Battle Mountain Resources, Inc
PO Box 310
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April 15, 2013

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Durango Field Office
Division of Reclamation,
Mining and Safety

Ms. Loretta Pineda
Division Director
Division of Reclamation, Mining and Safety
1313 Sherman Street, Suite 215
Denver, CO 80203

Re: Costilla County Request for Investigation of San Luis Mine Lined Tailings Facility

Dear Ms. Pineda:

We have reviewed the February 26, 2013 letter from John C. McClure and Edwin J. Lobto on behalf of the Board of County Commissioners of Costilla County and the Costilla County Conservancy District (collectively, "the County") to Ms. Loretta E. Pineda, re: Costilla County/BMRI – storage of poor quality water. That letter asserts that use of the lined tailings facility ("LTF") at the San Luis Mine for water management purposes poses a threat to community water supply wells, and requests the Division of Reclamation, Mining and Safety ("DRMS") to investigate water management practices at the San Luis Mine. We understand that DRMS is completing an investigation in response to that request. Battle Mountain Resources, Inc. ("BMRI") is providing the following information for DRMS's consideration during its investigation.

This is not the first time that the County's attorneys have raised unfounded claims concerning potential risks associated with water management at the LTF. In 2007, BMRI filed a water rights case seeking approval of a water right change and augmentation plan related to waters historically used for irrigation at the Salazar Ranch (No. 07CW42). The County, represented by Messrs. McClure and Lobato, objected to that proposal, and argued that the LTF may leak and contaminate downstream waters, including waters at the Salazar Ranch that BMRI proposed to use for augmentation. Following the objector's presentation of its case during several days of trial in December 2012, the District Judge for Water Division No. 3 found "there is no evidence before the Court to suggest that such a leak or a spill from the Lined Tailings Facility is likely or probable; or in terms of the burden of proof, there is no evidence that it is more probably true than not that such a leak or spill will occur." *See* Reporter's Transcript, Volume III of III, Case No. 2007CW42, December 13, 2012, appended as Attachment 1, pp. 497-498.

The County attorneys' letter and their accompanying memorandum (collectively, "the McClure Letter") contain several misstatements, and raise essentially the same arguments that the Court found to be unsubstantiated. Although the authors speculate about potential future water quality issues related to the LTF, they fail to include any evidence that adverse conditions have resulted or could reasonably be expected to result from water management practices at the LTF.

This letter is not intended to address every inaccuracy in the McClure letter. Rather, BMRI's objective is to provide an overview of facts necessary for an accurate understanding of the LTF operations and DRMS's comprehensive regulation of that facility. BMRI would be happy to provide any additional information that may assist DRMS in completing its investigation of water management practices at the San Luis Mine.

1. Brief History of the Permitting and Operation of the San Luis Mine LTF

The permitting process for the LTF was extensive and rigorous. DRMS originally issued the San Luis Project Reclamation Permit in 1988 (Permit No. M-88-112). The construction and operation of the LTF was permitted via Permit Amendment 1, which the Mined Land Reclamation Board ("MLRB") approved in January 1990. There were multiple rounds of DRMS Adequacy Comments and Battle Mountain Adequacy Responses. Many agencies were involved, and the pubic was engaged throughout the review process, culminating in a January 25, 1990 hearing before the MLRB ("MLRB"), which is memorialized in a more than 300-page transcript. *See* MLRB hearing transcript excerpt (January 25, 1990), appended as Attachment 2.

At pages 18 through 25 of that hearing transcript, Mr. Steve Renner of the DRMS (then known as the Mined Land Reclamation Division) detailed the extensive chain of events comprising the adequacy process leading up to the hearing. At that hearing, DRMS determined that BMRI had met the requirements of the Mined Land Reclamation Act and the implementing regulations, and recommended that the MLRB approve the Permit Amendment. *Id.* at 25. The MLRB approved the Permit Amendment on January 25, 1990, following the hearing. *See* Letter from Steven G. Renner to A. Walter Wise of Battle Mountain re: MLRB approval of Permit Amendment (January 31, 1990), appended as Attachment 3.

Active mining and milling ended at the San Luis Mine in 1996, and subsequent site activities have focused on closure and reclamation of the site. In response to water quality issues associated with the backfilled West Pit, BMRI developed Technical Revision No. 26 (TR-26) in March 1999, which established a water management program to pump and treat waters from the pit and various wells to prevent outflow from the West Pit. Later in 1999, DRMS (then known as the Division of Minerals and Geology) approved the transfer of water pumped from the West Pit to the LTF to enhance evaporative loss of the West Pit water. *See* DRMS approval documentation (July – November 1999), appended as Attachment 4. In December 2000, the Colorado Department of Public Health and the Environment issued BMRI a Colorado Discharge Permit System Permit authorizing the discharge of treated West Pit water from the San Luis Mine waste water treatment plant (Permit No. CP-0045675).

Water from the West Pit has been successfully managed through use of the LTF and water treatment plant since 2000. As predicted in TR-26, the backfilled West Pit materials have been rinsed such that the current West Pit ground water quality is the same as existed pre-mining. *See* Memorandum from Harry Posey to Bruce Humphries, re: Review: "Analysis of Pre-mining water quality in the vicinity of the West Pit" (September 14, 2005), appended as Attachment 5. Although the West Pit water is at pre-mining background quality, it continues to be treated to meet applicable state surface water quality standards prior to discharge.

2. <u>Design of the LTF and Collection Pond System</u>

The LTF is an important part of the current San Luis Mine water management system. The McClure letter incorrectly states that the LTF and collection pond system was not designed to contain water and thus, should not be utilized in connection with water management at the Mine. While implicitly acknowledging that there has been no adverse water quality impact associated with the LTF, that letter speculates that, at some time in the future, water could leak from the LTF. To the contrary, given the design of the LTF and collection pond, and current safety measures in place, use of the LTF for managing West Pit waters is protective of down-gradient waters.

The record of DRMS' comprehensive review and permitting of the LTF documents that the LTF and collection pond system was designed to receive and contain water, and in volumes substantially greater than are currently being managed in the LTF. During the 1990 MLRB Hearing for Permit Amendment 1, SRK Consulting described the substantial volumes of slurry water that would be sent to the LTF. *See* Attachment 2, MLRB Hearing Transcript, pp. 66-67. As approved by the MLRB and DRMS, Permit Amendment 1 included a water balance analysis, which projected that over 100 acre-feet of slurry would be discharged to the LTF each month. Conservatively applying the projected tailings density of 50 percent, this equates to more than 600 acre-feet per year of water being discharged to the LTF during milling operations. *See* Appendix K to Permit Amendment, Water Balance, appended as Attachment 6. That water balance also projected that there would be a free-water pond on the surface of the deposited tailings. *Id. See also* Excerpts of Exhibit D to Permit Amendment 1, Mine Plan, p. D-21, appended as Attachment 7 The LTF and collection pond system was designed and constructed to be a closed circuit, zero discharge facility that would contain those substantial volumes of water. *See* Attachment 7, Mine Plan, p. D-18.

In contrast to the large volumes of water discharged to the LTF during milling operations, water deliveries to the LTF in the past nine years have ranged from 20.77 acre-feet to 164.91 acre-feet per year. *See* Excerpts from October 2008 and October 2011 monthly augmentation accounting reports to Division of Water Resources, line labeled "Tailings Meter," appended as Attachment 8. Consistent with the substantial reduction in annual water deliveries since completion of milling, a comparison of an aerial photograph from September 23, 1994 during mining, to a more recent June 30, 2011 aerial photograph shows that the open water surface on the LTF is much smaller now than it was during mining/milling operations—approximately 17 acres vs. 45 acres. *See* Free

Water Surface at Lined Tailings Facility During and Post-Mining, appended as Attachment 9. In short, significantly more water was stored in the LTF during mining and milling operations than during the post-mining reclamation phase.

