

Executive Summary

DWR WAREHOUSE

Project Title/Applicant Name

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Mercury Vapor Study of Placer Mining Tailings, Oroville Wildlife Area, California; Folsom State Recreation Area, California; and Selected Federal Lands in the Yuba Gold Fields, California**Warren Rehn and Patty Rehn****Project description and Primary Biological and ecological Objectives**

In many areas of placer gold mining, especially where dredges and large sluices were used in the gold recovery process, mercury was used in the mining operation to recover fine gold particles. Significant amounts of the mercury were lost in the process and were carried into the local bodies of water. Although precise estimates of the total amount of mercury lost to the environment in California gold mining are not available it is estimated here that a minimum of 10 million pounds of mercury were lost directly into the rivers of central California.

This proposal is to test for unrecognized major sources of mercury contamination in the Sacramento River basin in historic placer mine tailings areas from within the three largest tailings disposal areas in the state: dredge tailings on the Oroville Wildlife Area, the Folsom State Recreation Area, and the Yuba Gold Fields. These sites were chosen for their accessibility due to state or federal ownership and due to their location in the largest-scale placer mining areas in California.

It is proposed to map mercury vapor emanations on the available locations to determine the area and degree of buried mercury pollution on these placer tailings sites.

The study has direct implication to water quality in the Sacramento River basin and in particular in the Feather River, Yuba River, and American River and all rivers downstream from the sources to the San Francisco Bay. Fish and fish eating species are the direct benefactors from identifying and reducing mercury loads in these rivers.

Approach/Tasks/Schedule

An orientation survey (Phase I) followed by detailed surveys of the three sites: Oroville, Folsom, and Yuba will allow characterization of the mercury in placer tailings problem in the Sacramento River basin area of California. The survey/study is scheduled to begin November 1997 and to be completed by August 1998. Results of the study will have far-reaching implications insofar as assessing point and non-point sources of mercury pollution in the basin.

Justification for Project and Funding by CALFED

The project is key to a number of CALFED objectives relating to water quality, elimination of mercury pollution sources, and understanding techniques of evaluating the importance of mercury pollution sources to the overall drainage basin contaminant load. It is also critical to be completed early in the overall timing of the CALFED projects due to the potential large impact on remediation planning. The magnitude of placer mining tailings in the Sacramento basin is huge by any global

comparison. Given the known use and loss of tens of millions of pounds of mercury in the placer mining operations of California it is imperative to characterize the nature of undocumented mercury pollution sources associated with this historic activity.

Budget costs and Third Party Impacts

The entire study is forecast at \$394,000. It would be possible to fund the orientation study (Phase I) for \$80,000 to clarify exact methodology and expected results of the study before funding the remaining detailed studies. There are no immediate third party impacts.

Applicant Qualifications

The principal investigators are professional geoscientists with over 50 years of combined experience in executing complex field studies in related areas.

Monitoring and Data Evaluation

Highest professional standards are maintained in evaluating data accuracy and precision. A full field and laboratory replicate and standard procedure is implemented and analyzed to assure the best quality data possible.

Local Support/Coordination with other programs/compatibility with CALFED objectives

Use of mercury vapor collectors to map and identify mercury pollution sources is advocated by many investigators in similar projects in the western US. Contacts with several other investigators involved in CALFED proposals has been tentatively collaborative. Coordination with Cache Creek mercury contamination studies is planned. It is believed that the proposal is completely compatible with CALFED objectives of identifying point and non-point sources of mercury pollution in the greater Sacramento River basin.

Title Page

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Mercury Vapor Study of Placer Mining Tailings, Oroville Wildlife Area, California; Folsom State Recreation Area, California; and Selected Federal Lands in the Yuba Gold Fields, California

Applicant:: Warren Rehn and Patty Rehn; Quicksilver Systems, 19005 Pinehurst Road, Bend, Oregon 97701; 541-385-3145, 541-385-0889; fax: 541-388-5068; email: alpacas@bendnet.com

Type of Organization and tax status: Sole proprietorship, private and taxable.

Tax ID: 585-74-2843

Technical and financial contact persons: Warren Rehn and/or Patty Rehn

Participants/Collaborators in Implementation:

Warren Rehn (geologist)

Patty Rehn (geologist and geochemist)

David R. Brown (geologist and placer consultant)

RFP Project Group Type: Group 3 – monitoring, assessment, and research

Project Description

Description and Approach

The proposed project will map the mercury vapor content in placer tailings at the ground surface. It is proposed to map mercury vapor content in the immediate subsurface layer of the tailings areas on a 100-foot grid.

