and characteristics of wetlands are key factors that affect the ability of stream ecosystems to transform mercury into methylmercury.

Methylmercury concentrations in stream water, fish, and other aquatic organisms, correlate strongly with wetland abundance in stream basins. Wetland characteristics, such as limited dissolved oxygen concentrations and abundant organic matter, provide favorable environments for microorganisms to convert inorganic mercury to methylmercury. Methylmercury production in wetlands and other aquatic ecosystems generally increases with increasing sulfate, which can be contributed to anthropogenic (of, relating to, or resulting from the influence of human beings on nature) sources.

Water-level fluctuations, including drying and wetting of soil and aquatic sediment, also, exacerbate mercury methylation. Fluctuating water levels can result from water-management actions, spring snow melt, and projects such as dam construction.   In addition, climate change is likely to increase the frequencies and intensities of droughts and storms, thus amplifying water-level fluctuations and increasing methylmercury concentrations. [17]

Above: Wetlands enroute to Spinney Mountain Reservoir, 22 miles from Fairplay
Wetlands are nearly continuous from Fairplay to Reservoir.

FACT #3: Methylmercury is extremely toxic to wildlife.[17]
Methylmercury poses a significant threat to wildlife—including fish, amphibians, reptiles, birds and mammals—because of its high bioavailability, its substantial bioaccumulation in food webs, and its extreme toxicity. Aquatic food webs are important pathways for exposure of wildlife, particularly in mercury methylating landscapes, such as wetlands. Processes and factors that control the production of methylmercury in ecosystems (or its concentrations at the base of food webs) strongly influence its concentrations in fish and wildlife supported by those food webs. In some ecosystems, exposure levels are high enough to adversely affect the reproduction and health of wildlife.

The adverse effects of methylmercury on the central nervous system and neurological function in wild birds and mammals have been well documented. It is becoming increasingly evident that the scope and severity of the mercury problem for wildlife have been substantially underestimated.[17] In birds, methylmercury in the diet of reproducing females is transferred to the developing egg—the most sensitive life stage, and as a result, reduced reproductive success has been associated with methylmercury exposure in field studies. [17]

<u>FACT #4: Methylmercury poisoning from fish consumption poses great risk to humans.</u>[17]
Methylmercury exposure from fish consumption has been associated with various adverse effects on human health, ranging from central nervous system toxicity in adults exposed to extremely high levels, to diminished cardiovascular health and endocrine disruption at lower exposure levels. Long term reductions or impairments in brain function in children associated with methylmercury exposure have been reported in studies around the world. The most well-established effects on humans at the relatively low levels of methylmercury exposure typical of fish-consuming populations are neurological impacts on children exposed in the womb, particularly during the third semester. High levels of exposure to inorganic mercury (primarily through inhalation of elemental mercury) also can cause negative health effects, such as kidney failure and central nervous system toxicity. [17]

<u>FACT #5: Although methylmercury leaves your body over time, the damage is irreversible.</u>
Although methylmercury is a potent neurotoxin that bioaccumulates in the ecosystem, natural biological processes in living beings slowly process the mercury and remove it from the body. Unfortunately, any exposure damage will remain after the methylmercury has left the system.

Conclusions:

Disturbing existing mercury piles is proven to pose considerable risk to health and fragile ecosystems.

- USGS has conducted extensive research on the release of mercury from historic mining operations.
- When elemental mercury is released into a wet anaerobic environment such as lake sediments, wetlands or river banks, a complex biological process occurs which creates methylmercury. Methylmercury is a potent neurotoxin that bioaccumulates in the ecosystem.
- Wetlands are especially liable to produce methylmercury.[17]

- Contaminated sediments are relatively harmless when buried, but when disturbed, they can be reintroduced to an aquatic ecosystem, resulting in methylation and bioaccumulation in the food web. Bioaccumulation is the process of organisms within the food chain absorbing methylmercury at a rate faster than that at which the methylmercury is lost to catabolism and excretion.

- USGS studies have confirmed that activities such as mining have mobilized Hg associated within buried sediments that would have otherwise likely remained buried under normal circumstances.

- USGS concluded that fine sediments contain the greatest amount of mercury available for methylation.

- USGS concluded that mining from above the waterline is potentially more harmful than in-stream mining, because the Hg exposed is more reactive (more likely to methylate).

- USGS has conducted experiments that have shown fine mercury contaminated sediments can remain suspended in water for up to 40 hours.

- Consuming methylmercury-contaminated organisms is more dangerous to children and fetuses than adults. Methylmercury can cause many types of problems in children, including brain and nervous system damage, retardation of development, mental impairment, seizures, abnormal muscle tone, and problems with coordination.

- It is becoming increasingly documented that "fish and wildlife from various ecosystems reach mercury levels of toxicological concern when directly affected by mercury-infused emissions from human-related activities. Human health concerns arise when fish and wildlife from those ecosystems are consumed by humans." USGS fact sheet 216-95

SECTION 3

Current South Park Area Mining Operations Reprocessing Historic Hydraulic and Dredge Mining Sediments

Accounts and documentation on the use of mercury in the South Park region of Colorado.

- USGS report "Mercury Contamination from Historical Gold Mining Operations in California"
- Fall of 2017, phone conversation with Eric Twitty from Mountain States Historical. Conversation confirmed the widespread use of mercury in historical dredge and hydraulic mining operations in the South Park Region as well as Breckenridge.
- Fall of 2017, first hand conversations with local miners, including a conversation about the silver soil unearthed at the AU Pit north of Fairplay Beach.
- Fall of 2017, first hand conversations about the process of retorting mercury recovered from the AU Pit.
- Summer 2016, replacement of culvert in Alma, CO unearthed a pool of liquid mercury below.

Historic hydraulic and dredge piles along the Middle Fork of the South Platte River.