To contain the substantial volume of slurry water discharged to the LTF, the LTF base area was originally conditioned by compacting the subsoil to a permeability of approximately 10^{-5} centimeters per second, and installing a 40-mil very low density polyethylene (VLDPE) synthetic liner on top of the compacted subsoil, with selected areas being lined with a 60-mil high-density polyethylene (HDPE) synthetic liner in areas with continued exposure or potentially high hydraulic heads. *See* Attachment 2, MLRB hearing transcript, p. 46; Letter from Allen Sorenson, Mined Land Reclamation Division, to Larry Oehler, MLRB, p. 2 (April 14, 1992), appended as Attachment 10. On top of the synthetic liner, there is a drainage blanket consisting of both cobbles and a pipe network to facilitate the drainage of tailings liquids into this underdrain system. The underdrain piping then runs through the embankment and into the collection pond.

The collection pond itself is a double-lined facility, with an upper liner of 60-mil HDPE and a lower liner of 40-mil VLDPE. *See* Attachment 2, MLRB hearing transcript, p. 48; Attachment 7, Mine Plan, p. D-38. Between these two liners is a gravel blanket that serves to collect any water that could potentially penetrate the upper liner. A pumpback system is installed within this gravel layer so that minimal hydraulic head is allowed to build on the lower liner, thereby keeping all of the fluids in the collection pond contained within the system. In fact, this design is consistent with the EPA's recommended method of hazardous liquid storage (40 CFR Part 264, Subpart K).

The substantial volume of tailings that were deposited into the LTF during milling operations adds yet another low permeable layer that further reduces the potential for seepage from the LTF. Those tailings are projected to have a permeability of 10^{-5} to 10^{-6} cm/sec. *See* Attachment 2, MLRB Hearing Transcript, p. 67. As shown on the aerial photographs appended as Attachment 9, the free water within the LTF is surrounded by a several hundred-feet thick layer of low-permeability tailings.

Not only was the LTF and collection pond system designed to contain fluids associated with the mining and milling operations, the system was also designed to control potential flood events. *See* Attachment 2, MLRB Hearing Transcript, p. 48; Attachment 7, Mine Plan, p. D-20. A diversion ditch system exists along the east and south side of the LTF, which is designed to route the 100-year, 24-hour storm event around the LTF and then deliver the water back to the natural channel downstream of the collection pond. *See* Attachment 2, MLRB hearing transcript, p. 50. In addition, the LTF embankment is designed to capture the probable maximum flood ("PMF") from the limited area inside the diversion ditch. As an extra measure of safety, in the event of a precipitation event that exceeds the 100-year, 24-hour storm event, the LTF is designed with additional capacity to retain any additional runoff between the 100-year storm and the PMF should the diversion ditch overtop into the LTF. *Id.* These stormwater control structures are inspected semi-annually, and an annual inspection report is submitted to the Colorado Department of Public Health and Environment.

Similarly, the collection pond has a diversion ditch that will divert water around the collection pond from storm events up to the 100-year, 24-hour storm for the entire upgradient area of the collection pond (the north, east, and south sides of the collection pond). In addition, the collection pond is designed not only to hold the water that is being drained from the tailings facility, but also to hold the expected runoff within the collection pond area from the 100-year, 24-hour storm event. *See* Attachment 7, Mine Plan, pp. D-38 to D-39.

In summary, the MClure letter's allegation that the LTF and collection pond were not designed to store water is incorrect. The LTF and collection pond were designed and constructed to contain substantially more free liquids than are currently being stored during the post-mining reclamation phase, and to handle additional waters from a maximum modeled storm event.

3. Additional Protective Measures Related to the LTF

While the LTF and collection pond system was designed to contain substantially greater volumes of water than are currently being managed, BMRI has also installed an extensive monitoring well network in both the unsaturated and saturated zones down gradient of these facilities to serve as an early detection system in the unlikely event there is an excursion of fluids from that system. Moreover, BMRI will be implementing a dam safety inspection plan to provide a further measure of assurance that the LTF will continue to effectively function as designed.

A. Monitoring System

Since its construction, BMRI has been required to monitor water quality downgradient of the LTF and collection pond system to ensure that the system remains protective of downgradient water resources. Those monitoring requirements were specified in BMRI's first water augmentation plan decree in Case No. 89CW32 and in several Technical Revisions to the DRMS Permit. The current post-mining monitoring requirements at the San Luis Mine site have been cataloged and summarized in Technical Revision 32. *See* Technical Revision 32, appended as Attachment 11, Table 1-1, Summary of Surface and Ground Water Monitoring at the San Luis Mine.

The ground water quality monitoring system for the LTF and collection pond consists of a network of monitoring wells and lysimeters. The location and construction of that network, along with the historic sampling results, are described in a recent memorandum prepared by Lytle Water Solutions, LLC. *See* Memorandum from Bruce A. Lytle to Larry Fiske, re: Design and Operation of the Monitoring System Network at the Lined Tailings Facility and Collection Pond (April 9, 2013), appended as Attachment 12. As described therein, eight monitoring wells located immediately downgradient of the LTF and collection pond have been completed in various horizons of the Santa Fe Formation, which underlays those facilities. Those wells were located specifically to detect any fluid movement through either the saturated or unsaturated zones that would be indicative of a potential excursion of fluids from the LTF and collection pond system. Both water level and water quality data collected from those monitoring wells demonstrate that there has not been any measurable seepage of waters from the LTF and collection pond system. *Id.* at 2.

In addition to the monitoring wells, six lysimeters (three pairs) were installed in the vicinity of the collection pond at various depths to actively collect water samples from the unsaturated zone of the Santa Fe Formation. *Id.* Sampling results since the early 1990s confirm that there has been no unsaturated flow in the vicinity of the lysimeters, which further demonstrates that there has been no measurable release of waters from the LTF and collection pond system. *Id.* at 2-3.

The monitoring wells and lysimeters monitor the saturated and unsaturated zones of the Santa Fe Formation, from 22 to 213 feet. This network provides an effective early warning system in the unlikely event there ever is a release of water from the LTF and collection pond system. *Id.* at 3-4. Given the nature of the underlying formation and the location of these monitoring facilities, a release from the LTF and collection pond system would be detected long before there would be even a potential for impacts to down-gradient water supplies, and would allow ample time for developing any appropriate response actions. *Id.* at 4.

As summarized in TR-32, substantial additional monitoring is required at the following components of the LTF: (1) water quality at the tailings pond also known as supernatant pond, pursuant to Technical Revisions 6, 7, 10, 15, 31, and 32; (2) collection pond water volume pursuant to Technical Revisions 6, 15, and 32, and collection pond water quality pursuant to Technical Revisions 6, 15, 31, and 32; (3) leak detection system water volume pursuant to Technical Revisions 4, 6, 31, and 32, and leak detection system water quality pursuant to Technical Revisions 6, 31, and 32; and (4) piezometers water volume and water quality pursuant to Technical Revisions 6, 23, and 32. *See* Attachment 11, Technical Revision 32, Table 1-1. That monitoring provides further information to ensure that the LTF and collection pond continue to function as designed.