It is well known that in many gold mining areas, the use of mercury in historical dredging, sluicing, panning, and gold-recovery operations has led to persistent mercury contamination, especially in river sediments (for example, Lechler, 1992 in the Carson River, NV;). It is likely that these areas of mercury contamination are a significant yet poorly identified source of total mercury pollution in water in the Sacramento River basin. The proposed study selects areas from the three largest dredge-mined placer gold areas on public ground controlled by the State of California or the US Government for further study.

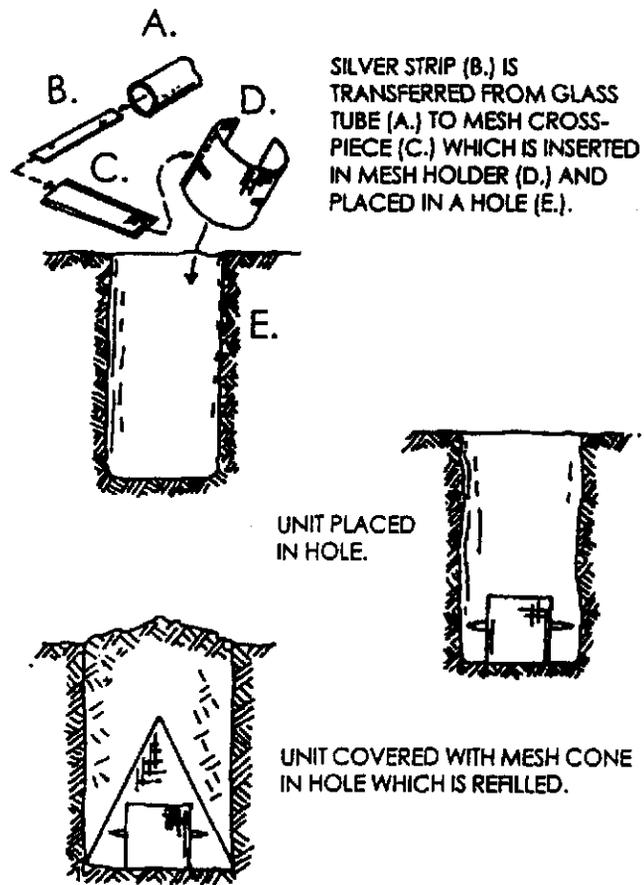
Proposed method

It is proposed to map the mercury vapor content at the surface of the dredge placer tails areas in the American River drainage at Folsom, in the Feather River drainage at Oroville, and in the Yuba River drainage at Yuba Gold Fields as a guide to establishing the likelihood of the tails containing a substantial content of mercury from historic mining processes. The method of mapping mercury vapor as a guide to total mercury contamination has been effectively used in the Carson River, Nevada drainage by Lechler (1992). Rehn and Rehn (1996) report the successful use of this mercury vapor mapping to identify subsurface mercury-rich mineralization beneath mercury poor transported cover in Nevada.

The mercury vapor data is collected by placing a small plastic and metal collecting device in a shallow hole in the soil (or overburden) for a period of time up to a few weeks (to be determined by orientation study depending on mercury flux in the area). The device is shown in Figure 1. After exposure, the devices are collected and analyzed in the Quicksilver Systems laboratory by the methods described in Rehn and Rehn (1996). Maps are then produced illustrating mercury vapor flux.

Locations

The study areas are shown on the general location map (Figure 2). The areas to be studied are the Oroville Wildlife Area on the Feather River, south of Oroville in Butte County, California, the Mississippi Bar area on the American Fork of the Sacramento River on the Folsom Lake State Recreation Area in Sacramento County, and selected federal ground in the Yuba Gold Field on the Yuba River in Yuba County, California. The Oroville refuge site covers an area of about 9 square miles on both sides of the Feather River along the site of a historic gold placer dredging area. The site is in Townships 18 and 19N and Range 3E MDBM in the Fernandez land grant. Of the total area 2+ square miles appear to be little disturbed since the historic mining activity. The Mississippi Bar site covers about 1 square mile on the north side of the American River in the Folsom dredge fields above Nimbus Dam in Township 9N, Range 7E, MDBM in the San Juan land grant. The Yuba Gold Fields sites are also dredge fields sites in Section 36, Township 16N, Range 4E, and Sections 22, 27, and 30, Township 16N Range 5E, MDBM aggregating about 1 square mile on north and south sides of the Yuba River. The accompanying location map (Figure 2) shows the



MODIFIED FROM REHN, 1996

Figure 1. Quicksilver Systems Mercury Collector Field Installation Procedure

FROM REHN AND REHN, 1996

most significant of the other potential placer mine tailings study locations within the CALFED study area.

