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Vulture Mine

MEMORANDUM

TO: Ben F. Dickerson, III, Carole A. O'Brien

FROM: Robert W. Hodder and Don C. White

DATE: December 14, 1985

SUBJECT: Definition of Exploration Targets at the Vulture Mine, Maricopa Co., Arizona

INTRODUCTION

In the week beginning December 8, 1985, Robert W. Hodder and Don C. White traversed the Vulture Mine area and reviewed previous exploration reported most notably by Thompson (1930) before the sinking of the Douglas exploration shaft, Searles (1931) which followed work from that shaft, mapping by Noranda Exploration Inc., (Donnelly, 1981 abstracted by BFD,III, 1984), sampling by Zortman/Landusky Mining Co. (Hennessey, 1982, Beling, 1983), mapping for A.F. Budge (Mining) Ltd. by Karis (1984), plus a statement of reserves by Hood (1985).

The objective of the present work is to define and prioritize exploration targets.

Hood (1985) notes the many stopes, shafts, pits, trenches and drill sites which attest to production and exploration since 1863. The most recent exploration efforts have had two main goals:

1. Most of the work has been directed to finding an eastward and down dip extension of the high grade ore body which sustained past production but which was lost against faults. The most reasonable estimates of this target are made from past production (White, 1985, b) during 1870 to 1930 and is 1 million tons averaging 0.35 oz Au, 0.25 oz Ag, 0.015 % Cu, and 0.09% Pb with a strike length of 1800 feet at surface, an average width of 12 feet and a down dip extension of 1000 feet maximum. Of this the pre-1915 underground production was probably not over 200,000 tons at twice the above noted grades.

2. Recently detailed sampling in and around the principal workings, tailings, and local placers has outlined a low grade tonnage possibly available for open pit mining and heap leaching. This was most recently estimated by Hood (1985) for an open pit to a depth of 115 feet, a cut off grade of 0.03 oz Au/ton with a 10% dilution at a grade of 0.025 oz Au/ton and a tonnage factor of 12 for hard rock and 20.47 for tailings. The rounded figures are:

Reserves	Tons	Grade	Contained Ounces
Proven	283,000	0.066	18,700
Probable	66,000	0.056	3,700
Dilution	35,000	0.025	800
Pit Total	384,000	0.060	23,200
Tailings	225,000	0.038	8,550
TOTAL	609,000	0.052	31,750

As this target is currently and adequately tested it will not be dealt with further and this report turns to the search for untested ground, and an untouched high grade target.

General Statement on the Nature and Significance of Targets at the Vulture Mine in Geologic Space and Time

Exploration at the Vulture Mine has focused for a long time on finding ore displaced by large faults at the east end of the Mine workings. These faults (Fig. 1) strike northwesterly, generally N 40 to 60° W, dip steeply to either northeast or southwest and appear from field relationships to be the youngest faults in the area. According to Reynolds (1980) and Rehrig, et. al. (1980) these are late Tertiary Basin and Range faults and are younger than 15 m.y. B.P. There are four such faults involved with the east end of the Vulture Mine and by general concensus in the reports are called, from east to west, the East fault, Schoolhouse fault, Astor fault, and Talmadge fault. In outcrop they are 1 to 4 feet wide zones of country rock fragments cemented by calcite and hematite. In some outcrops to the east, west, and south of the mine, faults of this attitude and age are occupied by purplish latite dykes. There is no evidence either in the old reports, or in the field, of metal concentrations in these faults except for minor amounts of ore dragged into the Talmadge and Astor faults from the main ore zone. There is very minor cubic pyrite and galena, or secondary minerals after these sulfide minerals, in the sparry calcite of the faults. There are several pits and shafts on these faults, their dumps and walls have been concientously sampled during the Zortman/Landusky program in 1982-1983 without returning so much as a trace gold in most instances. The conclusion is that the importance of these faults is in their profound effect on the distribution of ore body segments and not as part of mineralizing events.

There are also normal faults which strike northeasterly and dip southeasterly at 15 to 40°. These faults displace the Vulture ore body by 10 to 100 feet in a stepwise fashion with southside down (Thompson, 1930, cross section p.20). These faults are also unmineralized and are cut by the northwest trending Basin and Range faults. A third set of normal faults are the so-called flat faults. These are east-west striking, dip about 30 degrees north and are thus subparallel to the old Vulture lode. These too are cut by the Basin and Range faults and are here interpreted as similar to the listric normal faults of mid-Tertiary age recognized in the regional mapping of Rehrig, et. al. (1980) and beautifully exposed where they offset rhyolite on the southwest face of Twin Peaks, 5 miles north of the Vulture Mine.

The Vulture Mine ore body is most directly associated in space and time with a sill from the muscovite biotite granite stock which outcrops to the west of the mine site. This is the granite porphyry of the older reports. It generally has phenocrysts of quartz. The sill is conformable to the compositional layering and the foliation of the Precambrian rocks, striking easterly and dipping 30° north. It forms a core to quartz and sericite-rich wall rocks which together form a siliceous band approximately 100 feet thick with an amphibolite footwall and a chlorite sericite schist hanging wall. High grade sections in the mine appear to have been on both sides of this granite sill. The sill itself is gold-bearing, averaging about 0.05 oz Au/ton and locally containing high grade sections where quartz veins are frequent and feldspar is either absent or dulled by coating of sericite. There are quartz, pyrite and sericite-rich patches within the main mass of the stock which assay in the 0.02 to 0.03 oz/ton range and hence many times the background gold abundance of the Precambrian rocks. The granite stock appears to be a passive intrusion without notable contact metamorphic phenomena. It is in turn intruded by northwest trending latite dykes of the Tertiary volcanic suite. From these field relationships and by comparison with the Wickenburg granodiorite batholith, just 4 miles north of the mine, which is 68.4 m.y. old (Rehrig, et. al., 1980), the granite stock is interpreted as Laramide in age. It is interesting to note that the Wickenburg batholith has local metal concentrations and was the point of porphyry copper exploration in the 1970's.

Gold concentration at the Vulture Mine is closely associated with the granite in space and time and is therefore also considered a Laramide event. It follows that the Tertiary faults only disrupt its distribution and the Precambrian rocks are only a host and not of first order importance to gold concentration.

It is tempting to look to the Precambrian layered rock sequence for some indication that the Vulture ore is perhaps a pyritic gold occurrence stratabound within iron-rich flows, volcaniclastic and chemical sedimentary rocks, now metamorphosed to amphibolite, quartz-chlorite and sericite-bearing schists, and perhaps pyritic and auriferous meta-chert ultimately intruded by a Laramide stock and broken by Tertiary faults. However, the Zortman/Landusky sampling of pits, trenches, and shafts throughout the Precambrian exposures was very unrewarding; the only pyritic quartz sericite-bearing rock and the main body of quartz in the section are next to the aforementioned granite still, there is virtually no pyrite or casts of pyrite in the Precambrian rocks and there is no sign of the peripheral discordant carbonate veinlets and spots, alumino-silicate minerals, secondary feldspar, or iron silicate minerals common to stratabound Precambrian pyritic gold occurrences described from several areas worldwide.

The conclusion is that the gold is indeed a Laramide addition to the Pre-cambrian section and that exploration should be concerned with a Laramide metallization affected by Tertiary faulting.

The Targets in Order of Priority Based on Potential and Approachability

Block I

Block I is in the immediate footwall of the Vulture Mine workings where they reach surface. The target is a down-faulted repetition of the Vulture ore body along a shallow easterly striking, south dipping fault. Block I should be between and without major complications from the youngest northwest-trenching faults. The block is covered by alluvium and tailings to a depth of 20 feet as measured in backhoe trenches dug during evaluation of placer potential.

The target has not been drilled and is noted in the historic literature only by Thompson (1930, cross section p.20) on one figure but not in the text (White, 1985, a). It is the most approachable target comparable to Vulture Mine ore as it is near surface, has road access, and could be tested by 40 vertical percussion holes on 150 foot center, each to a depth of 100 feet. It would take approximately 2 months to complete this 4,000 feet of drilling and to have assays returned and evaulated. Drilling could be preceded by geophysics but the direct approach of sampling in the first instance is recommended.

Block 2

Block 2 includes the south margin of the granite pluton where it is covered by alluvium. The target is another sill of granite intruding the Precambrian sequence and accompanied by gold in a pyritic, sericitic and quartz-rich body. The premise is that gold concentration is spatially and genetically related to the Laramide stock and specifically to sills which protrude from its roof and margins carrying with them a late aqueous phase of the granite and perhaps involving an external fluid which pyritize, serecitize and silicify the wall rocks and deposit gold with minor base metals.