- Conversation with Boyd Astemborski, 2015 and 2017. He operated the Katushka Mine. Several conversations revealed that during his mining operations at the Katushka pit, he encountered "silver dirt".
- He also stated that he recovered and sold more than $500 worth of liquid mercury.

Above: 1940's photo of hydraulic mining dump between Fairplay and Alma, CO. This is the future location of Fairplay Beach. It is also the site of the disputed mining operations.

Current operations in areas likely contaminated with mercury:

1. High Speed Mining LLC, Fairplay AU Pit. DRMS permit no. M1991037

2. JRS Mining, LLC., Sullivan Aggregate Pit. DRMS permit no. M2015017

3. Sanborn Sand & Gravel, dba, Golden Cross Aggregates Inc. , Gloria Z Mine, DRMS permit no. M1984094**. Although this site was not historically mined, diggings from the surrounding historical mines were processed on this site, and large quantities of stumps and slash were burned here.**

4. Brannon Sand & Gravel Co. LLC. Trout Valley Ranch. DRMS permit no. M2016080

5. All placer mining and aggregate operations reworking historical hydraulic and dredge workings on the Middle Fork of the South Platte River and Beaver Creek, from the Fairplay region to the top of Hoosier Pass, in Park County.

Practices likely releasing mercury into the environment:

High Speed Mining Inc. Fairplay AU Pit DRMS Permit no. M1991037

Letter to Michael Cunningham, Division of Reclamation and Mining Safety from Greg Lewicki and Associates, PLLC. Environmental engineering firm representing Lance Baller, applicant for the AU Pit. RE: Fairplay AU Pit, M-1991-037, Conversion Application (CN01) – Adequacy Response 2.

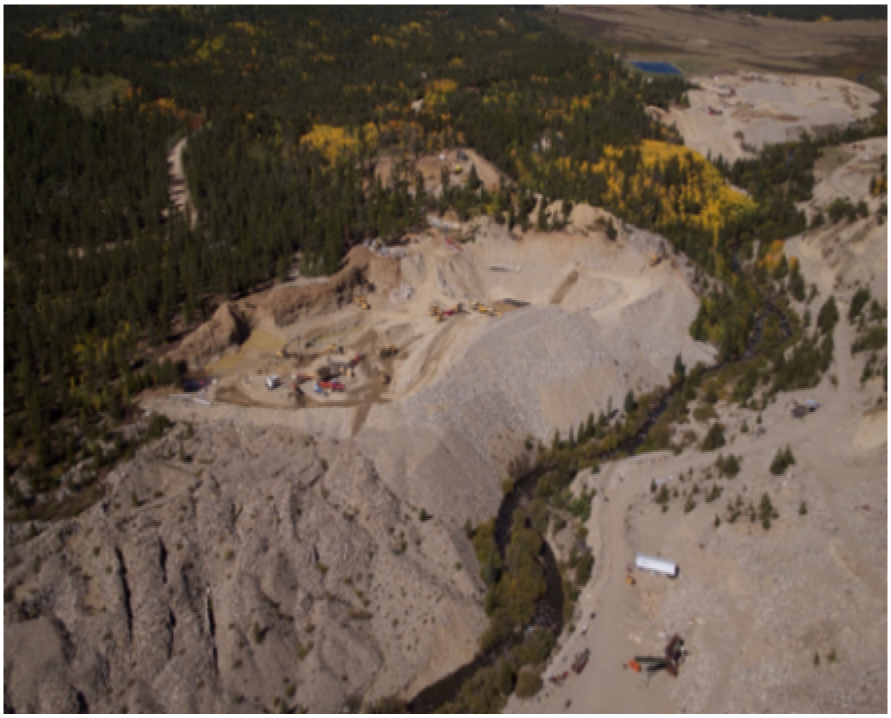
Page A-1 Introduction: "*These deposits and reworking of approximately 1860's era hydraulicking tailings will serve as the source of aggregate and placer gold mined here. Most of the deposits along the Middle Fork of the South Platte River in South Park were mined for gold in the latter half of the 19th century by hydraulicking and a large dredge. This left behind large piles of washed rock. These piles will be the primary source of sand and gravel for the operation – the secondary mined commodity onsite*".

Why is this of concern? USGS has identified historic hydraulic placer mining sediments as the primary source for methylmercury contamination in watersheds below historic hydraulic sites. Additionally, the USGS studies have concluded that more mercury was lost by historical hydraulic mining operations than any other form of placer mining.

Current and permitted operations by High Speed Mining Inc. are actively reworking the historic hydraulic mining deposits along the Middle Fork of the South Platte River, abutting the Town of Fairplay and directly above the Fairplay Beach recreation area, a popular fishing and day use area. Activities include fishing, fly fishing courses, picnicking, annual youth trout fishing tournament, annual llama running race (The Llama Rama) hiking trails, camping sites, and recreational gold panning. Most importantly, the Middle Fork of the South Platte River is the headwaters of the Platte River system and a major water source for the City of Denver, Colorado Springs, Aurora and many areas near the Front Range of Colorado.

Mining site preparation includes the removal of tree, bushes and willows growing on the historic tailing piles. Additionally, all topsoil is removed and stored onsite. The onsite vegetation has been burned in several instances. Note it has been scientifically documented that willows and trees uptake methylmercury, particularly the root systems.[18] The Gloria Z mine was issued a burn permit from the Colorado Department of Public Health and Environment last fall. Contrary to the rules stipulated on the permit, the Gloria Z mine staff burned hundreds of stumps and slash that accumulated on its property. Some of these stumps and slash may have been contaminated with mercury. This burning activity has happened on both the AU site as well as the Gloria Z pit. In both instances the smoke that was generated heavily infiltrated the Town of Fairplay and the flat plains east of Town.