Expected Benefits

Stressors

The study involves mercury, a known major stressor in the Sacramento River basin. The intent of this study is to test a probable major historical source of mercury contamination to determine if it is still potentially a major contributor to the overall mercury load of the drainage basin.

Species

Mercury is known to accumulate or is thought to accumulate in most fish species in the drainage basin including: winter-run chinook salmon, Spring-run chinook salmon, delta smelt, splittail, steelhead trout, green sturgeon, and striped bass. At even greater health risk due to bioaccumulation are top predatory piscivorous wildlife such as mergansers, osprey, eagles, kingfishers, and wading birds (Meyer, 1996) which include migratory birds. While the species of mercury accumulating in these animal species is methyl mercury (Wiener, 1996), it is well demonstrated that the availability of methyl mercury is related to the availability of Hg(II) or Hg(0) in the environment which is in turn related to total mercury loads (Veiga and Meech, 1995). The current study addresses identifying unrecognized but potentially significant sources of anthropogenic mercury contamination in the Sacramento River basin.

Habitats

The study focusses on the instream aquatic habitat however also will benefit understanding of contaminant loads in adjacent sediments, riparian terrane, and delta environments that are primarily freshwater. All of these environments may benefit from an improvement in overall water quality in the Sacramento basin. The proposed study specifically attempts to identify currently undocumented but potentially very significant point and non-point sources of anthropogenic mercury pollution.

Expected Benefits

The successful identification of buried sources of mercury contamination will allow more precise understanding of the mercury pollution problem and allow planning to implement an effective remediation campaign. Specifically the goal is to reduce mercury levels in fish and fish-eating wildlife. This study is the first step in the overall process of identifying additional sources of mercury pollution in the Sacramento River basin. This will ultimately improve population density of the fish and fish-eating wildlife and also benefit the sport-fishing industry. Locally identifying point sources of mercury contamination may also eventually benefit any human populations consuming water with elevated mercury levels.

Primary

The primary expected benefit is to identify additional point and non-point sources of mercury contamination in the Sacramento River basin. Because of similarities between historic placer mining methods throughout the Sierra foothills of central California in the Sacramento River basin, the study will have direct implication to a large number of other sites that contain historic placer mining tailings (Figure 1).

Secondary

Secondary benefits include demonstrating the effective use of an inexpensive method to map large areas to determine the relative levels of mercury contamination. This type of technology will be very useful in assessing what areas within large areas of known mercury pollution are the most critical for remediation to reduce overall mercury pollution loads in the river basin. This methodology could be used in the large number of placer tailings sites in the study area of central California as well as in the Clear Creek drainage known mercury contamination area. The study will include sufficient detail to make recommendations for further research on the location, distribution and amounts of mercury pollution in placer mining tailings areas.

Third party

Third party benefits include making the technology of economical mercury vapor collection and analysis available to other programs and studies in the CALFED study area. Local labor will be required in the completion of the proposed survey.

Other programs

Preliminary contacts were made with James Rytuba and William Croyle. We plan to share information and techniques with these investigators. It is also planned to coordinate with investigators involved in studying the mercury levels of fish in the Sacramento River basin.

CALFED non-ecosystem objectives

The study provides data for the identification of areas of mercury pollution that will allow understanding of how to improve water quality for all beneficial uses.

Background and Biological/Technical Justification

The Oroville district yielded nearly 2 million ounces of fine gold by dredging from 1898 to the 1950's. In 1905 35 dredges were operating in the district. From 1899 to 1959 the dredge production from the Folsom district on the American River was at least 3 million ounces of gold. The largest of the dredges moved 4 million cu. yds. of gravel per year. The Folsom area is considered the largest of the Quaternary placers in California. (Koschmann and Bergendahl, 1968). The Yuba Gold Fields produced nearly 5 million ounces of gold, mostly by dredging in the Quaternary placers.