There is only one local example of this target, the mined out Vulture ore body. It has a ridge in the topography and it is reasonable to assume that, if such a ridge exists downfaulted beneath the alluvium, it could be found by a shallow seismic survey. Although it might a appall a geophysicist, I would accompany that seismic survey with VLF and ground magnetometer. This recommendation is based solely on experience in using VLF and magnetometer in exploring other covered areas for pyritic gold occurrences and finding that there was enough contrast in conductivity and magnetism between rock types to map the bed rock even though that contrast could not be directly explained by the observable properties of the rocks. Both an EM-16 and a magnetometer could be borrowed in Phoenix. Seismic equipment could probably be rented locally. The work could be done in 7 to 10 days by 2 people.

Stanley B. Keith, president of Magma Chem Exploration, Inc. has contributed some chemical analyses of the granite stock as follow-up to the AGS field trip led by Don C. White to the Vulture Mine. Keith has not provided interpretation of these data in the context of this studies of pluton-related gold occurrences but he probably would for $100.00 or so. His interpretations would provide reinforcement for careful exploration of the stock's margin if the analyses fall into the magma series known to be gold associates.

Block 3

Block 3 is the fault bounded area which includes United Verde Extension's unsuccessful exploration from the Douglas shaft near the airstrip. The Schoolhouse fault is to the west, the East fault is to the east and a suspected northeast trending fault bounds the south near the Vulture Mine road. There is no structure yet defined which makes a north limit. It is covered by alluvium and 400 feet of Tertiary lavas and conglomerates as encountered in UVX drill holes and the Douglas shaft. The target is the east strike extension of the Vulture ore body which was mined to the Astor fault. This leaves a complicated wedge between the Astor and Schoolhouse fault which is unexplored and unattractive because it offers very limited potential strike length. Thompson (1931) passed over this segment and speculated on Block 3. It is interesting however to go back to the Astor fault in evaluating potential further eastward and to read Searle (1931, p. 6, 3rd P) which reads as follows:

> "...At no point on the line of intersection does the Astor fault actually cut ore of desirable grade. The vein on the 950 level, where the fault cuts it is of considerable width but hardly commercial grade, and is of decreasing importance at this intersection for this level up to the 700 level. So that if there is no valuable portion of the vein to the east of the ore body mined, it is a matter of some doubt that any ore has been displaced by the Astor faulting. ~~And it seems rather probable if this ore body last mined by the Astor faulting~~. And it seems rather possible if this ore body last mined be the eastern limit of the values in the vein, that the displaced segment will not pay to find, exploit and mine."

Searle later tempers his negative look eastward in light of Thompson's reporting gold in the area of the Douglas shaft and in recognition of barren or near barren segments in the Vulture ore body in most instances because of fault zones without drag ore. Nevertheless it does raise the warning that the Vulture ore body may wane eastward and a duplicate east of the Schoolhouse fault may be an unrealistic target. It is difficult to assess variability from west to east in the old mine records but a concentrated effort along these lines should be made if this target is to be approached. The bare evidence of favorability east of the Schoolhouse fault is:

1) Gold reported by Thompson (1931) in rock chips from the initial diamond drill hole and gold panned from sludge returned from this hole. Core recovery was 5 to 10% and no gold was detected in whole core. The gold from this drill hole could have come from placer material at the Tertiary-Precambrian unconformity. No gold was found in drifting or drilling from the Douglas shaft.

and,

2) A short interval of core described by Thompson as the porphyritic granite of the Vulture ore body. If one is willing to speculate on the existence and profitability of a Vulture-type ore body at depth in Block 3 then a major effort needs to be made to understand displacements on the northwest trending faults as a first step. They are mapped in underground working (Deberry 1915) and on current surface maps where they cross outcrops. Their trace in areas covered by alluvium could almost certainly be defined by a VLF survey as the vuggy hematite and calcite probably makes them water courses. With strike and dip on these faults, the attitude of the ore body east of the Astor fault and the best estimate on throw which can be made from the compendium of geologic information, one can speculate on target locations. If that location is similar to Thompson's of 1931 than that bet has been made.

Block 4

Block 4 is the exposed portion of the granite stock west of the old Vulture workings. The background gold values here are quite low but local highs occur in quartz beins, probably Laramide, and possibly in margins of Tertiary dykes filling the dominantly northwest oriented fractures related to basin and range faulting. The highest known gold concentration in this block is a single assay of 0.7 oz/t Au from an 8-inch quartz vein sampled by Zortman/Landusky (Pegasus). Followup on that sample by White (1985, c) failed to find any significant thickness, strike length, disseminations into the granite, or even to reproduce the original assay. Zortman/Landusky sampling included most of the quartz veins likely to be found in the granite. They had no other significant finds. Since the chances are slim of any of these veins becoming large enough to harbor more than a few tons, and there seem to be no vein networks or clusters like griesen, no work is recommended on this block.

Block 5

Block 5 is the broad area of exposed and covered Precambrian to north and south of the Vulture Mine. As noted above, the Precambrian per se is not attractive because we found neither gold, or indicator minerals, or favorable rock types therein. The exposed areas have been very well prospected over a long period of time. No further work is recommended in this block.

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WESTERN TECHNOLOGIES INC.
The Quality People

BIOREMEDIATION SITE REGISTRATION APPLICATION FOR
A.F. BUDGE (MINING) LIMITED
VULTURE MINE
WICKENBURG, ARIZONA

WT JOB NO. 7120K028

WESTERN TECHNOLOGIES INC.
The Quality People

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WESTERN TECHNOLOGIES INC.

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(602) 437-3737

April 26, 1990

Ms. Betsey P. Westell
Environmental Health Specialist
Solid Waste Unit
Arizona Department of Environmental Quality
2005 North Central Avenue
Phoenix, Arizona 85004

RE: TEMPORARY SOIL TREATMENT SITE REGISTRATION, VULTURE MINE, WICKENBURG, ARIZONA. WT JOB NO. 7120K028.

Dear Ms. Westell:

Pursuant to our recent discussions and the "Waste Management Guidelines" provided by the Arizona Department of Environmental Quality (ADEQ) Solid Waste Unit, Western Technologies Inc. (WT) would like to register a temporary soil treatment site at the above mentioned location. The site currently is owned by A.F. Budge (Mining) Limited. This application has been prepared in accordance with the "Guidelines" and follows the same sequential order.

Approximately 125-cubic yards of soil has been stockpiled at the site. The soil was transferred from an A.F. Budge (Mining) Limited facility in San Manuel, Arizona. WT estimates that the treatment program will require approximately 6 - 8 months to complete.

WT would appreciate your assistance in expediting the review process. As previously discussed, the guideline information will be sent to your office for each program of this nature that WT plans to perform. If you have any questions regarding this information, please call us at (602) 437-3737.

Respectfully submitted,

WESTERN TECHNOLOGIES INC.

Glen R Turney

Glen R. Turney, Ch.E.
Project Engineer, Remediation
Environmental Engineering Services

/bd

Attachments:

Copies to: Addressee (3)

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APPENDICES

BIOREMEDIATION SITE REGISTRATION APPLICATION FOR
A.F. BUDGE (MINING) LIMITED
VULTURE MINE
WICKENBURG, ARIZONA

WASTE MANAGEMENT GUIDELINE - SOIL TREATMENT SITE INFORMATION

A. Local Government Approval

1) See Appendix A, Maricopa County Bureau of Air Pollution Control. The area is outside of Phoenix city limits and is not zoned.

B. General Information

1) See Appendix B.

2) Source: Surface staining from mining equipment.
Amount: Approximately 125 cubic yards.
Concentration: Waste oil, average TPHC level = 6000 - 8000 parts per million (ppm).

3) Vulture mine site. Book 1, Page 2, SW 1/4 of SE 1/4 of Section 36, Township 6 North, Range 6 West, Gila and Salt River Meridian, Maricopa County, Arizona.

4) The site currently slopes gently from the northeast to the southwest. The containment pit will have the same 1 - 1-1/2% slope. The containment area is located on mine tailings from previous operations at the site. The tails are silty clays. Ground water in this area is limited to the alluvium in the valley. The mine is located at the mountain base and is not underlain by the alluvium.

5) See Figure Nos. 1 & 2 in Appendix C. Note: Area is not within the 100 year flood plain.