The mining operations consist of excavating the existing workings, loading, and transporting the diggings to an on site wash plant. Mined rock is then run through the wash plant, separating the gold bearing fines from the aggregate. The wash process is heavily reliant on water, which is stored in a containment pond and continually recirculated, adding water as needed. The wash and sediment ponds are then drained and cleaned throughout the operating season. As spelled out in the operating permit, due to a lack of natural topsoil, fines from the basins will be dried and stored onsite for future use as topsoil. These fines may be contaminated with legacy mercury.



Above: Steep walls built with mining debris along the Middle Fork of South Platte River, summer 2017

The process of digging and transporting mined material creates dust and debris rolling into the Middle Fork. In addition, the newly mined tailings are stacked in steep piles along the river. The newly constructed piles are then subject to erosion and runoff from snow melt and summer rains resulting in the deposition of potentially contaminated sediments into the river.

As noted in section 2, the USGS has concluded that mining from above the waterline is potentially more harmful than in-stream mining, because the Hg exposed is more reactive (more likely to methylate).[21] The suspended sediments then travel 800 yards downstream to Fairplay Beach, where they begin to settle into the lake. As noted in Section 1 conclusions: *When elemental mercury is released into a wet anaerobic environment, such as lake sediments, wetlands, river banks, a complex biological process takes place, creating methylmercury.*[17]

Above: Muddy water after heavy rain at Fairplay Beach, Summer 2017

The following google earth photos show the changes in the sandbar at Fairplay Beach. The first image was taken in 2010 prior to commencement of operations at the Katushka Mine in 2011. The second image was taken in 2017 after 7 years of mining operations at the Katushka Pit, later changed to the AU Mine. Notice the growth of the sandbar. Nearly 20% of the water surface area is now gone to sedimentation.

As the diggings are processed, they go through a separation process, similar to those originally used, with the current exception of the use of a closed wash basin. This opens the door to additional Hg concentration issues. As the historic tailing are run through the separation process, it would be expected that the inorganic Hg contained in the tailings would separate from the processed fines and collect in the processing equipment, along with the extracted gold, in many cases, creating a gold-based amalgam. Hg that has floured by the mechanical separation, or been absorbed by fine sediments, will most likely escape collection resulting in the deposition of Hg in both the wash basin and settlement ponds.

The process raises several troubling questions. What happens to the liquid mercury that is collected? How is the collected liquid mercury disposed? Elemental mercury will vaporize at normal atmospheric pressure and temperature, should it be stored outside of an approved storage container, releasing it into the atmosphere. Second, the recovered Hg contains gold. The general practice of separating the Hg from the gold requires the use of a retorting process - vaporizing the mercury through heat, then re-condensing the vaporized Hg and collecting the liquid mercury. This is a very dangerous process. Vaporized Hg released into the atmosphere has led to mercury poisoning and death.

What happens when sediments containing mercury are used for site reclamation? When fines recovered from the wash ponds are applied as topsoil, the resulting contamination will likely include the entire river basin adjacent to the site and the Town of Fairplay. Without groundcover, the topsoil will dry and likely become airborne, resulting in massive mercury mobilization due to the common and persistent high winds in the region. As a general rule of thumb, the predominant regional wind patterns are from the north-northwest. The Middle Fork of the South Platte river flows South to South East, resulting in mercury contaminated dust blowing into the Town and river. It should be noted that the South Park K-12 school campus is located .67 miles Southeast of the existing mine operations. The dangers of children inhaling mercury contaminated sediments have been documented to cause devastating long term health consequences.

These waters are also the headwaters of the Platte River and serve as a major water source for the City of Denver, City of Aurora, and the City of Colorado Springs. It is becoming increasingly documented that "*Fish and wildlife from various ecosystems attain mercury levels of toxicological concern when directly affected by mercury-containing emissions from human-related activities. Human health concerns arise when fish and wildlife from those ecosystems are consumed by humans.*" USGS fact sheet 216-95
The Middle Fork has been designated by the Colorado Wildlife Commission as a a Gold Medal fishery, including the legendary section of river known as the "Dream Stream," located between Spinney Mountain Reservoir and Eleven Mile Reservoir.

JRS Mining, LLC., Sullivan Aggregate Pit. Drms Permit no. M2015017
Adjacent to the Fairplay AU Pit and includes 1860's hydraulic mining tailings.

Operations here are similar in scope and location to the AU Mine. Operations take place on both sides of the Middle Fork of the South Platte River, and include two roads that cross the river., thereby directly introducing sediment into the river.

Brannon Sand & Gravel , LLC. Trout Valley Ranch Drms permit no. M2016080

Above: Dry crushing operations at Brannon Sand and Gravel. Note large amounts of dust in air, Fall 2017

Current operations consist of excavating and dry crushing historical dredge workings from the South Platte Dredge. The use of elemental mercury has been established in the operation of this large dredge. The crushed rock is then loaded into semi trucks and transported 80 miles to the front range of Denver. More than 50-60 trucks are loaded and hauled to the front range daily. Transport occurs daily without any dust containment apparatus, resulting in the continual distribution of dust from the crushed dredge rock, along the entire 285 corridor from Fairplay to Denver. This is potentially contaminating the entire valley with mercury contaminated crushed rock dust. Much of the route follows the North Fork of the South Platte River from Kenosha Pass to Bailey.