B. Tailings Dam Safety Inspection and Reporting Program

On March 13, 2013, BMRI submitted for DRMS approval Technical Revision 33 to the Permit (TR-33) establishing a Tailings Dam Safety Inspection and Reporting Program for the LTF. The Inspection Program includes a comprehensive review of the structural stability of the tailings dam and the hydraulic capacity of the associated flood diversion systems, and will identify any maintenance measures necessary to ensure the integrity of the water management system. This Inspection Program includes annual reviews of piezometric and other monitoring data to evaluate pore pressures within the dam, the seepage collection underdrain system and groundwater levels in the dam foundation below the liner to confirm that the LTF remains stable and protective of the environment. Quarterly inspections of the LTF and associated water management facilities will also be conducted to further ensure there are no operational issues.

The Dam Safety Inspection and Reporting Program also identifies several potential actions that may be taken in response to various inspection findings to further ensure that the integrity of the LTF is maintained. This Program will be implemented in conjunction with all of the existing monitoring requirements outlined in TR-32, including monitoring and reporting at lysimeters, monitoring wells, the leak detection system and the LTF underdrain.

We hope that the information provided with this letter is useful in completing DRMS's ongoing inspection of the LTF, and addressing the issues raised in the McClure letter. We believe that the design of the LTF, the permitting process and the monitoring data all demonstrate that the LTF is functioning in a manner that protects down-gradient waters. BMRI's ongoing monitoring and inspection programs will ensure that the LTF operations remain protective. We would be happy to provide any additional information to assist DRMS's review.

Respectfully,

Lawrence E. Fiske
Director Legacy Sites Closure and Reclamation
Newmont Mining Corporation

cc: Wallace H. Erickson (CDRMS)
Scott Hardt (TW&H)(e)(w/o attachments)
Jim Witwer (TRMW&F)(e)(w/o attachments)
Nancy Lipson (Newmont)(e)(w/o attachments)
Julio Madrid (Newmont)(e)(w/o attachments)
Steve Carino (BMRI)(e)(w/o attachments)

DISTRICT COURT
WATER DIVISION 3
STATE OF COLORADO

702 Fourth Street
Alamosa, CO 81101

IN THE MATTER OF THE APPLICATION FOR WATER RIGHTS OF BATTLE MOUNTAIN RESOURCES, INC., IN COSTILLA COUNTY

^COURT USE ONLY^

Case No. 2007CW42

For the Petitioner:
JAMES S. WITWER, #19482
ANDREA ASEFF, #42571
KRISTIN BAILEY, #44868

For the Board of Cty Cmmr's of Costilla County & Costilla Cty Conservancy District:
JOHN C. MCCLURE, #2896

For the Board of Cty Commr's & Montez, Espinosa, Acequia Chiquita, & San Luis People's Ditches:
Edwin J. Lobato, #4699

REPORTER'S TRANSCRIPT
(Excerpt of Proceedings)

The trial in this matter continued on Thursday, December 13, 2012, before the HONORABLE PATTIE P. SWIFT, Water Judge within and for the 12th Judicial District, State of Colorado.

MORNING SESSION, THURSDAY, DECEMBER 13, 2012

00:00:08 (The court reconvened at approximately
00:00:13 10:25 a.m., and the following proceedings were
00:00:23 had:)

00:41:31 THE COURT: We'll go back on the record
00:41:33 this morning. This is 2007 CW 42, In the Matter
00:41:38 of the Application of Battle Mountain Gold --
00:41:44 Battle Mountain Resources, Inc., excuse me.

00:41:49 At the conclusion of Costilla County's
00:41:51 case yesterday afternoon, Battle Mountain asked
00:41:54 this Court to rule on Battle Mountain's objections
00:41:57 to the admission of evidence concerning water
00:42:00 quality and, specifically, evidence concerning how
00:42:04 Battle Mountain manages water in the Lined
00:42:09 Tailings Facility, the LTF.

00:42:11 Battle Mountain argued that none of this
00:42:15 evidence is relevant to the Court's decision on
00:42:17 the matter that is actually before the Court in
00:42:19 this case; that is, whether to approve Battle
00:42:22 Mountain's request to change the use of the
00:42:24 Salazar Ranch water rights and to approve the
00:42:28 request to allow those water rights to serve as
00:42:31 replacement water in the augmentation plan
00:42:35 previously approved in Case No. 99 CW 57.

00:42:41 The evidence before the Court on this

00:42:43 point is as follows. And I apologize; I actually
00:42:49 thought there would probably be more people from
00:42:51 the community in the audience; and I kind of wrote
00:42:53 this decision, in part, to make sure that people
00:42:56 understood what I was talking about. Counsel may
00:42:58 say, "Boy, Judge, why are you going into all of
00:43:01 this?" But I'm going to go ahead and read to you
00:43:04 what I have.
00:43:05 After gold mining ceased at the San Luis
00:43:08 gold mine in 1996, Battle Mountain began
00:43:12 reclamation of the site. In the late 1990s, there
00:43:15 was a release of poor quality water from the West
00:43:18 Pit into the Rito Seco.
00:43:20 This release of poor quality water
00:43:21 occurred and would continue to occur to this day
00:43:24 if there were no remediation, because the mining
00:43:28 operation pierced what has been called the green
00:43:32 clay layer that had previously stopped the poor
00:43:37 quality water from traveling to the Rito Seco.
00:43:39 To remediate this problem, one or both of
00:43:42 the regulatory agencies overseeing Battle
00:43:45 Mountain's reclamation efforts; that is, the
00:43:47 Colorado Division of Reclamation and Mining Safety
00:43:49 or the Colorado Department of Public Health and
00:43:53 Environment, ordered Battle Mountain to drill and

pump water from wells in the West Pit to lower the water table so that that poor quality water would not flow into the Rito Seco. Case No. 99 CW 57 approved that plan for augmentation that allowed this out-of-priority pumping to occur.

Part of the reclamation and remediation plan required Battle Mountain to construct a reverse osmosis water treatment facility to treat this water. From 2003 to 2010, Battle Mountain pumped all of the West Pit water to the reverse osmosis plant where the water was treated and then discharged into the Rito Seco.

A by-product of the reverse osmosis plant is brine, which is water that contains the contaminants removed from the West Pit water in a concentrated form. Battle Mountain pumps the brine through a pipe to a lined tailings facility, where the brine -- where the water evaporates.

The Lined Tailings Facility was constructed at the time the mine began operations. It is the location where the tailings, the material left over from processing the ore to remove the gold, were transported in a slurry and where the solid material decanted from the slurry and where those solids remain to this day.

In 2011 and again in 2012, Battle Mountain did not pump all of the West Pit water to the reverse osmosis treatment facility. Rather, in those two years, Battle Mountain pumped over a hundred acre-feet of West Pit water directly to the Lined Tailings Facility. Such water is not treated to remove contaminants. Rather, it is allowed to evaporate, leaving the contaminants in place in the lining tailings facility with the other mine tailings.

During the last two days of trial, Costilla County has presented evidence, by way of cross-examination and in their case in chief, concerning their lack of information about the construction and the suitability of the Lined Tailings Facility to store water and concerning the possibility that a spill or a leak from the Lined Tailings Facility would contaminate downstream water rights, including the Salazar Ranch water rights, which are part of the replacement water included in the plan for augmentation in this case.

It is this evidence that Battle Mountain seeks to exclude. Battle Mountain argues that this evidence is irrelevant to the Court's decision on the augmentation plan and the change of water rights application.

In deciding this issue, the Court has first considered the fact that the Colorado Rules of Evidence define "relevant evidence" as evidence having any tendency to make the existence of any fact that is of consequence to the determination of the action more probable or less probable than it would be without the evidence.

Under Colorado water law, the Court shall approve a change of water right and/or a plan for augmentation if such change or plan will not injuriously affect the owner of or persons entitled to use water under a vested water right or a decreed conditional water right. That is CRS, 37-92-305(3)(a).