In the "charging of the sluices" on dredges and in hydraulicking operations the rule of thumb was 3 flasks of mercury (one flask is 76 pounds) for a 6-foot wide sluice covering 200 or 300 feet of length. Depending on the operation, sluices are charged daily (dredges) or weekly or longer (hydraulicking operations). Given the total placer gold yield of California of about 68,000,000 ounces, and given the high usage of mercury in amalgamating the gold, especially in the fine gold dredging operations, it is easily possible that more than 10 million lbs. was *lost* to the rivers of the Sacramento basin in the gold mining years. (Numbers derived from historical records in Bowie, 1910 and from sources cited in Veiga and Meech, 1994.) As can be seen in Figure 3 the Sierra Nevada Gold Belt, the area comprising virtually all significant California placer gold production, is entirely within the Sacramento River basin. Given the poor historical record of gold production and of mercury consumption, the actual amount of mercury loss is likely to be much higher, possibly twice the minimum value. For comparison the 1969 world mercury production was about 21.7 million pounds of mercury. It is likely, then, that the mercury lost in placer gold mining activities in the Sacramento Basin in the late 19th and early 20th centuries equaled one year of *world* mercury



Figure 3. Location of Major Placer Districts in California Showing Location of the Sierra Nevada Gold Belt in the Sacramento River Basin.

From BIVLE, 1979.

production. Much of this mercury is likely still present in the placer mining tails and is being slowly released to the environment.

A quote from a recent USGS workshop on mercury contamination sums up the above arguments: "... Because of re-emissions of Hg from terrestrial and marine environments to the atmosphere, past activities continue to affect current atmospheric Hg concentrations. ... The model predicts that peaks associated with gold mining during the late 1800's should be a significant fraction of modern deposition rates in sedimentary records analyzed with adequate temporal resolution. There is some evidence that this is the case, implying that **anthropogenic emissions then and now are significantly greater than natural emissions.**(emphasis added)." from Porcellaepri, Hudson, and Gherini, 1996.

Comparison of approaches

Other mercury vapor survey methods include instantaneous mercury vapor analysis in situ, however these techniques are inferior to the use of an integrating collector over time because of the temporal changes in mercury vapor flux as a result of changes in local pressure and temperature. The technique proposed for use here was developed over an 8 year period of active field trials and is known by the authors to be the most efficient cost-effective method available to remotely collect mercury vapor.

Basis for expected benefits

The demonstrated effectiveness of the Quicksilver Systems device in collecting mercury vapor is well documented (see Rehn and Rehn, 1996;). In general, the technique of measuring mercury vapor to infer buried sources of mercury has been very well documented in studies by Klusman (1993), and McCarthy and others (1968). Lechler (1992) used the mercury vapor technique effectively in evaluating mine dumps in the Carson River area of Nevada to determine the relative strength of subsurface mercury contamination.

Current status

The authors are not aware of any other programs currently working to identify and quantify additional sources of mercury contamination in the historic placer tails of California. The authors have ongoing projects to use mercury vapor mapping as a mineral deposit exploration tool in other locations (Bolivia).

Proposed Scope of Work

Phases

Phase I – Reconnaissance Of The Properties, orientation survey lines to determine magnitude of mercury vapor and to resolve uncertainties in the exact approach. Estimated time: 2 months. Identification of alternative sites if necessary.

Phase II – Survey of the Properties, Implementation of mercury vapor survey using design and methodology optimized in Phase I. Estimated time: 5 months.

Phase III – Analysis and Interpretation of Results, Characterization of and mapping data. Revisit to sites to verify if required. Consultation with other investigators. Estimated time: 1 month.

Phase IV – Reporting and Recommendations, Completion of report and research into justified further recommendations. Estimated time: 1 month

Tasks

Phase I Task 1. Orientation survey, interpretation; Phase II Task 2. Detailed survey at Oroville location Task 3. Detailed Survey at Folsom location Task 4. Detailed Survey at Yuba location; Phase III Task 5. Data analysis, mapping, consultation; Phase IV Task 6. Reporting, recommendations.