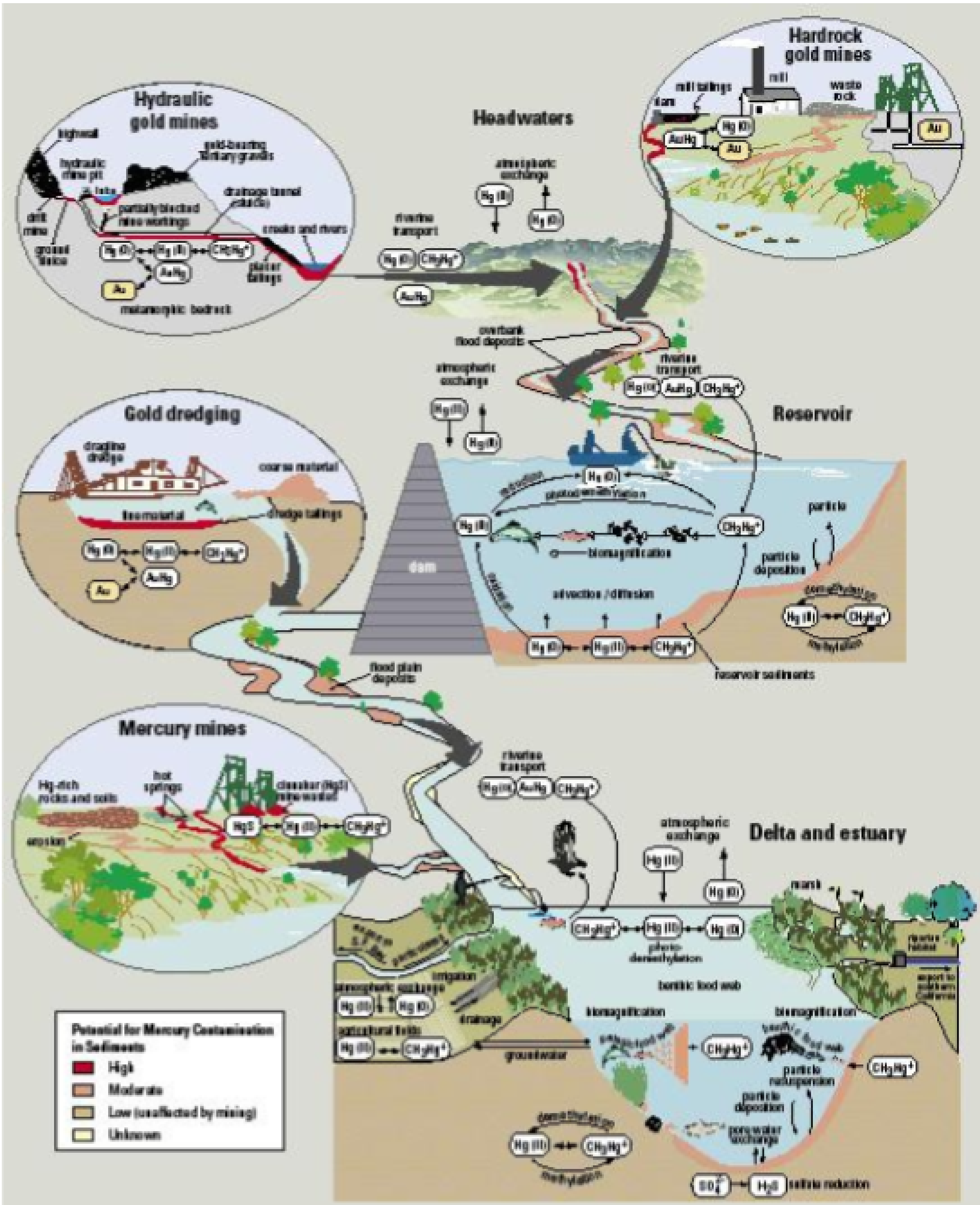
Photo from same location when no crushing operations are taking place. Fall 2017

DRMS permitting outlines and reclamation plans (included in the operating permit) include the use of fines from crushing and sediments from onsite lakes (created by the dredge) as topsoil for the reclamation of the site. The fines are to be stored onsite until used. As established in Part 1, the most contaminated sediments from dredging operations are located in the fines and in the pond basins created by the dredge operations. Allowing these sediments to be stacked and stored onsite is potentially remobilizing the mercury contained within the lakes onsite. The permit also calls for the excavation of all dredge piles to a depth of 20 feet below the surface of land. This is once again the location of the most contaminated sediments released by dredging operations.

Placing it as topsoil will greatly add to the further remobilization of the contaminated deposits. Fairplay is well known for its high sustained winds and lack of winter snow cover on the site.

The permit states that mining may not take place within 200 feet of the Middle Fork of the South Platte River, but this protection may not be adequate considering that dust from the operations enters the air and settles within the surrounding valley, including the river. Add this to the AU gold mining operations and the JRS mining operations taking place 1.29 miles upstream, it would stand to reason that the potential for mercury contamination within the river is significant.

Google earth photo of Brannon Sand and Gravel operating on the Trout Valley Ranch.



Above: USGS schematic showing the transport of mercury and potentially contaminated sediments from the mountain headwaters (hydraulic drift, and hardrock mine environments) through rivers, reservoirs and the flood plain, and into the estuary. A simplified mercury cycle is shown, including overall methylation reactions and bioaccumulations, the actual cycle is much more complex. USGS

Conclusions:

South Park area mines are disturbing existing mercury piles, but rezoning and permitting did not consider these risks.