6) The only surface water source in the area is a lined mine tailings pond located approximately 1/4 mile east of the containment area. The mine tailings piles are located between the containment area and the pond which precludes a discharge to the pond. There is an arroyo located 500 feet to the west of the containment area. However, the containment pit slope is parallel to the arroyo and the pit is 30 to 40 feet in elevation above the wash.

7) See Appendix D. The ambient petroleum hydrocarbon concentrations ranged from 10 parts per million (ppm) to 15 ppm. See Section D. - Operating Procedures for ambient sampling procedures. The two samples were taken from soils that will underlie the containment pit. The soil is very uniform and WT deemed two samples sufficient to define the ambient conditions. The samples were taken from about 6 - 12 inches below ground surface.

C. Design of the Site and System

1) Berm Design:

The polyethylene liner will extend over the soil berm. The soil berms which surround the pit will be approximately 3 feet in height. As discussed with Mr. Larson formerly of ADEQ, the berms will be approximately 6 feet wide instead of 9 feet. This yields a 2:1 angle of repose, which is more functional for a pit of this size than a 3:1. In the Wickenburg area a 10 year/24 hour flood event is approximately 2.76 inches. The berms of the pit will be one foot higher than the soil enclosed, which will provide four times the suggested containment.

2) Nature of containment system:

A.) One layer of polyethylene sheeting will be used to line the containment pit and soil berm.

B.) The layer will be 20 millimeters (mm) in thickness. No chemical reaction is expected between the petroleum contaminated soil (PCS) and the polyethylene liner. Previous jobs of a similar nature have indicated that the shear strength of the liner is sufficient to sustain the treatment process. No permeability information was available from the polyfilm.

C.) The polyethylene sheeting is to be field seamed with a chemically inert adhesive. A 12 to 16-inch overlap will be used for each layer of the liner. A 6-inch buffer layer of clean fill will be placed over the liner in order to assure that the integrity is not compromised during aeration.

3) Remediation system to be employed:

C.) Biological remediation will be employed on the PCS soil. Three times per week, the soil will be turned with a mechanical tilling device. This will introduce oxygen into the soil and enhance biological growth. Biological media and nutrients will be introduced into the soil by inoculation 1 to 2 times during the program. The bacteria will be hydrated in a 55-gallon water tank and sprayed onto the soil. The nutrients will be applied by a conventional fertilizer spreader.

D.) Operating Procedures

1) Site Preparation:

A.) Two ambient native soil samples have been taken from the area where the containment pit will be placed. The samples were taken at the approximate location of the collection area of the containment pit. With the pit slope and possible standing water, this would be the most likely area if a discharge were to occur.

B.) Ambient sampling.

1) A WT field engineer with experience in sampling and quality assurance procedures obtained the samples. The engineer has OSHA 40-hour Hazardous Waste Training certification.

2-6) The soil samples were taken with decontaminated soil scoops from 6 to 12 inches below the soil surface. The soil was placed into the jar up to the brim to prevent headspace and possible volatile losses. The sample containers were 125 milliliter (ml) lab jars which had teflon-lined lids. The samples then were placed on ice in a cooler for transport. Following sampling, the soil scoops were washed in an Alconox solution, rinsed in potable water, and finally rinsed in deionized water.

The sampling gloves used were discarded at the WT laboratory.

2) Transportation and Handling:

A-C.) The soil will be taken from the stockpile and placed on the liner with a backhoe. The soil will be deposited on one end and the unloading will continue to the other end. The soil berm will then be replaced at the point of entry by the backhoe into the pit. An engineer will oversee the procedure to see that the liner integrity is not compromised. Patching material will be available should a liner breach occur. The soil will be placed on the liner to a depth of 1.5 feet, overlying a 6-inch thick layer of granular fill. The fill with provide additional protection against incidental slashing of the polyethylene liner during tilling.

3) Operation and Maintenance Schedule:

The soil will be tilled three times each week following the initial inoculation. Moisture will also be added as needed. The liner and berms will be inspected visually during each tilling.

4) Sampling Schedule and Schedule for Submittance of Results to ADEQ:

The soil will be sampled monthly after the initial sampling. Four samples will be obtained during each sampling round. A copy of the analytical reports will be provided to ADEQ upon completion of the project unless a more frequent reporting is required.

1-3) A copy of a WT chain-of-custody form is included as Appendix E. Also included is a QA/QC form followed by WT personnel.

B.) As earlier referred to, a copy of the lab analysis will be provided.

The samples will be analyzed for total petroleum hydrocarbon by EPA Method 8015. They will also be analyzed by EPA Method 8020 for benzene, toluene, ethylbenzene, and xylenes. Both methods are described in Test Methods for Evaluation Solid Wastes SW846, third edition, United States EPA, November, 1986.

Any rinse water thought to be contaminated will be placed into the pit for treatment. In the event of runoff from the pit, procedures will be followed to determine the extent of the contamination through sampling and excavation.

E) As-Built Plan - N/A

F) Closure Plan

1.) The soil beneath the containment pit will be sampled following removal of the formerly contaminated soil from the pit. WT will obtain samples from the original areas sampled and also from any areas that indicate a possible leak or compromise of the pit.

2.) The remediated soil will remain on the site following treatment. If the treatment process is not effective in reducing the TPH levels, WT will be prepared to transfer the soil to an approved facility.

3.) The liner will be reused for the facilities mining operation if possible.

4.) The land will be used for expansion of the mine tailings in the future or for a maintenance access road for A.F. Budge.

APPENDIX A

WESTERN TECHNOLOGIES INC.

P.O. Box 21387 85036
3737 East Broadway Road
Phoenix, Arizona 85040
(602) 437-3737

May 2, 1990

Mr. Jess Lotwala
Public Health Engineer
Bureau of Air Pollution Control
Maricopa County Department of Health Services
1845 East Roosevelt Street
Phoenix, Arizona 85006

RE: APPLICATION FOR AIR QUALITY PERMIT FOR BIOREMEDIATION SITE LOCATED AT THE VULTURE MINE, WICKENBURG, ARIZONA.

Dear Mr. Lotwala:

Western Technologies Inc. (WT), on behalf of A.F. Budge (Mining) Limited, would like to request an air quality permit for the above mentioned facility. The site is currently owned by A.F. Budge (Mining) Limited.

A.F. Budge will be performing soil moisturizing and aeration as part of a biological treatment process at the site. WT will be directing the bioremediation and has submitted registration information to the Arizona Department of Environmental Quality, Solid Waste Unit. A copy of this information is attached.

The process is to be performed on soil contaminated with heavy oils and is expected to take 6 to 8 months. During the program it is estimated that releases to the atmosphere from the soil would be minimal due to the non-volatile nature of the contaminant.

WT would appreciate your assistance in expediting the review process. As previously discussed, a permit application will be sent to your office for each program of this nature that WT plans to perform in Maricopa County.

If you have any questions, please call me at (602) 437-3737.

Respectfully submitted,

WESTERN TECHNOLOGIES INC.

Glen R. Turney

Glen R. Turney, Ch.E.
Sr. Remediation Engineer
Environmental Engineering Services

/bd

Attachments: Registration Information

APPENDIX B

BUDGE

A.F. Budge (Mining) Limited

4301 North 75th Street
Suite 101
Scottsdale, AZ 85251-3504

(602) 945-4630
FAX (602) 949-1737

RECEIVED ... 1990 WESTERN TECHNOLOGIES, INC. ARIZONA PHOENIX

April 27, 1990

Glen Turney
Project Remediation Engineer
Environmental Engineering Services
Western Technology Inc.
3737 East Broadway Road
Phoenix, Arizona 85040

Dear Mr. Turney:

Please be advised that the owner of record of the land in the SW1/4SE1/4 of Section 36, Township 6 North, Range 6West, Maricopa County is:

A.F. Budge (Mining) Limited
4301 North 75th Street, Suite 101
Scottsdale, AZ 85251

We are aware that material containing petroleum hydrocarbons have been deposited at this site. We are also aware that a bioremediation plan has been proposed by Western Technologies Inc. to treat this material and we approve of this plan.