In ruling on a plan for augmentation, the Court must determine whether there will be sufficient water available from the substitute water supply to replace all out-of-priority depletions in time, place, and amount.

In addition, in determining whether to approve a plan for augmentation, the Court must decide whether the water to be substituted will be of the quality necessary to, quote, meet the

00:47:55 requirements for which the water of the senior appropriator has normally been used, unquote, CRS, 37-92-305(5). These are the only issues before this Court in this augmentation plan and change of water rights application.

The facts that are of consequence to this Court's decision then are facts concerning the amount of out-of-priority depletions caused by the West Pit wells, the amount of historic consumptive use of the Salazar Ranch water rights that are available to replace those depletions, the location of where that water can be replaced in the stream or aquifer, and whether that water produced by the Salazar Ranch water rights is of a sufficient quality to meet the requirements of senior water users.

Costilla County has essentially conceded that these facts have been proved. Costilla County, however, argues that Battle Mountain is seeking permission from this Court concerning how it disposes of poor quality water from the West Pit and that, therefore, the evidence concerning what Battle Mountain is doing at the Lined Tailings Facility is relevant to this Court's decision.

I previously reviewed what water quality issues this Court could properly decide in this Application for Change of Water Rights and Application for Approval of a Plan for Augmentation, and I'm just going to quote from my previous ruling.

This is the conclusion: "The Court generally agrees with Battle Mountain that the only water quality issue before a court in a typical case in which an applicant seeks approval of a plan for augmentation is whether the water being substituted is of sufficient quality to be suitable for the use the senior water users previously made of their water.

"In the current case, however, because of the parties' previous agreements concerning monitoring and remediation of water quality, the Court has jurisdiction to require those terms to be included in the final decree in this case.

"In addition, the Court has jurisdiction to review the water quality effects of Battle Mountain's management of water that does not enter the Rito Seco only if Battle Mountain is seeking a change in the protective provisions to which it previously agreed in 89 CW 32 and 99 CW 57, as those provisions apply to the management of such water, or if Costilla County proves that there is a likelihood that such water will contaminate the proposed replacement water."

So under this ruling, there are two ways in which evidence of water management in the Lined Tailings Facility could be relevant to my decision. First, if Battle Mountain were asking to delete or change previous conditions from the previous decrees in the current decree, the Court would have to determine whether that was appropriate. Here, however, Battle Mountain has agreed to include all of the terms in the final decree that were included in the previous decrees.

Costilla County points out that there are terms in the proposed final decree that concern how the West Pit water will be managed, in particular, the new term included at the request of the state and division engineers that no crops be grown on the Lined Tailings Facility. These terms, however, are included as court enforceable agreements between the parties to settle disputes between the parties.

As I said in my written decision, the inclusion of these terms does not give this Court jurisdiction over water quality issues generally; rather, the Court has ancillary jurisdiction to make sure the parties' previous agreements are not undermined by the terms of the current decree.

That does not make it appropriate for the Court to add other nonstipulated water quality terms to this order or to make changes in the previously agreed terms to clarify them to read in a way one or the other party now desires them to read.

Since the Court will not be adding additional water quality provisions, except any to which the parties themselves agree, evidence concerning the means by which Battle Mountain manages water on the Lined Tailings Facility or the wisdom of any of those water management programs is irrelevant to this Court's decision.

Under my Rule 56(h) decision, I also determined that there was another way in which evidence of Battle Mountain's management of the West Pit waters could be relevant to my decision, and that would be if Costilla County proved that there is a likelihood that water stored in the Lined Tailings Facility will contaminate the proposed replacement water.

Costilla County has argued that Battle Mountain's use of the Lined Tailings Facility as an alternate location for the disposal of poor quality water could result in a spill of that water, which could contaminate the Rito Seco, thus contaminating the water available under the Salazar Ranch water rights and thus impairing the quality of the replacement water provided under the augmentation plan.

Since the quality of the replacement water is a question for the Court in approving an augmentation plan, this evidence would be relevant if Costilla County has shown that it is likely that the waters in the Lined Tailings Facility will contaminate the Salazar Ranch replacement water supplies.

Battle Mountain disputed this claim arguing that it has complied with all of the previous water quality monitoring requirements and that there have been no issues.

There is some evidence before this Court that if there were a spill or if there were a leak from the Lined Tailings Facility, it would likely travel to the Salazar Ranch location and could contaminate the Salazar Ranch wells; however, there is no evidence before the Court to suggest that such a leak or a spill from the Lined Tailings Facility is likely or probable; or, in terms of the burden of proof, there is no evidence that it is more probably true than not that such a leak or a spill will occur.

The evidence before the Court is that the water produced from the Salazar Ranch water rights is of a sufficiently good quality to properly replace the out-of-priority depletions caused by pumping of the West Pit wells. The evidence before the Court does not establish that any of the other activities of Battle Mountain are more likely than not going to impair that water quality.

The Court's finding on this point is not intended to diminish the serious concerns that were presented to this Court. This Court must agree with Costilla County's frustration in not having more information about the construction and appropriateness of the Lined Tailings Facility as a water storage facility.

It is easy enough for lawyers and engineers who do not live below the tailings facility to tell this Court, as well as Costilla

County citizens and officials, "Don't worry. It will all be okay. We're doing everything we're required to do." All of us have lived long enough to be aware of numerous instances around the country in which such assurances proved not to be reliable.

The Court heard Mr. Gallegos' testimony concerning his prior predictions of harm having come true, but such predictions cannot be a basis for this Court's rulings.

Furthermore, this Court is not an administrative or regulatory body; and the Court has no investigatory powers. The Court must wait for disputes to be brought to it, and then it must rule on the evidence it has before it. And the evidence before the Court at this time does not establish a likelihood that the Lined Tailings Facility will leak and cause contamination of the Salazar Ranch water rights.

Thus, the evidence before the Court does not show a connection between Battle Mountain's disposal of poor quality water in the Lined Tailings Facility and the quality of the replacement water to be provided under the augmentation plan; and so evidence concerning the

00:56:37 wisdom of the disposal of poor quality water in the Lined Tailings Facility is not relevant to any decision that this Court has to make in this case.

00:56:49 During arguments yesterday, the suggestion was made that this Court should exercise some authority over the Lined Tailings Facility because it is an undecreed water storage facility. The issue of whether the Lined Tailings Facility should have a water decree is not before this Court and this change of water rights and augmentation plan proceeding.

00:57:12 If the Lined Tailings Facility is, in fact, a reservoir or is created by a dam that impounds water, then it may be that the division engineer should be regulating it pursuant to CRS, 37-87-101, et seq. Such a regulatory function belongs to the state and division engineers. They can investigate the situation, and they can take regulatory action.

00:57:39 As I said before, however, the Court must wait for a dispute to be brought to the Court; and the Court's rulings are confined to the matters at issue in the dispute before it.

00:57:49 Before me is the question of approval of a plan for augmentation and a change of water

00:57:55 rights. There is no request before the Court to approve Lined Tailings Facility for water storage. The division engineer has looked at the application and hasn't said anything to the applicant about a need to request such a water storage right, and there is no injunctive proceeding before me asking me to order that the Lined Tailings Facility not be used for water storage. It is not an issue before me at this time.

Yesterday, the argument was also made that Battle Mountain is violating prior decrees in this case by the way in which it is disposing of the West Pit waters in the Lined Tailings Facility.

As I said yesterday -- or as I questioned -- I guess, as I implied yesterday, and as I said in my written ruling, if Battle Mountain is violating those prior decrees, that is a matter that can be brought to the Court's attention in an injunctive proceeding; but that is not what I have before me. This is not a proceeding for an injunction.