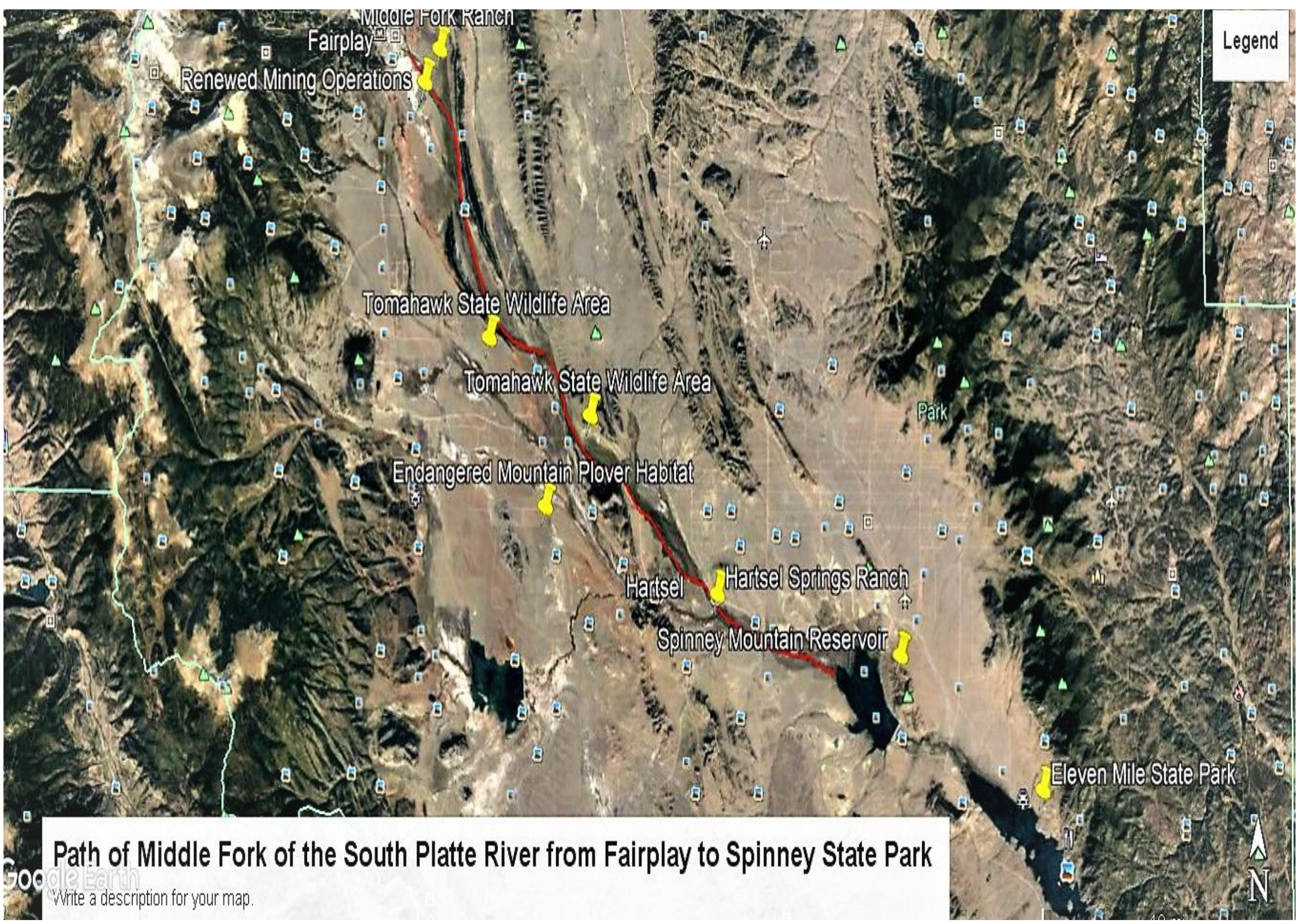
- Mining activities in the Fairplay, Colorado region are reprocessing historic hydraulic sediments along the Middle Fork of the South Platte River.
- State mining permits do not mention or consider mercury contamination, or what to do if mercury is encountered.
- Sediments from these mines are entering the river as a result of snow melt and summer rains.
- Erosion of disturbed sediments into cycling aquatic environments will likely transport the mercury for methylation.
- Sediments pulled from processing ponds (categorized by the USGS as the most contaminated) for reclamation purposes will likely be contaminated with mercury.
- Contaminated sediments used for reclamation purposes will likely mobilize through the adjoined valley, river and Town of Fairplay
- Rezoning 28 acres of Residential land to Mining did not take into account that the subject property was likely contaminated with elemental mercury.
- Dredge rock dry crushing operations are generating large amounts of dust and potentially mobilizing the contained mercury.
- Crushed rock from Brannon Sand and Gravel is being trucked 80 miles to Denver at a rate of 50 - 60 trucks per day.
- Brannon transport trucks have no dust containment systems
- All dredge piles are to be excavated to a depth of 20’ below ground level. The highest levels of mercury contamination exist within the fines buried under the large cobble.

SECTION 4:

Immediate corrective and preventive action must be taken to protect the health and well being of local and downstream communities

Water from the South Park area below the mines of concern flows downstream to Spinney Mountain Reservoir and 11 Mile Reservoir, through almost continuous wetlands.

Areas of potential impact, starting in Fairplay and ending at 11 Mile State Park



Above: Wetlands on the Middle Fork Ranch, Fairplay, CO

Above: Calves coming home after a large-scale cattle round up on the Middle Fork Ranch

- ***Where does bioaccumulation start? Plants and other small organisms, such as plankton, are typically the starting point for the bioaccumulation of mercury. Plants and other autotrophic organisms take in methylmercury from the environment by the simple process of surface absorption.***
- ***Cattle consuming contaminated grass will become contaminated, and a result, humans eating the contaminated beef will become contaminated.***

Above: Mountain Plover in South Park

"On February 16, 1999, a notice was published in the Federal Register proposing to list the Mountain Plover as a Threatened Species.

We estimated the population of plovers in South Park at 2,310 adults. We conclude that South Park represents a contemporarily large concentration of breeding Mountain Plovers."

THE HIGH-ELEVATION POPULATION OF MOUNTAIN PLOVERS IN COLORADO

Michael B. Wunder, Fritz L. Knopf Chris A. Pague

USGS - Mercury in the Nation's Rivers

"Methylmercury has been demonstrated to reduce the reproductive success of birds exposed."