Very truly yours,

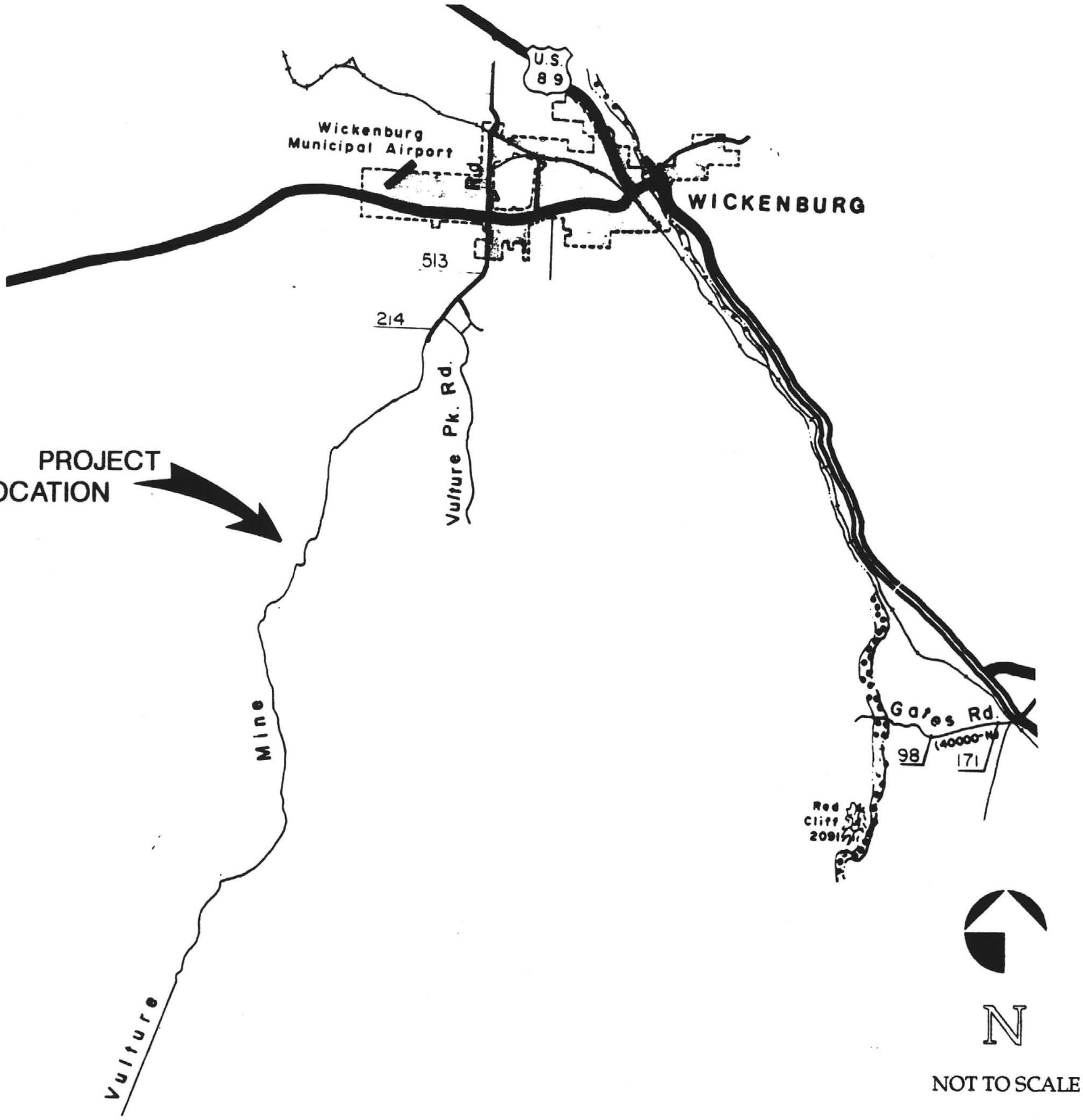
Carole A. O'Brien

Carole A. O'Brien
Mining and Financial Coordinator

APPENDIX C

Soil Remediation

A. F. Budge (Mining) Limited
Vicinity Map
Figure 1

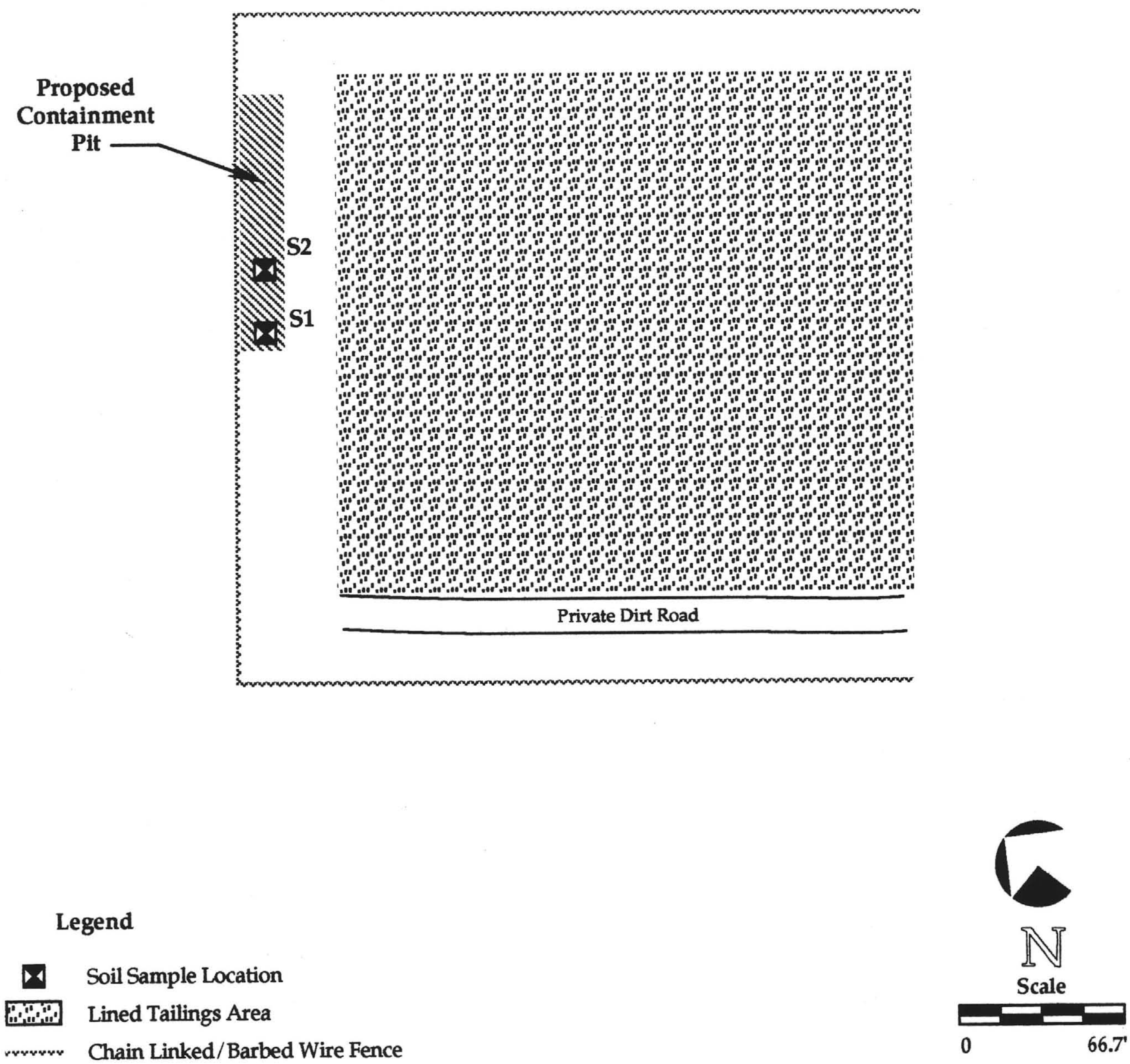


JOB NO. 7120K028

REVIEWED	R. Livermore	WESTERN TECHNOLOGIES INC.
PREPARED	T. Chapman	The Quality People

Soil Remediation

A. F. Budge (Mining) Limited
Site Plan
Figure 2



JOB NO. 7120K028

REVIEWED	R. Livermore
PREPARED	T. Chapman

WESTERN TECHNOLOGIES INC.
The Quality People

APPENDIX D

WESTERN TECHNOLOGIES INC.
3737 East Broadway Road
P.O. Box 21387
Phoenix, Arizona 85036
(602) 437-3737

LABORATORY REPORT

CLIENT A F BUDGE (MINING) LIMITED
4301 N. 75TH STREET
SCOTTSDALE, AZ 85251

SAMPLE NO. : 9002361
INVOICE NO.: 7120W028
DATE : 04-26-90
REVIEWED BY: M E. Dmein
PAGE : 1 OF 1

CLIENT SAMPLE ID : AFB-001-A
SAMPLE TYPE .....: SOIL
SAMPLE SOURCE ...: --
SAMPLED BY ......: WTI/G. TURNEY
SUBMITTED BY ....: WTI/G. TURNEY