And, as I said, this Court is not a regulatory agency that can determine whether

Battle Mountain's operation of the Lined Tailings Facility and the use of that facility to evaporate larger quantities of water complies or does not comply with the reclamation plan in this case.

The only issue before this Court concerns the right to use water and to change the use of water, not how the Lined Tailings Facility is used.

It appears that Battle Mountain has agreed to include all of the terms from the previous decrees in the current stipulated proposed decree. To the extent that there is new language proposed that would change the prior stipulations in the prior decrees, then I will consider those arguments in ruling on the actual language to be included in the final decree.

There was some argument yesterday that some of the wording actually changes what the prior decrees provided; and certainly, I think, that's an appropriate matter to be brought to this Court's attention in determining what final language will be approved. And so I will allow the parties to argue these language issues before I issue a final ruling and decree, but those language issues don't have to do with -- the

Court's not going to be deciding the wisdom of how the Lined Tailings Facility is used in making decisions on those language questions.

Also, the argument was made yesterday that, if the Court approves the decree in this case, the Court will in some way be approving Battle Mountain's choice in how it is managing the West Pit waters and how it's transporting waters to the Lined Tailings Facility at this time; and I want to make clear that, from this Court's perspective, any ruling on the decree in this case is not an approval of that mechanism of dealing with the West Pit waters.

I'm specifically finding by what I'm ordering right this very minute that the way in which the Lined Tailings Facility is managed is not an issue for this Court or not relevant to this Court's decision on the augmentation plan or the change of water rights; therefore, this Court's decision cannot approve that method of dealing with the West Pit waters. And I will include a specific provision in the final decree that says that. Counsel can propose something to the Court, and I will include that in the decree.

So I am generally granting Battle

Mountain's request that evidence presented concerning the wisdom or advisability of disposing poor quality West Pit water in the Lined Treatment -- I'm sorry, in the Lined Tailings Facility or the ability of the Lined Tailings Facility adequately to store that water -- that those issues are not relevant to any question before this Court and; therefore, will not be considered by the Court in any decision.

I'm not striking the evidence that such water has been transported to the Lined Tailings Facility or the amount of such water that has been transported or the fact that a canola crop was grown in the Lined Tailings Facility in 2011. So that's the Court's ruling.

MR. LOBATO: Thank you, Your Honor.

THE COURT: Mr. Witwer, then, are you ready to proceed with your rebuttal?

MR. WITWER: Could I have just one moment to confer, Your Honor, in light of the ruling?

THE COURT: You may. You may.

(There was a brief pause in the proceedings at this time.)

THE COURT: All right. Mr. Witwer.

MR. WITWER: Thank you, Your Honor. I

appreciate the Court's analysis and rendering the opinion, and we can talk in a moment about next steps. I think in light of the Court's ruling, Battle Mountain probably does not intend to put on any rebuttal case.

I would like to offer a few thoughts on some of the items in the Court's ruling. One, given the concerns about information exchange, et cetera, et cetera, I think we have discussed that this property -- it was 15 years ago or more that mining ceased on the property, and a lot of the issues in the long permit amendment and technical revisions process are, at least, lost to the memories of any current Battle Mountain employees.

The company was bought by its current owner in, I believe it was, 2001, long after mining had ceased and it's been longer since. We have spent considerable time in recent time, since the Court's November 14 ruling, trying to look through the online database at the Colorado Division of Mining, Reclamation and Safety, to unearth additional documents, other than the one the Court has heard about today. And had the Court made a different ruling with respect to the likelihood standard, the Court would have been offered those documents in evidence today.

We have shared those documents -- I want to say, as a practical matter -- this morning with counsel for both parties. And I would hope that, to the extent their clients and this Court remain frustrated, that that proffer, a lot of work in a pretty clunky online database of probably hundreds of thousands of pages of documents, will provide some comfort that, in fact, a number of the issues concerning flood water safety and the amount of water that was going on the tailings during mining and how it was designed to take all of that water versus what is there -- that additional comfort can be provided to a community that there's no dispute, as Battle Mountain has numerous employees who live downstream and downgradient of this same community in the town of San Luis. One could point out that they're not going to do anything to themselves and their families any more than anyone else.

But those are legitimate concerns; and those are concerns that information from those files that we believe we shared with the opposers today, we would hope, would have some beneficial effect, regardless of whether those issues are brought before this Court or, informally, in further discussions or in front of other forums; but that it is certainly not the company's intent.

Despite the fact of the long passage of time and the difficulty in retrieving things rapidly -- because a lot of the tailings impoundment issues did not come up in this case until October -- that we would hope that we made a good faith effort to try to provide some information, regardless of the fact that it's not going to come up in this case, as it turns out.

I would point out one item with respect to the Court's ruling. I think the Court suggested that the property might be a reservoir and, therefore, subject to state engineer jurisdiction over that.

That issue has been specifically addressed in the 1989 CW 32 decree in paragraph 47 of that decree. This is Exhibit 8, paragraph 47 of that decree on page 46. It states, in the Conclusions of Law, "The tailings disposal facility and collection pond are exempt from the Rules and Regulations For Dam Safety and Dam Construction." And there's a citation, including

01:09:30 to the 37-87 statute, but also to the rules of the
01:09:34 state engineer.
01:09:36 And it continues, "The absence of such
01:09:38 approval in any event does not affect the
01:09:41 jurisdiction of this Court to enter this Decree,"
01:09:44 and that was the augmentation plan.
01:09:46 I think the Court's rationale is sound
01:09:49 rationale, which is, in any event, this is a
01:09:51 change case and an augmentation plan case, wherein
01:09:55 issues like that wouldn't come up and so, I think,
01:09:58 consistent with the prior finding that the
01:10:01 jurisdiction of this Court to enter a decree is
01:10:04 not affected by that exemption.
01:10:05 And the practical matter is it's exempt
01:10:08 from dam safety jurisdiction by one agency; but
01:10:12 those issues in the impoundment, from cradle to
01:10:19 grave, the regulation of that facility, really
01:10:23 remains consigned to the DRMS agency, where it has
01:10:30 been all of this time and where, you know, large
01:10:33 volumes of documents included with permit
01:10:38 amendments and over 30 technical revisions, which
01:10:42 are also very voluminous, rest.
01:10:45 I guess the only thing I would finally
01:10:47 say, and I know I reiterated this last night, is
01:10:51 if the Court knows today that there are additional

01:10:54 provisions, either as a result of its ruling or as
01:10:56 a result of things that were not directly
01:10:58 addressed in the case concerning the proposed
01:11:00 decree, wherein it would be useful to hear
01:11:03 testimony from Mr. Lytle on engineering matters,
01:11:08 we certainly offer him to the Court; but
01:11:10 otherwise, we don't intend to put on a rebuttal
01:11:13 case.

01:11:13 THE COURT: All right. Thank you. Well,
01:11:16 I --

01:11:17 MR. MCCLURE: I just have a couple of
01:11:20 quick comments, just in response to Mr. Witwer.

01:11:24 In all fairness to his comment about the
01:11:28 documents that were produced today -- and we
01:11:32 received these this morning, basically, DRMS
01:11:38 records from the mining period or premining
01:11:41 period. In terms of those giving us additional
01:11:44 comfort, we disagree with that. It really
01:11:47 doesn't.

01:11:47 What occurred during the mining period
01:11:50 and what is occurring now, in an extended period
01:11:53 of reclamation that apparently won't end, is two
01:11:59 different matters; and our concerns were, I think,
01:12:02 expressed yesterday about the manner and use of
01:12:04 that Lined Tailings Facility now.

01:12:08 And, in terms of good faith efforts to provide information, I -- in all due respect, I don't think that's occurred. We have been trying to get information in discovery; and at every stage, we have been thwarted.