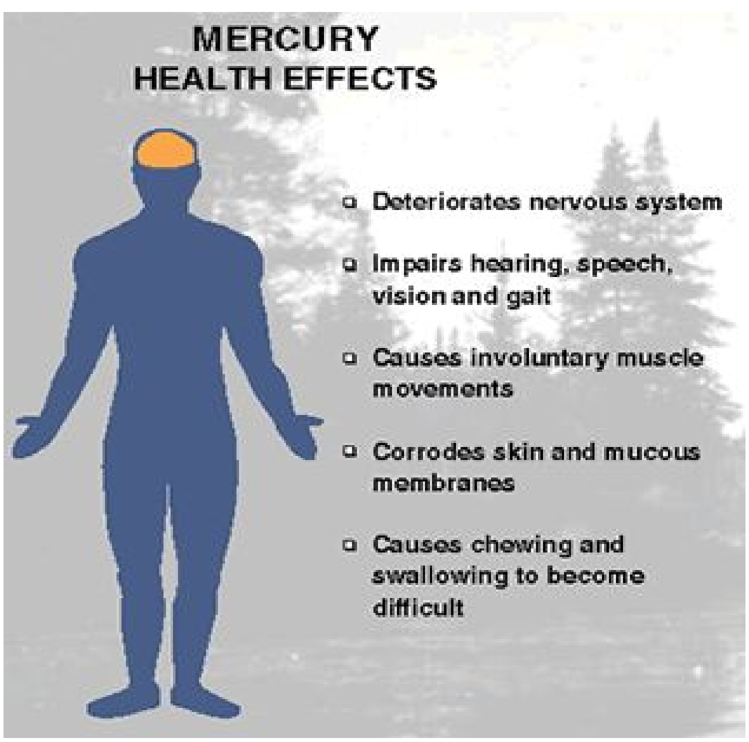
Below: Tomahawk State WIldlife Area - between Fairplay and Hartsel

USGS - Mercury in the Nation's Rivers

"The abundance and characteristics of wetlands are key factors that affect the ability of stream ecosystems to transform mercury into methylmercury."

Below: Hartsel Springs Ranch, between Hartsel and Spinney State Park

USGS - Mercury in the Nation's Rivers



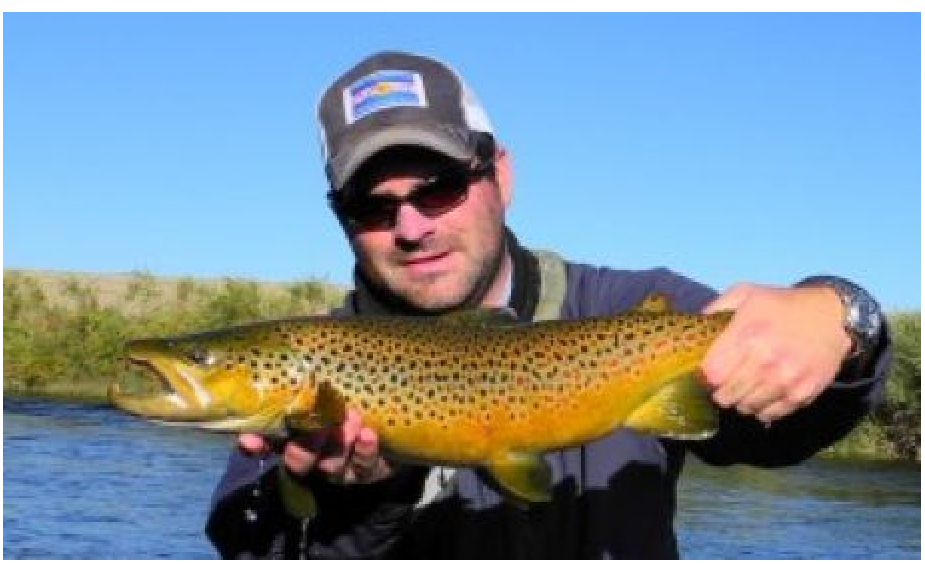
"Methylmercury exposure from fish consumption has been associated with various adverse effects on human health, ranging from central nervous system toxicity in adults exposed to extremely high levels to diminished cardiovascular health and endocrine disruption at lower exposure levels."

Spinney Mountain Reservoir

For Gold Medal fishing, it would be hard to find any place better than Spinney Mountain Reservoir. Anglers can find shoreline or fly fishing, belly boating or trolling opportunities in a setting that is both peaceful and scenic. World class trout fishing awaits beneath the waters of Spinney Reservoir.

Note the wetlands leading to and surrounding the reservoir

South Platte River - The Dream Stream



The Dream Stream is the section of the South Platte which wanders through lush meadows tucked between snow-capped mountains.   The river is comprised of prime trout habitat, which includes, riffles, runs, gravel bars, shelves, and undercut banks. Fly-fishers can expect to catch a mixed bag of rainbows, browns, and cutthroats in 16-20 inch range. In addition, spring (rainbows, and cutthroats) and fall (browns and kokanee salmon) spawning runs from Eleven Mile Reservoir are quite impressive with fish up to 12 pounds landed during a key three-four week period.

Prime flows for the Dream Stream are between 100-400 CFS. The Dream Stream is a year around fishery. This is due to the constant water flowing from the bottom of Spinney Reservoir. Access for the Dream Stream is easy. The entire river is fair game and you can fish wherever you please, all the way down to Eleven Mile Reservoir.

Eleven Mile State Park

Anglers and writers consistently tout Eleven Mile's large reservoir for its outstanding fishing. When not reeling in a trophy rainbow, brown, cutthroat, kokanee or pike, there are nearly five miles of scenic hiking and biking trails that await exploration.

Ideal wind conditions make Eleven Mile a popular, but not overly crowded destination for sailing, windsurfing and winter ice boating on this wide-open reservoir. Motor boaters and kayakers also find plenty of room to play during the summer months.

Many species of birds reside in or migrate through the park, making for wonderful bird watching prospects. Neighboring park, Spinney Mountain, offers additional opportunities for birding and fishing. Waterfowl hunting chances for a wide variety of ducks are excellent and are available each fall!




Conclusions:

South Park area mines are disturbing existing mercury piles, but re-zoning and permitting did not consider these risks. Therefore, if testing proves dangerous levels of mercury exist, action must be taken immediately to mitigate the health, environmental, and economic impacts. Regardless of test results, ongoing testing should be required at each site and downriver to monitor exposures.