AUTHORIZED BY: AFBML/PERSONNEL
CLIENT P.O. : --

SAMPLE DATE .: 04-20-90
SUBMITTED ON : 04-20-90

REMARKS -

TOTAL PETROLEUM HYDROCARBONS BY MODIFIED 418.1

DATA TABLE

PARAMETER	RESULT	UNIT	TEST DATE
Total Petroleum Hydrocarbons .....:	10.	mg/Kg	04-23-90

(1) Copy to Client

WESTERN TECHNOLOGIES INC.
3737 East Broadway Road
P.O. Box 21387
Phoenix, Arizona 85036
(602) 437-3737

LABORATORY REPORT

CLIENT A F BUDGE (MINING) LIMITED
4301 N. 75TH STREET
SCOTTSDALE, AZ 85251

SAMPLE NO. : 9002362
INVOICE NO.: 7120W028
DATE : 04-26-90
REVIEWED BY: M.E. [signature]
PAGE : 1 OF 1

CLIENT SAMPLE ID : AFB-002-A
SAMPLE TYPE .....: SOIL
SAMPLE SOURCE ...: --
SAMPLED BY ......: WTI/G. TURNEY
SUBMITTED BY ....: WTI/G. TURNEY

AUTHORIZED BY: AFBML/PERSONNEL
CLIENT P.O. : --
SAMPLE DATE .: 04-20-90
SUBMITTED ON : 04-20-90

REMARKS -

TOTAL PETROLEUM HYDROCARBONS BY MODIFIED 418.1

DATA TABLE

[--------- PARAMETER ---------]	[-- RESULT --]	[- UNIT -]	TEST [DATE]
Total Petroleum Hydrocarbons .....:	15.	mg/Kg	04-23-90

(1) Copy to Client

№ 5091

CHAIN OF CUSTODY RECORD

JOB NO.: 712OKO

PROJECT NAME: AF BUDGE

SAMPLER (SIGNATURE): GR Turney

SAMPLE IDENTIFICATION	DATE	TIME	COMP.	GRAB	SAMPLE LOCATION	NUMBER OF CONTAINERS	VACSAM	SOIL SCOOP	SOIL AUGER	SPLIT-SPOON	BAILER		REMARKS (PHYSICAL APPEARANCE, etc.)	LABORATORY IDENTIFICATION
AFB-001-A	4/20/90	1130		✓		1		✓					SOIL	9002361
AFB-002-A	4/20/90	1130		✓		1		✓					"	9002362

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)
GR Turney	4/20/90	1500					

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE	TIME	REMARKS
			Anne Nichols	4/20/90	15:00	

SHIPPING TEMP. (°F)

MIN. MAX.

WESTERN TECHNOLOGIES INC.

White–Testing Laboratory; Yellow–Department Job File; Pink–Field Sampler

APPENDIX E

CHAIN OF CUSTODY RECORD

№ 902177

JOB NO.	PROJECT NAME
SAMPLER (SIGNATURE)	

SAMPLE IDENTIFICATION	DATE	TIME	COMP.	GRAB	SAMPLE LOCATION	NUMBER OF CONTAINERS	SAMPLE METHOD: VACSAM	SOIL SCOOP	SOIL AUGER	SPLIT-SPOON	BAILER		REMARKS (PHYSICAL APPEARANCE, etc.)	LABORATORY IDENTIFICATION

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)
RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)	RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY (SIGNATURE)
RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LABORATORY BY (SIGNATURE)	DATE	TIME	REMARKS	

SHIPPING TEMP. (°F)	
MIN.	MAX.

WESTERN TECHNOLOGIES INC.

White–Testing Laboratory; Yellow–Department Job File; Pink–Field Sampler

QUALITY ASSURANCE PROCEDURES

QUALITY ASSURANCE OBJECTIVES

The overall QA objectives are to develop and implement procedures for collecting and evaluating data in an accurate, precise and complete manner. Data obtained under such procedures will insure that the measurement of data, sampling procedures, and field measurement provide information that is representative of actual site condition. The definitions for accuracy, precision, completeness, and representativeness are as follows (quoted from EPAs QAMS-005/80, December 29, 1980):

- Accuracy - the degree of agreement of a measurement (or an average of measurements of the same thing), X, with an accepted reference or true value, T, usually expressed as the difference between the two values, X-T, or the difference as a percentage of the reference or true value, 100 (X-T)/T. Accuracy is a measure of the bias in a system.

- Precision - a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision is best expressed in terms of the standard deviation. Various measures of precision exist depending upon the "prescribed similar conditions."

- Completeness - a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions.

- Representativeness - expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

The procedures for gathering accurate, precise, complete and representative data are described in subsequent sections.

The overall QA/QC Program will be administered and directed by a QA/QC Officer who will be directly responsible to the Program Director, who will ensure that all procedures outlined in this document and site-specific plans are followed by the field, laboratory, administrative and data interpretation personnel. If any discrepancies are observed by the QA/QC Officer, the Program Director will be notified and corrective action instituted. The QA/QC Officer will review all site-specific investigation plans to insure that each contains adequate QA/QC Plans and that all work can be inspected or audited for compliance. The QA/QC Officer will review all draft reports to insure the quality assurance plans were observed.

1.0 Document Control and Filing Systems

All documents will be under the control of the Program Director. The documents from each site investigated will be placed into a central file (either manual or computerized). The filing system will be based on a serial-number system. The files will be kept in filing cabinets which are kept locked when not in use. The QA/QC Officer and Program Director will be responsible for ensuring that the document system is available to users while providing adequate control on security and usefulness of files.

All correspondence will be logged in and placed in a designated file upon receipt. The central files will be located at Western Technologies Inc., Las Vegas, Nevada. Separate file numbers will be assigned in the central filing systems to each site investigated under this contract. This will insure against files being misfiled.

The files will contain all field/laboratory documentation (field logs, Chain-of-Custody Records, data sheets, etc.), work plans, project management plans, assessments and progress reports.

2.0 Field Activities

All field activities will be conducted according to written protocols. Field personnel will be briefed on the activities to be performed before any work commences. Field personnel unfamiliar with new equipment or procedures will be trained before field activities are performed. Additionally, field personnel will be briefed concerning the Health and Safety Plan of the site before work is commenced at the site.

2.1 Development of Standard Operating Procedures (SOPs) for Sampling

Before any site is investigated in this program, sampling SOPs will be developed. The development of sampling SOPs and adherence to the SOPs during field work is required for a complete quality assurance program. The sampling SOPs will define objectives, design the plan, preparation of containers, maintenance of equipment sample packaging and chain-of-custody protocols. It is important to note that in the design of the sampling plan, it is necessary to insure that the samples being collected are representative of the population (soil, water) being sampled. Therefore, a statistical approach will be used to estimate the minimum number of samples needed to meet an acceptable confidence level. Because environmental samples are usually grossly heterogeneous, a statistical approach can aid insuring adequate samples are collected to meet the objective of the site investigation or remediation. The sampling plan will be prepared by the Project Manager and reviewed by the QA/QC Officer for adherence to the overall quality assurance program.

2.2 Sampling: Soils, Sludges

The field personnel conducting sampling will coordinate with the laboratories to ensure the correct sampling equipment and containers are employed. Sample containers will be labelled before the sampling activity commences. The sample containers will be checked to ensure they are cleaned and contain the correct preservatives, if necessary. After the sample is collected, the date, time, name of sampler and sampling location will be written on the sample label. The sample will be capped and a sample seal placed on the area between the cap and the container. The sampler will place sample into an a cooler for transport to the laboratory. The sampler will record each sample on a Chain-of-Custody Record. The sampler will be responsible for custody of the samples until the samples have been delivered to the laboratory or a shipping agent. The laboratory or shipping agent will be required to sign the Chain-of-Custody Record before the sampler will relinquish custody of samples.

The field quality control program will include the use of travel blanks and field spikes to evaluate problems which can be encountered in sampling and transport to the laboratory. Travel blanks are containers (e.g. 40-ml VOA bottles) filled with deionized water at the site. The container containing the travel blank is labelled, sample seal applied, placed in the cooler and transported to the laboratory along with the samples collected at the site. The sample is analyzed to ascertain if the samples may have been contaminated during transit. Field spikes are prepared by adding a known concentration of the chemical parameter to a sample or deionized water. The container is labelled, sealed and transported with the samples collected at the site. The spiking solution will contain chemical parameters which are being investigated at the site. Field spikes may indicate losses associated with transport or matrix interferences. Field spikes will not be revealed as such to the laboratory and, therefore, can be used as an independent check on the performance of the laboratory.