01:12:26 And, if there was a good faith effort, then we would hope those good faith efforts would manifest themselves in addressing this issue where, apparently, they are contending they can take unlimited waters, quantities of poor quality water, up to the Lined Tailings Facility. We just feel that actions speak louder than words.

01:12:53 MR. LOBATO: May I? Just one quick comment. Your Honor, as Mr. Witwer indicated, trying to access information from the files of DRMS, the electronic files of DRMS, is a monumental chore. I've spent countless hours trying to access and retrieve information about this structure, and it's a real challenge.

01:13:24 I will say one thing. In my investigation, I found that in 1992 the employees at DRMS had written some correspondence with the mine where DRMS challenged the impermeability of that liner and wrote that mine and said, "You overstated the impermeability. The information

01:13:52 provided by your engineering firm, by the
01:13:55 Geotechnical firm, is inaccurate. We want a
01:13:57 response to this. We want a response to this
01:13:59 finding."
01:14:00 And in all of my efforts, I could never
01:14:03 find a response that was provided by SRK; wherein
01:14:08 the DRMS stated to SRK or to Battle Mountain, "For
01:14:13 every foot of water on this liner, you diminish
01:14:20 the impermeability of this liner significantly."
01:14:25 We heard yesterday that, at a minimum,
01:14:27 there was 5 feet of water that is piped in there
01:14:34 and piped out of there every year. In the opinion
01:14:41 of that engineer at DRMS, there was a real
01:14:45 question of the viability of that liner.
01:14:46 We've yet -- we've never, in any of the
01:14:49 discovery, received any information about the
01:14:52 impermeability of that liner; and to the extent
01:14:56 that we consider it a real safety concern, we'll
01:15:01 pursue it where we have to pursue it. Thank you.
01:15:04 THE COURT: Thank you, Mr. Lobato. Since
01:15:08 then there is not going to be any rebuttal
01:15:10 evidence, I think that what would be most useful
01:15:13 for me would be either written closings.
01:15:16 I've got a proposed decree; and I think,
01:15:18 based on what I've just done as far as the oral

ruling of the Court, I think the issue remaining is whether there are specific provisions in that proposed final decree that Costilla County believes change the provisions that were included in the prior decrees because, as I've said over and over again, the Court's going to require that those same provisions be in there.

And so that's what I'd like to give the opportunity to the -- to Costilla County, to provide me in written form discussion of what terms you think should -- are not the same as what were in the prior decrees and proposed language that you think would make it the same as the prior decrees.

Also, propose the language that I said I would include that the Court was not making a finding concerning Battle Mountain's management of the water; that the Court's not finding it's appropriate or not. The Court simply is not deciding that. That's not before the Court.

I think that that's what is necessary to finish this up. And I don't think I need anything other than that. Is there any disagreement as far as that? Does anybody want to make some other argument to me beyond that?

indicate that the Court was making -- was not authorizing any particular practice of water management, and it would -- does the Court have some language that it is going to draft that's going to include that?

THE COURT: I'm asking you to propose it to me.

MR. LOBATO: Okay.

THE COURT: And then I'll decide. No, I don't have any specific.

MR. LOBATO: Thank you.

THE COURT: So then we want a response time for Battle Mountain. How much time do you need to respond to that?

MR. WITWER: Sometime around the end of the month.

THE COURT: So a couple of weeks. That's fine then. So by the 31st of January, which is a Thursday, you can file your -- any response; and then I'll give Costilla County seven days to file any reply to that. That would be by the 7th of February. And then I will issue a decree after that. Mr. Witwer.

MR. WITWER: This is just, frankly, in aid of the task before the parties. Obviously, it

REPORTER'S CERTIFICATE

The above and foregoing is a true and complete transcription of my stenotype notes taken in my capacity as Official Certified Reporter within and for the 12th Judicial District, State of Colorado, at the time and place above stated.

Dated this 7th day of January, 2013.

Catherine V. Rodriguez
Registered Merit Reporter

MINED LAND RECLAMATION BOARD
STATE OF COLORADO

REPORTER'S TRANSCRIPT OF PUBLIC HEARING
Volume I

January 25, 1990

IN RE:

APPLICATION OF BATTLE MOUNTAIN RESOURCES, INC., IN COSTILLA COUNTY.

PURSUANT TO NOTICE to all parties in interest, the above-entitled matter came on for public hearing before the Mined Land Reclamation Board on January 25, 1990, at 1313 Sherman Street, Denver, Colorado.

BOARD MEMBERS PRESENT:

Terry O'Connor, Chair
James Cooley, Acting Chair
Dennis Donald
Chris Jouglas
Mike Entz

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as a mill facility. Approximately one half of the ore was to be processed in the heap leach and the other half of the ore was to be processed within the mill, which consisted of a carbon in leach and flotation mill circuit.

The CIL and flotation tailings, the mill tailings were to be combined with other waste rock materials and deposited in an area known as the south waste rock disposal area.

The heap leach facility would be operated for approximately seven years and would undergo detoxification and ultimate reclamation by grading, top soiling and re-vegetation.

We are -- we have been processing an amendment to the original permit. This amendment calls for the deletion of the heap leach facility and, instead, would process all the ore mined from the two pits through a carbon in leach or CIL-type circuit, which you can essentially envision as the cyanide operation enclosed within a number of vats. The vats are located within a mill facility.

Battle Mountain Resources, during their presentation, will give you much more detail as to the processing and how the process works and what the advantages they feel are for this type of process.

The cyanide within the tailings -- and there will be cyanide used in the process -- the cyanide within the tailings will be volatilized, at least partially within the mill, and the tailings will then be stored in a managed thin layer deposition tailings disposal area, which is located at the general location of the previously approved heap leach facility.

I will just go through a chronology of what has occurred there since October 10 of 1989 and how the Division's review process has proceeded and how we have incorporated objectors and various parties into the review process.

On October 10 of 1989, Battle Mountain Resources submitted an amendment to the application, as I previously described, and on the 20th of October the Division found that the application amendment was complete, and that would be the filing date.

On the 7th of November we received some interest from a party, Ms. Nora Jacquez, who acquired a copy of the application from our office at that time. Also on the 7th of November we notified Mr. Neil Cohen, who has previously represented the

Costilla County Committee on Environmental Soundness, that we were in receipt of the application, and noticed him as to when the close of the public comment period was.

On the 27th of November we received comments from the Division of Wildlife, as required by the Mined Land Reclamation Act, and detailed their concerns, which essentially consisted of whether fencing would or would not be provided around any ponds which contain potentially toxic materials and what waterfowl mitigation measures were proposed by the company.

During the period December 1 through December 13, we received approximately 21 letters of objection to the amendment. These letters of objection raised various issues, which varied from socioeconomic impacts to Costilla County and San Luis, as well as technical concerns about the amendment application.

We have forwarded at various times, upon receipt of these letters, to both the company and to the Board, copies of each of these letters of objection.

At the December 14, 1989, Board meeting, the Board heard a request for formal public hearing and then set the matter for the January Board meeting, a formal public hearing that we are conducting today.

On the 16th of December the Board issued a prehearing order which detailed the objectives and dates to be accomplished by the Division, by the objectors, and by Battle Mountain Resources, and this was set out so that an orderly proceeding could be conducted from that point in time until today, which would facilitate the exchange of information to all interested people.

On December 15th we noticed all objectors of the January hearing. On the 18th we forwarded to all the objectors the prehearing order.

Also on that date, the 18th of December, the Division concluded its review of the amendment application and we issued our preliminary adequacy review. And the preliminary adequacy review consists of approximately 52 questions, comments and concerns which were generated during our review of the amendment application. We forwarded copies of the adequacy review to Battle Mountain Resources as well as all objectors.