<u>Recommended Action Steps:</u>

Test, Test, Test !!!

1. Test Fairplay Beach water, fish, and flora for methylmercury

2. Test mining operation site soil, recirculation ponds, dredge ponds, mining sediments, dredge piles for elemental as well as methylmercury.

3. If mercury levels are deemed acceptable, a plan for continued testing should be established due to the high probability of future contamination

4. If dangerous mercury levels are recorded, all mining operations in the immediate area should cease until an action plan is in place.

5. All operations on historic hydraulic and dredge waste piles need to post bonds covering the worst-case mercury contamination scenario.

6. Regulations should be established ensuring appropriate mercury mitigation protocols for all operations that are complete or are considered inactive. Inactive sites continue to actively mobilize disturbed sediments.

7. Disturbed piles need to be stabilized and capped, thereby preventing the mobilization of mercury into the environment.

8. All proposed operations on identified locations must first test for the presence of mercury.

9. Public notice in all affected communities must be posted and all downstream communities should be notified of the findings.

10. *No new mining operations on affected sites should be permitted without meaningful public input. County Commissioners should make every effort to give adequate notice of any permitting or zoning meetings. These meetings should be scheduled at a place and time residents who work can attend.*

11. *Establish an inventory of all potentially contaminated sites along the Middle Fork of the South Platte River*

12. *All operations currently processing potentially contaminated soils must develop a mitigation and action plan should mercury be encountered and post bond to cover the cost of such implementation.*

13. *All current operations must develop an operation plan that includes approved safety measures and precautions for employees potentially exposed to contaminated soils or dust.*

14. *All operations must develop and provide and informational packet, presented to current and future employees, discussing the potential dangers of exposure to mercury contaminated sediments or dust.*

15. *All operations should comply with the Initiative for Responsible Mining Assurance (IRMA) Standard for Responsible Mining (April 2016), Chapter 3.10, Mercury Management. The Standard sets forth requirements for planning, mercury capture and disposal, monitoring, and reporting.*

16. *DRMS and CDPHE should work collaboratively to review existing statutes, regulations, and rules to ensure they are sufficient to protect the health, environment, and economies of the citizens of Colorado from mercury emissions. These regulations should be informed by the experiences of the State of California.*

REFERENCES

1. Alpers, C.N., Hunerlach, M.P., May, J.T., Hothem, R.L., Taylor, H.E., Antweiler, R.C., De Wild, J.F., and Lawler, D.A., 2005, Geochemical characterization of water, sediment, and biota affected by mercury contamination and acidic drainage from historical gold mining, Greenhorn Creek, Nevada County, California, 1999-2001: U.S. Geological Survey Scientific Investigations Report 2004-5251, 278 p. Available at https://pubs.usgs.gov/sir/2004-5251/

2. Ashley, R.P., Rytuba, J.J., Rogers, Ronald, Kotlyar, B.B., and Lawler, David, 2002, Preliminary report on mercury geochemistry of placer gold dredge tailings, sediments, bedrock, and waters in the Clear Creek restoration area, Shasta County, California: U.S. Geological Survey Open-File Report 02-401, 43 p. Available at http://geopubs.wr.usgs.gov/open-file/of02-401/

3. Averill, C.V., 1946, Placer mining for gold in California: California State Division of Mines and Geology Bulletin 135, 336 p.

4. Bowie, A.J., 1905, A practical treatise on hydraulic mining in California: New York, Van Nostrand, 313p.

5. Bradley, E.M., 1918, Quicksilver resources of the state of California: California State Mining Bureau Bulletin 78, 389 p.

6. Churchill, R.K., 2000, Contributions of mercury to California's environment from mercury and gold mining activities; Insights from the historical record, *in* Extended abstracts for the U.S. EPA sponsored meeting, Assessing and Managing Mercury from Historic and Current Mining Activities, November 28-30, 2000, San Francisco, Calif., p. 33-36 and S35-S48.

7. Hunerlach, M.P., Alpers, C.N., Marvin-DiPasquale, M., Taylor, H.E., and De Wild, J.F., 2004, Geochemistry of mercury and other trace elements in fluvial tailings upstream of Daguerre Point Dam, Yuba River, California, August 2001: U.S. Geological Survey Scientific Investigations Report 2004-5165, 66 p. Available at https://pubs.water.usgs.gov/sir2004-5165/

8. Hunerlach, M.P., Rytuba, J.J., and Alpers, C.N., 1999, Mercury contamination from hydraulic placer-gold mining in the Dutch Flat mining district, California: U.S. Geological Survey Water-Resources Investigations Report 99-4018B, p. 179-189. Available at http://ca.water.usgs.gov/mercury/dutch/wrir994018b.pdf

9. Klasing, Susan, and Brodberg, Robert, 2003, Evaluation of potential health effects of eating fish from selected water bodies in the northern Sierra Nevada Foothills (Nevada, Placer, and Yuba Counties): Guidelines for sport fish consumption: California Office of Environmental Health Hazard Assessment, 48 p. Available at http://www.oehha.ca.gov/fish/pdf/SierraLakesAdvisoryfinal.pdf

10. Klasing, Susan, and Brodberg, Robert, 2004, Fish consumption guidelines for Lake Natoma (including nearby creeks and ponds) and the lower American River (Sacramento County): California Office of Environmental Health Hazard Assessment, 41 p. Available at http://www.oehha.ca.gov/fish/pdf/NatomaFinalAdvisory9204.pdf

11. Kuwabara, J.S., Alpers, C.N., Marvin-DiPasquale, M., Topping, B.R., Carter, J.L., Stewart, A.R., Fend, S.V., Parchaso, F., Moon, G.E., and Krabbenhoft, D.P., 2003, Sediment-water interactions affecting dissolved-mercury distributions in Camp Far West Reservoir, California: U.S. Geological Survey Water-Resources Investigations Report 03-4140, 64 p. Available at https://pubs.water.usgs.gov/wri03-4140/