The field equipment (split-spoon samplers, spatulas, etc.) will be cleaned before each sample is collected. The equipment will be cleaned with a solution of trisodium phosphate and triple rinsed with distilled water. The water will be collected and taken off site for disposal.

Field logs will be written with waterproof ink and log books. The sampler will place all observations concerning collection of samples such as time, depth, location, geologic materials encountered, soil moisture, etc. The logs will be signed by the field supervisor at the end of each working day. The field logs will become part of the document control system at the end of the field activities.

The QA/QC Officer will visit each site being investigated to insure the procedures listed in this document and the site-specific documents are implemented. The visit will be unannounced and the results of the audit reported to Program Director and Project Managers.

2.3 Sampling; Natural Waters

The groundwater sampling will conform to the following guidelines. All measuring and sampling equipment will be decontaminated prior to sample collection from each well. Prior to sampling, a submersible pump and stainless steel bailer will be used to evacuate a minimum of three casing volumes prior to sampling. Temperature, conductivity and pH will be monitored during evacuation to verify purging of static water in well. The sample will be taken after well has recovered with 80% of the water level above the bottom of the well prior to purging.

Water samples will be collected with a stainless steel bailer or submersible bladder pump. Samples collected for volatile organics will be placed in 40-mL VOA bottles and filled from the bottom up and capped tightly to avoid formation of bubbles. Samples will be placed in the containers using the preservatives and holding times outlined in Table I. The sample label, seal and Chain-of-Custody Record will be completed. The sampler will enter the following information in the field notebook:

- Sampler's name
- Sample number
- Location
- Purged volume
- Unusual conditions (i.e., color, odor, solids, etc.).
- pH, temperature, conductivity
- Water level

The samples and a travel blank will be placed into a cooler containing ice. The cooler will be marked "Fragile" and "this-end-up" labels on all four sides of each cooler. The cooler will deliver to shipper or laboratory and the Chain-of-Custody formed signed.

All field instruments (pH, conductivity, temperature) will be calibrated at the beginning of each work day and must not vary by more than 5% of true measurement.

2.4 Lithologic Logging

A complete log of conditions encountered during drilling will be maintained using Unified Soil Classification System by an engineer or geologist. A borehole log form will be used to record observations.

3.0 Laboratory Activities

Upon receipt of the sample, the laboratory will sign the Chain-of-Custody Record and forward a photocopy to the project manager for inclusion in the project files. The sample will be logged in, assigned a laboratory tracking number and stored in the proper location in the laboratory.

Samples requiring organic analyses will be refrigerated. Refrigerators used to store volatile organics will be monitored using refrigerator blanks. Refrigerator blanks are 40-ml VOA bottles containing deionized water. Periodically, the blanks are analyzed to ascertain if the deionized water has been contaminated by the storage of volatile organics. Refrigerator blanks are helpful in ascertaining possible contaminant pathways if a field blank tests positive for volatile organics.

The samples will be analyzed within the time periods listed in Table I. The time is measured from the time of collection to time of analysis or extraction. The table also lists the type of containers to be used and the required preservatives for aqueous samples.

The chemical laboratory will monitor the following operations which affect the control of quality of chemical analysis. The QA/QC Officer will be responsible for proper monitoring of all operations.

Deionized Water

The deionized water will be monitored to insure that it meets the following specifications for laboratory and field use:

pH	6.7 to 7.3 pH units
Electrical Conductivity	$<$ 1.0 mohs/cm @ 25C°
Particulates	$\leq$ 0.1 mg/l

Measurements are taken at least monthly and recorded in the log book.

Water for Special Uses

Deionized water is boiled for 24 hours and then packed in 40-mL vials for later use. Organic-free water is prepared on a weekly basis.

Carbon dioxide free water obtained by deionized water is boiled for 15 to 20 minutes, cooled to room temperature and sealed in a glass container.

Ammonia-free water is obtained by passing water through an ion exchange column.

Chemicals and Gases

All chemicals used in preparation of standards, decompositions, and extractions will be analytical grade or better. The use of method blanks will assist in monitoring the quality of chemicals used with sample decomposition and extractions. If at any point a method blank fails to perform according to the parameters of the method, the chemicals used with the method blank will be replaced. Reagents are logged under an inventory control and disposed of at the date of expiration.

Glassware

In all cases, polyethylene or borosilicate (Pyrex, Kimax) containers will be used for storage of standards and reagents, including tinted glass for photosensitive reagents. Most metal stock solutions are placed in polyethylene bottles, except for elemental solutions known to react with polyethylene (such as antimony).

Volumetric Glassware

Standard solutions are prepared in Class "A" volumetric flasks. For all titrimetric procedures, Class "A" microburets are employed. All G.C. syringes are calibrated and certified by the distributor (Hamilton, Supelco).

Standards

Commercially prepared and certified calibration and stock standards are purchased for all analyses requiring such standards. Organic standards are purchased from Ultra Scientific, Supelco or Chem Service. Fisher Scientific is the supplier for inorganic and metal standards. Pesticide grade solvents are purchased from Burdick and Jackson. Quality control check samples for organic analyses are provided by EPA. Quality control check samples not obtained from a certified source are prepared in the laboratory using a chemical reagent which differs from the reagent used in preparing the external (calibration) standards. The standard stock solutions (usually 1000 ppm) are prepared on a monthly basis. The diluted stock solutions used for external or internal standards are prepared daily.

3.1 Internal Quality Control Checks

The quality assurance procedures of the environmental laboratory are based on Standard Methods for Examination of Water and Wastewater, 16th edition, Handbook for Analytical Quality Control in Water and Wastewater Laboratories, EPA, June 1972, by the Analytical Control Laboratory, Cincinnati, Ohio and "Establishment of Chemistry Laboratory Quality Assurance Policies", Arizona Department of Health Services, Memorandum; Laboratory Certification and Licensors Section 2551188, December 1, 1982.

The laboratory will perform environmental analyses in accordance with the following documents:

Methods for Organic Analysis of Municipal and Industrial Wastewater, EPA-600/4-82-057

Methods for Chemical Analyses of Water and Wastes, EPA-600/4-79-020

Standard Methods for Examination of Water and Wastewater, 15th Edition

Test Methods for Evaluating Solid Waste, SW-846, 2nd Editions

The quality control procedures mandated in each of the above documents will be observed. Additionally, many of the recommended quality control procedures associated with the above documents will be incorporated into this QA/QC plan. The quality control checks incorporated in this QA/QC Plan are listed and defined below:

3.1.1 Reagent/Method Blank - a sampled of deionized/organic free water that is processed through all procedures, quantities of materials and labware used in sample preparation. Methods requiring the addition of internal standards and/or surrogate spikes, the spikes will be added to Reagent/-Method blank. The data from the blank assesses whether adequate contaminant control was exercised. If the method blank gives a positive response for the parameter(s) of interest, corrective action will be taken. Actions will include review of method and possible replacement of reagents, water, glassware, etc. A method blank will be analyzed for each batch of samples or once every ten samples.

3.1.2 Check Standard - Certified check samples will be used when available from commercial or government sources. EPA check samples are available for many of the organic analyses. Laboratory prepared check samples will be prepared with an analytical reagent which differs from the one used to prepare the calibration standards. The check standard is not carried through the entire analytical procedure, but is analyzed directly by the analytical instrumentation (e.g. direct injection of a G. C. column). A check standard result is used to validate an existing concentration calibration curve. If the check standard deviates by more than ± 10% from the calibration curve, corrective action will be taken. A check standard will be analyzed for each batch of samples or once every ten samples.

3.1.3 Surrogate Spike - prepared by adding a known amount of a pure compound to the environmental sample. The compounds selected for surrogate spikes are not expected to be found in the sample, but is similar to the compounds of interest. Surrogate spikes are added to an environmental sample prior to any extraction process and are carried through the total analytical method. In analytical methods requiring surrogate spikes, the spike is added to every environmental sample. Surrogates are used to monitor the operation of the analytical method. The data is used to calculate a percent recovery of the surrogate spike (an estimate of accuracy). The percent recovery of the surrogate spikes must fall within the acceptable range of recovery or corrective action will be taken.