On December 21, the Division and Battle Mountain met in the Division offices to discuss and clarify our adequacy comments and concerns.

On the 26th of December, as required by the Act, we arranged for publication of notice of the public hearing in two newspapers, one in Alamosa and one at San Luis.

On December 27th we received correspondence from the Colorado Historical Society which stated that the core zone in San Luis Culebra Historic Division will not be affected by the permit amendment.

On the 5th day of January of this year, the Division and Battle Mountain once again met to discuss specific aspects of the adequacy document. Battle Mountain Resources at that time submitted initial tailings geochemical data to the Division for its review.

On January 5th and the 8th we forwarded to the Board requests for party status, which I believe there were five requests for party status.

On the 9th of January we issued a -- the Division issued a tentative list of issues to be considered at the public hearing today.

Also on the 9th, Battle Mountain Resources responded to the Division's adequacy concerns.

On the 10th of January, Battle Mountain submitted proof of publication and proof of notification to adjacent landowners, also a requirement of the Act.

On the 16th of January the Division and Battle Mountain met to discuss the Battle Mountain response to our adequacy concerns and to discuss further potential questions and concerns that we had generated by our review of their response.

On the 16th of January we also received a response to the Battle Mountain response to our adequacy review from the Costilla County Committee for Environmental Soundness and Joe Gallegos.

On the 18th of January the Division, Battle Mountain and the parties exchanged lists of witnesses and evidence to be used at today's hearing.

Also on the 18th, Battle Mountain submitted to the Division for further review, additional information which was to be -- which addressed the concerns, questions and comments we discussed at our January 16th meeting.

On the 19th of January, Battle Mountain provided more information which would clarify the points raised in the January 18th submittal.

On the 19th of January the Division issued its recommendation to the Board in regard to the amendment application.

On January 23, Battle Mountain submitted a prehearing statement to the Board. I was just given more copies of that and if the Board does not have those copies, I will certainly pass those down, and take one if you need one.

On the 24th of January, Battle Mountain submitted additional reclamation cost estimate information to the Division for review and analysis.

And then on the 25th of January, Battle Mountain submitted additional commitments to the Division regarding monitoring to occur at the tailings facility.

So since October 20th, the filing date of the amendment application, the Division has reviewed the amendment application, we have reviewed all objections received pertaining to the amendment application, we have compiled a list of questions, comments and concerns which we believe were responsive not only to our technical concerns, but also to the relevant concepts contained in the letters of objection we received in December, we reviewed four responses from Battle Mountain

Resources to our adequacy concerns, we have met with Battle Mountain now four different times to discuss technical issues, concerns about the project.

We have reviewed all of the information submitted to date in light of the requirements of the Act and the rules and regulations. Our review of all the information submitted in the context of the requirements of the Act and the rules and regulations would indicate that Battle Mountain has met the requirements of the Act and the rules and regulations.

So with that in mind, the Division would recommend to the Board approval of the amendment application with a financial warranty established in the amount of $3,345,500.

UNIDENTIFIED PERSON: Three million what?

MR. RENNER: $3,345,500. That's for the life -- that's for the entire mining operation.

UNIDENTIFIED PERSON: How is that changed from the existing financial warranty?

MR. RENNER: It went up by approximately -- it went up by approximately $45,000.

UNIDENTIFIED PERSON: Okay.

THE CHAIRMAN: Other questions? Are

The disposal area has six components that I want to touch briefly on. The first component is the tailings delivery and distribution system. That is a line coming from the mill facilities and it will be connected to a spigot line that runs around the entire perimeter of the tailings disposal area.

In the initial stages there will be two disposal areas and the spigotting will be done slightly differently. That's because you are at the bottom of the valley. You don't have as long a beach slope to work with, so you have to do things a little bit differently.

Eventually, the center berm will be covered with tailings and there will be one large tailings facility. The tailings area, as I indicated before, is lined. It's lined with a composite liner system consisting of a compacted subsoil, compacted to 10 to the minus 5 centimeters per second permeability and a 40 mill very low density polyethylene synthetic liner.

In addition, as you place the tailings, the tailings will also consolidate and compact. And the testing that we have run on the tailings indicates that the tailings are expected to compact to somewhere on the order of 10 to the minus 5 or 10 to the minus 6 centimeters per second permeabilities.

There are two embankments associated with this initially and then the larger embankment will -- the larger downstream embankment will be the embankment that will be in place for the life of the facility. Those embankments will be built using fill available on-site and they are built with the drainage blankets to promote drainage through the embankments.

These embankments are not dams and they are not designed to impound water. They are designed to allow water to drain through them to achieve the consolidation and dewatering of the tailings that you want to achieve in this process.

There is an internal water collection system associated with the tailings. That will -- that also is designed to enhance tailing, dewatering and reduce the head. That is designed to be effective throughout the life, but will serve its primary function during the initial stages of deposition when the tailings are being deposited right on top of the liner.

That is a drainage blanket consisting of cobbles and a pipe network, and the pipe network, this sits above the liner, and it runs through the embankment and into a collection pond system. The collection pond system and the ditch that leads to the collection pond system are also both lined facilities. The collection pond is double-lined with an upper liner of 60 mill HDPE and a lower liner of 40 mill, very low density polyethylene.

The collection pond has been designed based on the drainage layer; capacity of the drainage layer to transmit flows to the collection pond and a 100-year, 24-hour design storm to hold 9.4 million gallons of water.

From the collection pond, there will be a pump and pump-back system which will pump the water from the collection pond back up to the tailings facility. The tailings facility will have a free water pool on top of it which will allow reclamation of the water from the tailings to be recycled back through the mill to minimize the amount of makeup water needed in the system.

It's a closed system and you are constantly recycling the same water back into the mill and then out into the tailings facility.

In addition, there are diversion ditches that is not involved in the processing.

UNIDENTIFIED PERSON: Did you say that the embankment goes up as the tailings increases over time at other stages?

MS. BALDRIGE: Rob will answer this in a minute, but I didn't cover that. The embankment is built in one stage initially and then there are two raises to that initial stage.

UNIDENTIFIED PERSON: How does the liner system work into that?

UNIDENTIFIED PERSON: (Inaudible).

MS. BALDRIGE: No, because you want it to drain. There a drainage blanket on the upstream slope. Underneath the embankment system is lined. The whole valley bottom would be lined, but not either of the embankment faces.

Rob will get into more specifics on the design.

(Inaudible.)

MS. BALDRIGE: The diversion system, as I indicated before, is designed for the 100-year, 24-hour storm. However, there is an extra measure of safety built into this project because, should a storm greater than a 100-year, 24-hour occur and the ditch overtops and the water runs into the tailings disposal area, that disposal area is designed to handle the probable maximum precipitation at all times during the life of the operation.

Rob will discuss the stability analysis for the tailings embankment. That stability analysis was performed on the embankments and the subsequent raises to the embankments and indicates acceptable factors of safety under both static and pseudostatic conditions.

Very briefly, I'm going to touch on several other aspects of the project that have changed slightly.

A water source has been obtained for the project. I'll go into more depth on that water source in just a minute. The security for the project will remain essentially the same as the approved permit. I've already touched on the cyanide, the secured cyanide storage area.

The tailings area will be fenced with a standard 4-foot high barbed wire fence, four-strand barbed wire fence. The collection area will be fenced with a 7-foot high fence, primarily to protect the liner from damage should any wildlife get into the pond.