12. Long, K.R., DeYoung, J.H., Jr., and Ludington, S.D., 1998, Database of significant deposits of gold, silver, copper, lead, and zinc in the United States: U.S. Geological Survey Open-File Report 98-206A, 33 p. Available at http://geopubs.wr.usgs.gov/open-file/of98-206/of98-206a.pdf

13. May, J.T., Hothem, R.L., Alpers, C.N., and Law, M.A., 2000, Mercury bioaccumulation in fish in a region affected by historic gold mining: The South Yuba River, Deer Creek, and Bear River watersheds, California, 1999: U.S. Geological Survey Open-File Report 00-367, 30 p. https://pubs.water.usgs.gov/ofr00-367/

14. Saiki, M.K., Slotton, D.G., May, T.W., Ayers, S.M., and Alpers, C.N., 2004, Summary of total mercury concentrations in fillets of selected sport fishes collected during 2000-2003 from Lake Natoma, Sacramento County, California: U.S. Geological Survey Data Series 103, 21 p. Available at https://pubs.water.usgs.gov/ds103/

15. U.S. Environmental Protection Agency, 2001, Water quality criterion for the protection of human health: Methylmercury: EPA-823-R-01-001, 16 p. Available at http://www.epa.gov/waterscience/criteria/methylmercury/merctitl.pdf

16.https://www.researchgate.net/profiRobin_Grayson/publication/202236459_Bucket-line_gold_dredges_-_a_review_of_world_techniques/links/57f28fb208ae886b897bfcd7/Bucket-line-gold-dredges-a-review-of-world-techniques.pdf

17. http://education.savingthebay.org/

18. Wentz, D.A., Brigham, M.E., Chasar, L.C., Lutz, M.A., and Krabbenhoft, D.P., 2014, Mercury in the Nation's streams—Levels, trends, and implications: U.S. Geological Survey Circular 1395, 90 p., *https://dx.doi.org/10.3133/cir1395*.

19. Fall 12-12-2014 Remediation options for mercury-contaminated sediments within the Yuba River watershed Tara Fitzgerald University of San Francisco, tafitz9@gmail.com https://repository.usfca.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1111&context=capstone

20. Gregory J. Reller, Project Manager , ENGINEERING EVALUATION/COST ANALYSIS RELIEF HILL HYDRAULIC MINE NEVADA COUNTY, CALIFORNIA Prepared For TAHOE NATIONAL FOREST NEVADA CITY, CALIFORNIA U.S. DEPARTMENT OF AGRICULTURE FOREST SERVICE REGION 5 June 2007 Prepared By TETRA TECH EM INC. 10860 Gold Center Drive, Suite 200 Rancho Cordova, California, 95670 https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprd3824561.pdf

21. Charles N. Alpers, Michael P. Hunerlach, Jason T. May, And Roger L. Hothem, November 2005 Mercury Contamination from Historical Gold Mining in California, USGS circular 3014 version https://pubs.usgs.gov/fs/2005/3014/fs2005_3014_v1.1.pdf

22. Fleck, J.A.., Alpers, C.N., Marvin-DiPasquale, M., Hothem, R.L., Wright, S.A., Ellett, K., Beaulieu, E., Agee, J.L., Kakouros, E., Kieu, L.H., Eberl, D.D., Blum, A.E., and May, J.T., 2011, The effects of sediment and mercury mobilization in the South Yuba River and Humbug Creek Confluence Area,, Nevada County, California: Concentrations, speciation, and environmental fate—Part 1: Field characterization: U.S. Geological Survey Open-File Report, 2010-1325A, 104 p.

23. Fleck, J.A.., Alpers, C.N., Marvin-DiPasquale, M., Hothem, R.L., Wright, S.A., Ellett, K., Beaulieu, E., Agee, J.L., Kakouros, E., Kieu, L.H., Eberl, D.D., Blum, A.E., and May, J.T., 2011, The effects of sediment and mercury mobilization in the South Yuba River and Humbug Creek Confluence Area,, Nevada County, California: Concentrations, speciation, and environmental fate—Part 1: Field characterization: U.S. Geological Survey Open-File Report, 2010-1325A, 104 p.

24. Marvin-DiPasquale, M., Agee, J.L., Kakouros, E., Kieu, L.H., Fleck, J.A., and Alpers, C.N., 2011, The effects of sediment and mercury mobilization in the South Yuba River and Humbug Creek confluence area, Nevada County, California: Concentrations, speciation and environmental fate—Part 2: Laboratory Experiments: U.S. Geological Survey Open-File Report 2010−1325B, 54 p.

25. HWC Prommel, Oct 1941, Engineering and Mining Journal, Colorado attracks another large bucket-line dredge http://fairy-lamp.com/SPCMuseum/Dredge_article_1941.pdf

26. Paul J. Lechler, Miller, J.R., Hsu, L., Desilets, M.O., 1997, Mercury mobility at the Carson River Superfund Site, west-central Nevada, USA: interpretation of mercury speciation data in mill tailings, soils, and sediments, Journal of Geochemical Exploration 58 (1997) 259-267.

27. Eric D. Morway, Thodal, C.E., Marvin-DiPasquale, M., 2017, Long-term trends of surface-water mercury and methylmercury concentrations downstream of historic mining within the Carson River watershed, Environmental Pollution 229 (2017) 1006e1018.

28. J. C. Bonzongo, Heim, K.J., Warwick, J.J., Lyons, W.B., 1995, Mercury levels in surface waters of the Carson River-Lahontan Reservoir system, Nevada: Influence of historic mining activities, Environmental Pollution, Vol. 92, No. 2, pp. 193-201,

Contact: Trevor Messa
Mailing Address:
Save South Park
P.O. Box 2168
Fairplay, CO 80440
Contact: https://www.savesouthparkco.org/contact
www.savesouthparkco.org