Water Samples
Surrogate Spikes

	Acceptable Range of Recovery (%)
Volatiles	80-120
Base/neutral	30-130
Acids	50-110
Pesticides	70-120
TCDD	20-150

Soil/Waste Samples
Surrogate Spikes

	Acceptable Range of Recovery (%)
Pesticides	25-140
Volatiles	60-130
Base/neutral	25-120
Acids	15-110

The laboratory maintains quality control charts to monitor the continuous (accuracy) performance of the analysis. If the control charts indicate the analysis is "out of control" by the laboratory, even though the acceptable ranges listed above have not been exceeded, the laboratory will take corrective action.

3.1.4 Internal Standard - prepared by adding a known amount of a compound to the environmental sample. The compound selected is not one expected to be found in the sample, but is similar in nature to the compound of interest. Internal standards are added to the environmental sample just prior to analysis. With the purge and trap techniques, the internal standard and surrogate spike are identical. The internal standard is used to monitor the operation and sensitivity of the analytical system and the effectiveness of purging apparatus. In analytical methods requiring internal standards, the standard is added to each environmental sample.

3.1.5 Calibration Standards - prepared by adding a known amount of compound to deionized water. The solution is serially diluted to produce 4 to 5 solutions of different concentrations. The calibration standards are analyzed and used to produce an external calibration curve. The curve must be linear and have correlation coefficient of $\geq$.995 before samples will be analyzed.

3.1.6 Matrix Spike - prepared by adding a known amount of a pure compound to the environmental sample. The compound used for the spike is the same as that being analyzed for in the sample. The matrix spike is added to the environmental sample prior to any extraction or decomposition and is carried through the entire analytical process. A matrix spike will be analyzed for each batch of samples or once every ten samples. The data is used to calculate a percent recovery of the matrix spike. The percent recovery of the matrix spikes must fall within the acceptable range of recovery or corrective action will be taken.

Water Samples
Matrix Spikes

	Acceptable Range of Recovery (%)
Pesticides	40-130
Volatiles	60-145
Base/neutrals	30-120
Acids	10-120

Soil/Waste Samples
Matrix Spikes

	Acceptable Range of Recovery (%)
Pesticides	25-140
Volatiles	60-140
Base/neutral	30-140
Acids	20-120

The laboratory maintains quality control charts to monitor the continuous (accuracy) performance of the analysis. If the control charts indicate the analysis is "out of control" by the laboratory, even though the acceptable ranges listed above have not been exceeded, the laboratory will take corrective action. Matrix spikes for organic parameter is not listed above and inorganics will use acceptance criteria listed by the respective EPA method.

3.1.7 Matrix Duplication - Aliquots are made in the laboratory of the same environmental sample and each aliquot is treated exactly the same throughout the analytical method. If the maximum acceptable percent difference of the duplicates exceeds the criteria listed below, then corrective action will be taken.

	Maximum % Difference
Volatile	15%
Base/neutral	50%
Acid	40%
Pesticide	40%

3.1.8 GC/MS Tuning Sample - The EPA tuning compounds will be used. Set the mass spectrometer to the acceptance criteria listed with the respective EPA method. The GC/MC will be tuned every 24 hours.

3.1.9 Control Charts

The laboratory maintains control charts on both inorganic and organic analyses. The type of chart used consists of a central line and two limit lines spaced above and below the central line. These are termed the inner and outer control limits. The charts used to assess accuracy (% recovery) the central line represents the mean of the % recovery values. The inner control limits and outer control limits are located two and three standard deviations from the central line, respectively. If a % recovery is located outside of the outer control limits or two consecutive % recovery values reside outside of the inner control limits, then the analysis is considered "out of control." The analyst must take corrective action before proceeding.

Additionally, charts are developed to assess precision of the analysis (% difference of duplicates).

3.2 External Quality Control

A laboratory in order to maintain a consistent quality control program must include outside sources of standards. The sources supply control solutions similar in properties to the internal quality control solutions used by the laboratory. The recommended frequency of an external quality control check is once or twice annually.

Western Technologies Inc. participates twice annually in the EPA Performance Evaluation Water Pollution and Water Supply studies as an external check on our capabilities.

3.3 Record Keeping

All reports, charts and calculations associated with an analyses are filed according to the name of the client. Records are kept on file for at least seven years. The QC data is maintained in separate log books. The maintenance of QC log books and control charts are under the control of the laboratory QA/QC Manager. The QA/QC Manager is responsible for checking calculations and the accuracy of QC data.

3.4 Maintenance and Calibration of Instrumentation

The laboratory has an in depth QA/QC Document which lists specifically the calibration for each instrument in the laboratory. A brief description is given below:

1. Instrument calibration is done at the time of use as dictated by the SOP for each individual instrument.
2. All balances are zeroed before each day's use and checked against Class S weights monthly and annually calibrated by a commercial calibration service.
3. Volumetric glassware which is not Class A is checked for calibration semiannually.
4. Thermometer calibrations are performed annually by a commercial calibration service.
5. Documentation is kept on all gas cylinder changes as well as change of gas line filter and molecular sieves.
6. Records of service contracts and service/ maintenance visits are kept.
7. A preventive maintenance schedule is maintained in accordance with the laboratory QA/QC Manual.

3.5 Laboratory QA/QC Manual and Standard Operating Procedures (SOP)

The laboratory has prepared an in depth QA/QC Manual (130 pages). The manual incorporates all the QA/QC procedures used in the laboratory.

Standard Operating Procedure (SOP) manuals have been written for each environmental analyses performed by the laboratory. SOP's are detailed restatements of EPA methods. The SOPs mandate the exact type of standardization (internal or external), chemicals to be used, concentrations of spiking solutions and many other analytical techniques left to the discretion of the individual laboratories by EPA methods. The SOPs are updated each year and must be approved by the laboratory QA/QC Officer and Laboratory Manager.

4.0 Performance and System Audits

An audit is an independent assessment of data quality. The QA/QC Officer will conduct field office and laboratory audits. The function of the field auditor will be to:

- Observe procedures and techniques of the field sampling crew;
- Check and verify records of calibration;
- Assess the effectiveness of and adherence to prescribed QC procedures;
- Review document control procedures;
- Identify and correct any weakness in the sampling/analytical approach and techniques and;
- Assess the overall data quality of the various sampling/analytical systems.

The function of the laboratory auditor will be to review:

- Calibration documentation of instruments;
- Completeness of laboratory data forms;
- Sampling logging procedures;
- Documentation of quality control data (control charts).

The function of the office auditor will be to review:

- o Field data review and validation procedures;
- o Field data storage and filing procedures;
- o Laboratory data review and filing procedures.

Upon completion of the audit, the QA/QC Officer will discuss any specific weaknesses with the Project Manager and make recommendations for corrective action. An audit report will subsequently be prepared and distributed to Project Manager, Program Director and Arizona Department of Environmental Quality. This report will outline the audit approach and present a summary of results and recommendations.

560 E. Ave. J-1
Lancaster, CA 93534

ASSAYING - CHEMICAL ANALYSES - FLOW SHEETS
RESEARCH - ORE TESTING - SAMPLING
CONSULTING SERVICES - QUALITY CONTROL

PM LABS
(EXTRACTIVE METALLURGICAL CHEMISTRY)

PHONE
(805) 942-8145

LABORATORY CERTIFICATE

December 21, 1985

Robert Jobes
3016 Mason Ave.
Las Vegas, NV 89102

Re: Results from wet chemical analyses of five "Huddy" samples for silver and gold. 4 AT samples used in all analyses with silver and gold beads recovered and placed on file card enclosed.

Sample Mark:	Silver Recovered, 4AT:	Gold Recovered, 4AT:
Huddy #1	8.64 mg.	1.44 mg.
Huddy #2	25.44 mg.	1.08 mg.
Huddy #3	2.16 mg.	1.56 mg.
Huddy #4	2.04 mg.	.96 mg.
Huddy #5	6.16 mg.	.68 mg.

CALCULATIONS:

	Sample Mark:	Silver (Troy oz./T):	Gold (Troy oz./T):
32	Huddy #1	2.16	.36
7	Huddy #2	6.36	.27
	Huddy #3	.54	.39
7	Huddy #4	.51	.24
2	Huddy #5	1.54	.17
	Averages:	2.22	.29

Submitted by:

Willard A. Luegge

WAL:jw

Please note: No sample is truly representative of a possible ore body. These laboratory results represent evidence based upon laboratory methods of extraction which rarely can be duplicated by common production methods.