Deliverables

1. Report on optimization procedures of measuring mercury vapor at placer tailings sites as defined during orientation survey.
2. Raw results of approximately 10,000 samples from detailed mercury vapor surveys at Oroville, Folsom, and Yuba sites.
3. Interpreted results and maps of mercury vapor levels at Oroville, Folsom, and Yuba sites.
4. Final report summarizing all studies and recommending further work at these and other locations based on results.

Reports

1. Monthly progress reports during the duration of the project.
2. Orientation survey report on optimizing use of mercury vapor collectors to detect mercury at selected placer tailings sites.
3. Final report on mercury vapor content at Oroville, Folsom, and Yuba placer tailings sites.

Technical

Nature – Written reports to professional standards. Maps at appropriate scales to show the required level of detail. Electronic (email) reports available. All data available in digital format.

Content – Fully documented reports to professional scientific standards. Full reporting of all raw data, methodology, equipment used, analyses performed, data manipulations, discussion on results, and conclusions drawn.

Timing – Monthly progress reports postmarked or sent electronically by the 15th of each month covering events of the previous month. Orientation report, data results, and maps within 30 days of completion of raw analytical results. Final report within 90 days of completion of Phase III, data analysis and interpretation.

Financial

Nature – spreadsheet format itemization of all expenditures with corroborating receipts or invoices for billed professional services. All payees identified by tax identification number. Review and approval by CPA.

Content – complete and detailed accounting for every expenditure from granted funds.

Timing – Monthly accounting reports for the preceding month by the 15th day of each month during the project. Final project accounting within 90 days of the end of the project.

Monitoring and Data Evaluation

All projects will be personally supervised by one of the three principal investigators. Replicate sampling is routinely 10% of the total samples. Analytical standards and blanks are internally used and will be reported to support analytical precision, accuracy, and lack of ambient contamination. A full discussion of analytical and sampling variance will be made available in the final report.

Comparison with alternatives

Known alternative techniques for time-integrated sampling of mercury vapor in unconsolidated materials are less effective than the selected device based on the authors' experience. A full comparison of all known alternatives is beyond the scope of this proposal. Instantaneous-reading mercury vapor analyzers do not provide a comparable set of data by which to compare the time-integrating technique proposed here.

Integration with other programs

It is proposed to keep in communication with William Croyle, Central Valley Region Bay Protection Toxic Cleanup Program, Sacramento Water Regional Control Board and James Rytuba, USGS, Western Region.

Peer review

It is proposed to schedule peer review of the project results by two qualified researchers generally respected in the fields of geochemistry, environmental research, or geology.

Implementability

Compliance with laws and regulations

The project will be undertaken in full compliance with all applicable laws and regulations in the appropriate municipality, county, and reserve as well as the those of the State of California and the USA. Permission to undertake the surveys on the Oroville Wildlife Area and at the Folsom State Recreation Area has been requested and it has been indicated that there will be no objection from these agencies to the field survey. Permission to survey the federal lands at the Yuba site is also pending, but not strictly required.

Coordination with other projects

It is planned to coordinate activities and share data with the Cache Creek mercury studies and with any other interested groups.

Sensitivity to hydrologic and climatic conditions

The orientation and detailed mercury surveys will be best conducted in the dry seasons and not during heavy run-off or flooded periods.

Nature and extent of local support

Interest in the results of the study was expressed by the staff at the Folsom State Recreation Area. It is anticipated that the environmental studies group at the Oroville Wildlife Area will also be interested in the study.

Land use conditions

Only minor ground disturbance is required to implement the study. Disturbance on previously disturbed man-made tailings is not considered to be an issue by regulating agencies. Some use restrictions may exist in the wildlife refuge depending on the season and the exact area of survey.

Hazardous materials conditions

No hazardous material conditions are expected in the field. Laboratory reagents, wastes, exposed mercury adsorbents are all disposed according to state and federal hazardous waste disposal guidelines. Other impacts are not known.

Costs and Schedule to Implement Proposed Project

Budget Costs

Table 1 - Cost Breakdown Table

Project Phase and Task	Direct Labor Days	Direct Salary and Benefits	Overhead Labor (General, Admin and fee)	Service Contracts	Material and Acquisition Contracts	Miscellaneous and other Direct Costs	Total Cost
Phase I							
Task 1 Orientation	75	30000	3000	30000	0	17000	80000
Phase II							
Task 2 Oroville	75	30000	3000	75000	0	17000	125000
Task 3 Folsom	45	18000	1800	45000	0	11000	75800
Task 4 Yuba	45	18000	1800	45000	0	11000	75800
Phase III							
Task 5 Data Anal.	30	12000	1200	0	0	8000	21200
Phase IV							
Task 6 Final Reports	30	12000	1200	0	0	3000	16200
Totals	275	120000	12000	195000	0	67000	\$394,000

Need for CALFED funding

There is no other available funding that the authors are aware of to complete this study which is critical to identifying sources of mercury contamination in the Sacramento River basin.

Potential for phased funding

The potential exists to fund Phase I, the orientation study and await results before funding Phase II through IV.

Contingency planning

The budget in Table 1 accurately reflects the anticipated costs of the program. No further contingency funding is required for the stated deliverables.

Schedule Milestones

Task completion dates

Table 2. Task Completion Dates

Project Phase and Task	Start Date	End Date
Phase I		
Task 1 Orientation	Nov '97	Jan '98
Phase II		
Task 2 Oroville	Apr '98	June '98
Task 3 Folsom	June '98	July '98
Task 4 Yuba	June '98	July '98
Phase III		
Task 5 Data Analysis	July '98	Aug '98
Phase IV		
Task 6 Final Reports	Aug '98	Oct '98

Funding Requirements

Monthly payments of invoiced and reimbursable expenses are required.

Applicant Qualifications

Organization of staff

The principal investigators and administrators of the project are Warren Rehn and Patty Rehn, sole proprietors of Quicksilver Systems. Accounting will be handled on a consulting basis by a CPA accountant. Field staff and analytical staff are hired on an hourly basis as needed. David R. Brown, placer expert, is hired on a daily consulting basis.

Responsibilities

Full responsibility of deliverable products lies with the principal investigators. All analytical control, survey design, data quality procedures, and data analysis are personally supervised or personally completed. Field staff and analytical staff responsibilities are for closely supervised partial tasks, only. The company operates as a team of professional consultants. Administrative tasks are handled by the principal investigators with the exception of accounting which is handled by an independent CPA.

Biosketches

WARREN M. REHN

Mr. Rehn holds a B.S. Geol. Engr. from University of Idaho, 1977 and a M.Sc. in Geology from Colorado School of Mines in 1983. Mr. Rehn has worked as a professional geologist since 1981 with extended employment at both Gold Fields Mining Corp. and Noranda Exploration, Inc. until 1994. At both Gold Fields and Noranda a significant responsibility was developing and implementing innovative exploration techniques, principally geochemical in nature, and including mercury vapor techniques. Since 1994 Mr. Rehn has been involved in international geologic consulting, principally in South America. Administration of budgets in excess of \$1 million annually and supervision of teams of technical staff has been a common theme in the recent 8 years of his career.

Bibliography:

Rehn, P. and Rehn, W., 1996, Mercury vapor anomalies at the Section 30 Deposit, Twin Creeks Mine, Nevada, in Coyner, A.R., and Fahey, P.L., eds. Geology and Ore deposits of the American Cordillera: Geological Society of Nevada Symposium Proceedings, Reno/Sparks, Nevada, April 1995, p.769-778.

PATTY REHN

Ms. Rehn holds a B.Sc. in Geology from New Mexico Institute of Mining and Technology in 1975 and a M.Sc. in Geochemistry from Colorado School of Mines in 1980. Employed in both the public and private sector since 1973, Ms. Rehn has conducted both geologic scientific investigations as well as exploration geology projects.

Ms. Rehn began development work on the Quicksilver mercury detection technique in 1989 and was awarded a patent in 1995. Quicksilver Systems has performed 14 mercury vapor surveys for private industry in the US, Canada and Bolivia, providing both field and analytical support.

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Rehn, P. and Rehn, W., 1996, Mercury vapor anomalies at the Section 30 Deposit, Twin Creeks Mine, Nevada, in Coyner, A.R., and Fahey, P.L., eds. Geology and Ore deposits of the American Cordillera: Geological Society of Nevada Symposium Proceedings, Reno/Sparks, Nevada, April 1995, p.769-778.

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Mutschler, F.E., Ernst, D.R., Gaskill, D.L. and Billings, Patty, 1981, Igneous rocks of the Elk Mountains and vicinity, CO-chemistry and related ore deposits: NM Geological Society Guidebook, 32nd Field Conference.