560 E. Ave. J-1
Lancaster, CA 93534

ASSAYING - CHEMICAL ANALYSES - FLOW SHEETS
RESEARCH - ORE TESTING - SAMPLING
CONSULTING SERVICES - QUALITY CONTROL

PM LABS
(EXTRACTIVE METALLURGICAL CHEMISTRY)

PHONE
(805) 942-5145

March 20, 1984

Ray Rees
Searchlight Mining Association
3430 E. Flamingo
Suite 306
Las Vegas, Nevada 89121

Dear Mr. Rees:

For your information, I was made aware that my assaying is accepted by the Vancouver Stock Exchange. This was acknowledged through business clients in Vancover.

Yours truly,

Willard A. Luegge

WAL:jw

360 E. AVE. J-1
LANCASTER, CA 93534

PHONE
(805) 942-5145

FIVE POUND TEST OF ROASTED ORE VIA CYANIDE LEACH:

5 lbs. of head ore was all ground to pass - 60 mesh and than roasted at 800° F for 30 min. A .1% Sodium Cyanide solution was used; pH 10-11; room temperature; agitation/airation.24 hr. leach time used. Pregnant solution was divided into three fractions and the silver/gold recovered via previous methods.

Method Identification:	Silver:*	Gold:*
Zinc Precipitation	7.83	.33
Lead Plating	7.87	.35
Carbon Ab/Strip/Plating	7.51	.31

Note: The lead plating method is a little better than the other two methods and is the "simplest" of the three. However, a larger volume of pregnant solution is involved. Consequently, I am going to incorpoate two methods in the procedural flow sheet so you have an option.

This completes the ore testing and now I can compile the procedural flow sheet having adequate data.

* Troy oz./Ton of ore

Submitted by:

Willard A. Luegge

WAL:jw

Willard A. Luegge

NEVADA MINERAL REFINING CORPORATION

A.J. CHRISTENSEN ENTERPRISES

WORLD WIDE

MINING CONSULTANTS

671 W. SUNSET RD.
HENDERSON, NV 89015

BUS (702) 565-7780
BUS (702) 565-0131

Certificate of Assay

FOR: Ray Reese
3430 E. Flamingo #306
Las Vegas, Nv.

DATE: 12-17-84
PHONE: 458-6692

SAMPLE	AU	AG	RH	PT
SAMPLE #1 (BLEND)	0.79	6,42	Trace	Trace
FROM: Wickenburg, AZ				

The above material was ground to -325 fine, acid washed. Tested for any contamination and dryed. Then above fire assay was taken.

CERT. # 06317

CHARGES $35.00

PD Ø CASH Ø CHECK O

Paid in full
AJC

BY: [signature]
ASSAYER

Custom Assay Office
ASSAY CERTIFICATE
J. W. (Jack) Sharpe, E. M.
Assayer

No.............. Wickenburg, Arizona....10/19/56

Royal Investments

Sample No.	Owner's Mark on Sample	Gold Oz. Ton	Gold Val. Ton	Silver Oz. Ton	Silver Val. Ton	Per Cent of Cu		
	#2 Cores (Composite #2 Hole as check)					1.7		

Gold at $.......... per oz. Charges $1.50 Pd

[signature]

Custom Assay Office
ASSAY CERTIFICATE
J. W. (Jack) Sharpe, E. M.
Assayer

H-4

Certificate No. 4

Wickenburg, Arizona 12/4/56 19....

Royal Investment Co
Scott Weaver Mine

Sample No.	Owner's Mark on Sample	Gold Oz. Ton	Gold Val. Ton	Silver Oz. Ton	Silver Val. Ton	Per Cent of Cu			Total Value per Ton
	#4 0-9½'					1.5			
	#4 9½-19'					0.7			
	#4 19-33½'					0.4			
	#4 33-40'					1.4			
	#5 40-45'					2.3			
	#4 55-63'					2.9			
	#4 63-76'					2.1			
	#4 76-86'					0.9			
	~~#4 86-100'~~					~~0.8~~			
	~~#4 100-111'~~					~~1.2~~			
	~~#4 111-116'~~					~~1.3~~			
	~~#4 126-141'~~					~~1.6~~			
	~~#4 141-156'~~					~~3.7~~			
	(0.4% to 2.90% Cu)								

1.15 x 130 = 149.50
1.40 x 156 = 218.40
367.90
367.9 ÷ 286 = 1.29+% Cu
ERH

E. Ross Householder

Footage x Assay Totaled = 218 ÷ 156 (Total footage) = 1.4% for #4 Hole ERH

Gold at $.......... per oz. Charges $..........

[signature] Assayer

NOT SCANNED

R. RTL A TESTI[ng]
A DIVISION OF CLAUDE E. [McLEAN]
PHONE AL 3-6272

Chemists . . . Engin[eers]

Royal Investment Corporatio[n]
% Herman Radner
1132 South 5th Street
Las Vegas, Nevada

Sample: cores DDH #1 M

Received: -

Submitted by: Mr. A. H. Ellett

Report of

Identification		Silver Oz/ton	Silver Value	Copper (Cu)
129405	0-6	Nil		
129406	15-16	0.20	——	Nil
129407	16-15	Nil	0.18	0.66
129408	16-25	Nil	——	Nil
129409	25-30	0.40	——	Nil
129410	30-36.5	0.20	0.36	1.60
129411	36.5-46	0.20	0.18	0.95
129412	46-51	0.20	0.18	0.85
129413	51-56.5	0.20	0.18	0.50
129414	56.5-59.5	0.40	0.18	0.60
129415	59.5-64	0.20	0.36	2.40
129416	64-65.5	0.40	0.18	0.40
129417	65.5-69.5	0.20	0.36	3.40
129418	69.5-73.5	0.20	0.18	0.60
129419	73½-81	0.40	0.18	0.90
129420	81-85	0.20	0.36	1.80
129421	85-91	0.20	0.18	1.00
129422	91-101	0.20	0.18	0.90
			0.18	0.50

cc: Mr. A. H. Ellett

(.95% to 3.40%)
(24' lost)
(101-24 = 77')
weighted average 77' is 1.03% Cu
down to 101' level

REGISTERED ASSAYER CERTIFICATE EXPIRES CLAUDE E. McLEAN DEC. 31, 1956 ARIZONA, U.S.A.

CHARGES $ 105.00

c/MAIL

Custom Assay Office
ASSAY CERTIFICATE
J. W. (Jack) Sharpe, E.M.
Assayer

No. 1 Wickenburg, Arizona 12/4/54

Royal Investment Co
Scott Weaver Mine

Owner's Mark on Sample	Gold Oz. Ton	Gold Val. Ton	Silver Oz. Ton	Silver Val. Ton	Per Cent of Cu	Total Value Per Ton
#2 0-6'					0.3	
#2 6-11'					0.8	
#2 11-16½'					1.1	
#2 16½-20'					0.9	
#2 20½-29'					0.7	
#2 29½-33'					0.4	
#2 33-38'					0.6	
#2 38-49½'					0.1	

Charges $ .... per oz. .... Assayer

Custom Assay Office
ASSAY CERTIFICATE
J. W. (Jack) Sharpe, E.M.
Assayer

Certificate No. 2 Wickenburg, Arizona 12/4/54

Royal Investment Co
Scott Weaver Mine

Owner's Mark on Sample	Gold Oz. Ton	Gold Val. Ton	Silver Oz. Ton	Silver Val. Ton	Per Cent of Cu	Total Value Per Ton
#2 43½-55'					0.4	
#2 55-64½'					2.1	
#2 64½-67'					1.0	
#2 67½-72'					1.7	
#2 72-77'					0.3	
#2 77-86½'					0.1	
#2 86½-95'					0.2	
#2 95½-105½'					0.3	

Gold at .... per oz. Charges $ .... Assayer

20 Horseshoe [illegible]

Custom Assay Office
ASSAY CERTIFICATE
J. W. (Jack) Sharpe, E.M.
Assayer

Certificate No. 3 Wickenburg, Arizona 12/4/54

Royal Investment Co
Scott Weaver Mine

Owner's Mark on Sample	Gold Oz. Ton	Gold Val. Ton	Silver Oz. Ton	Silver Val. Ton	Per Cent of Cu	Total Value Per Ton
#2 105½-116					0.8	
#2 116-128'					0.2	
#2 128-130½					1.7	
#1 1-49'					0.3	
#1 49-82'					0.1	
#1 82-102'					Tr	

Charges $ .... per oz. .... Assayer

#3