Billings, Patty, 1980, Fission Track annealing related to vein mineralization and hydrothermal alteration, Ouray County, CO: unpublished M.S. thesis, Colorado School of Mines.

DAVID R. BROWN

Mr. Brown graduated in 1972 with an Honors B.Sc. in Geology from Brock University-a university specializing in Pleistocene geology. In his capacity as an exploration geologist, Mr. Brown has conducted placer exploration projects in Alaska, Yukon Territory, British Columbia and most western states.

Mr. Brown's placer exploration career has encompassed the entire range of placer deposit types in a variety of geomorphic and geographic terrains. These include residual deposits; gulch, creek and river placers; marine strand deposits, both off-shore and on-shore; and, alluvial fan deposits. Several projects were directed toward evaluation of tailings from previous hardrock and underground placer gold deposits as well as several underground placer mines. Although the target mineral in the majority of these deposits was gold, Mr. Brown has also explored for placer tin and garnet.

Mr. Brown has conducted 13 major placer drilling programs using a variety of different drill systems-standard rotary, conventional rotary, Becker drill, sonic drill and chum drill. Also, Mr. Brown has conducted 10 large-scale test pit exploration projects and has mapped and sampled several dozen other placer properties. With rare exception, the projects were designed to investigate the fine gold potential of the properties.

Conflicts of Interest

The authors of this proposal have no known conflicts of interest through any past contracts or employment. We believe ourselves to be in full compliance with the applicable statutes.

Compliance with standard terms and conditions

The authors/investigators representing Quicksilver Systems have no objection to the standard terms and agreement clauses as stated in the CALFED RFP of June 1997, Attachment D. Furthermore it is fully agreed to complete a contract in the form of the exhibit for Group 3 contractors in the event of acceptance by CALFED of this proposal. The Nondiscrimination affidavit and Small Business statement are attached.

References

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Boyle, R.W., 1979, The Geochemistry of Gold and its Deposits, Geol. Survey of Canada Bull 280, 584 p.

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NONDISCRIMINATION COMPLIANCE STATEMENT

The company named above (hereinafter referred to as "prospective contractor") hereby certifies, unless specifically exempted, compliance with Government Code Section 12990 (a-f) and California Code of Regulations, Title 2, Division 4, Chapter 5 in matters relating to reporting requirements and the development, implementation and maintenance of a Nondiscrimination Program. Prospective contractor agrees not to unlawfully discriminate, harass or allow harassment against any employee or applicant for employment because of sex, race, color, ancestry, religion, religious creed, national origin, disability (including HIV and AIDS), medical condition (cancer), age, marital status, denial of family and medical care leave and denial of pregnancy disability leave.

CERTIFICATION

I, the official named below, hereby swear that I am duly authorized to legally bind the prospective contractor to the above described certification. I am fully aware that this certification, executed on the date and in the county below, is made under penalty of perjury under the laws of the State of California.

WARREN M. REHN	
DATE SIGNED: 05/19/97	
SIGNATURE: <i>[Signature]</i>	
EMPLOYER'S NAME: QUICKSILVER SYSTEMS	
ADDRESS: SACRAMENTO, CA	
CITY AND COUNTY: SACRAMENTO, CA	
COUNTY: SACRAMENTO	
DATE SIGNED: 05/19/97	
SIGNATURE: <i>[Signature]</i>	
EMPLOYER'S NAME: QUICKSILVER SYSTEMS	

QUICKSILVER SYSTEMS, BEND, OR

Item 12

Agreement No. _____

Exhibit _____

STANDARD CLAUSES - SMALL BUSINESS PREFERENCE AND CONTRACTOR IDENTIFICATION NUMBER

NOTICE TO ALL BIDDERS:

Section 14835, et. seq. of the California Government Code requires that a five percent preference be given to bidders who qualify as a small business. The rules and regulations of this law, including the definition of a small business for the delivery of service, are contained in Title 2, California Code of Regulations, Section 18906, et. seq. A copy of the regulations is available upon request. Questions regarding the preference approval process should be directed to the Office of Small and Minority Business at (916) 322-6060. To claim the small business preference, you must submit a copy of your certification approval letter with your bid.

Are you claiming preference as a small business?

Yes*

No

*Attach a copy of your certification approval letter.