The levels of those cyanide and metals

in the water that will be associated with this facility are not considered to be toxic to wildlife or to birds. The birds generally established criteria for avian mortality based on cyanide is 50 parts per million free cyanide and we are anticipating less than 3.8 parts per million free cyanide in this. So we are odds of magnitude less than the avian mortality criteria.

I also want to point out that we have amended the emergency response plan that was presented in the approved permit. That plan has been amended to include the tailings facility and to eliminate the heap leach facility. The emergency response plan is designed to allow Battle Mountain Gold flexibility to react on a case-by-case basis, depending on the circumstances of any spill that could occur on-site.

I spoke on water rights earlier. We -- the Battle Mountain Gold will comply with the condition of its approved reclamation permit that requires it to obtain water rights and the legal right to utilize these rights prior to leaching or processing of any ore.

Since the approved permit was issued, Battle Mountain has acquired adequate water rights for the operation and they have prepared and filed a temporary substitute supply plan and an augmentation plan to adjudicate the use of its water rights. In addition, they filed an application to adjudicate nontributary groundwater located beneath the land that they own.

Both of those are currently pending in the State Engineer's Office and the Division 3 Water Court in Alamosa.

Water monitoring for this project will be very similar to what was approved in the original application with the exception of reevaluation of water monitoring in the area of the tailings facility.

Battle Mountain Gold has placed four additional wells in the area of the tailings facility. For those four additional wells, as well as other wells and surface water monitoring in the area of the tailings facility, they will comply with the stipulation placed on the approved permit. That stipulation required monthly monitoring of ground and surface water in the vicinity of the heap leach and quarterly reporting to the Mined Land Reclamation Division. They will comply with that as it relates to the tailings facility.

tailings go in there -- as low as possible, and so that after the phases -- Phase 1 is developed, we get to the point where both of these cells are at the same elevation.

Now, Phase 1 embankment construction involves 90 feet of material placed in a embankment. This is all natural on-site materials. As Anne said, these materials are not designed to be an impermeable structure. They are designed to allow drainage, horizontally and vertically, through the embankment to the ponds from the tailings themselves.

The slurry Anne talked about, for the reason of splitting the two areas in the initial deposition area phase, is also use of on-site materials and is permeable.

Phase 1 has approximately 3-1/2 to 4 years' operating capacity. It has a total tonnage capacity on the order of 6 to 7 million tons. Once that operation has been completed, prior to that there will be an increase with the two additional stages which are rated on the initial 30 feet, approximately. That provides total containment capacity of between 12-1/2 and 13 million tons.

The discrete factors, discrete

description of what is actually handled in the impoundment here, it's best, I think, to talk about what our liner or containment system is. We did a very extensive evaluation of what the subsoil and substrate materials are on the property.

We have done material testing in terms of what is the permeability of the materials and what the permeabilities that are available by reworking those materials on the site.

The drainage system should be considered as involving the tailings themselves. The tailings, as Anne said, have the ability to reduce the permeability following deposition. From all our test programs, we believe that the permeability of the material which is in direct contact with the drainage member will be as low as 10 to the minus 6 centimeters per second. It will be equivalent to 1 foot per year.

So the tailings is in contact with the drainage member itself and there are 3 feet of that material where the drainage network within it is to the entire line system.

You can't ignore the tailings as having a very positive proponent in reducing the potential solution migration out of the base of that tailings that is deposited, which is then collected and routed out of the system.

We are likely to use a synthetic membrane, very large polyethylene material. It is ideally suited to these situations in terms of ability to stay and maintain its integrity through operations and has the ability to withstand the operating stresses of the layers that are going to be applied to that lining system.

Be that (inaudible) an area that has sufficient fine-grained materials to allow us to rework and compact that material to a density which will provide us a minimum of 10 to the minus 5 centimeters per second.

Now, in terms of how the facility will operate, as I mentioned, initial deposition will be split between those two cells. As the tailings develop within these areas, and schematically shown on this plan here are deposition points which will allow us to fill out the base and plate over that drainage member as quickly as we can.

From the first contact of those (inaudible) to the drainage member, we are creating a secondary line within the impoundment. As the deposition continues, the rate of rise of these areas will decrease, so we have sufficient time as each layer is placed to dry through natural evaporative processes, to desiccate, to reach moisture condition which is below that of saturation, and essentially produce a dense, solid, low permeability stable tailing product.

As that process continues, we have evaluated from our operations standpoint that we can achieve approximately 50 percent of the area under evaporative forces at all times. In other words, half will be under deposition, half will be drying and desiccating.

We have an area where we have designed to collect and allow recircling of the solution that's associated with the tailings and have that pumped back to the mill site.

On a water balance standpoint, the operation of this facility is continuously requiring makeup supply. We can supply back approximately 400 of the 800 gallons a minute that are required to operate and transport the slurry from here to here.

Our objective is to isolate, as quickly as we can, the free water pool from the basin of the impoundment which has the drainage system and the lining containment. As soon as we replace tailings between the pond and the liner, we essentially raise that way and have it not in contact with any of the drainage network, and it then becomes its own isolated solution slurry for recirculating to the pond.

Intensive design objectives we have, as Anne said, a number of tests that give us a confidence level that we have achieved a material that has a dry density of about 90 pounds per cubic foot, a material which has a permeability certainly in contact with the drainage network of 10 to the minus 6.

We will also anticipate permeabilities of the desiccated tailings between 10 to the minus 5 and 10 to the minus 6. As I say, there is sufficient capacity within the space to contain the entire tailings product that comes from processing.

In terms of the reclamation scenario, Anne talked about the ability and affectability of this procedure to allow us to selectively deposit materials around the perimeter of the facility. As we deposit, it is seen there are a cycle -- or a circle of the tailings distribution system which goes entirely around the facility.

To allow us to develop a beach area,

999

STATE OF COLORADO

MINED LAND RECLAMATION DIVISION
Department of Natural Resources
1313 Sherman St., Room 215
Denver, CO 80203
303 866-3567
FAX. 303 832-8106

SP

January 31, 1990

File

Mr. A. Walter Wise
Battle Mountain Resources
333 Clay Street, 42nd Floor
Houston, Texas 77002

RE: San Luis Project Permit Amendment (File M-88-112)

Dear Mr. Wise:

On January 25, 1990, the Mined Land Reclamation Board approved the Battle Mountain Resources permit amendment.

The amount of financial warranty set by the Board for the amended operation is $3,345,500.00. The original permit allowed for financial warranty submittal in two phases. Phase one warranty in the amount of $2,052,000.00 was submitted in the form of a letter of credit in 1989. The remaining $1,248,300.00 was to have been submitted prior to commencement of phase two of the operations. The approved amendment, at Exhibit E (reclamation plan) and Exhibit L (reclamation cost estimate) does not discuss the phased approach to submittal of financial warranty. Therefore, Battle Mountain Resources should submit the entire $3,345,500.00 financial warranty as either an amendment to the currently held letter of credit, or by supplying a new form of warranty. The Mined Land Reclamation Act (C.R.S. 34-32-117(4)(c)) allows the operator sixty days from the hearing date to supply the additional financial warranty. I am enclosing a number of financial warranty forms for your use.

Please contact me if you have any questions or comments.

Sincerely,

Steven G. Renner
Senior Reclamation Specialist

SGR/scg

Enclosure(s)

cc: Bruce Humphries
Deborah Mulloy
Dean Massey

3648F

ATTACHMENT 3

July 26, 1999

Mr. Jim Dillie
Division of Minerals and Geology
1313 Sherman Street, Room 215
Denver, Colorado 80203

Re: Battle Mountain Resources, Inc. - San Luis
DMG Permit No. M-88-112

Dear Mr. Dillie:

BMRI would like to request approval to transport West Mine backfill water from the evaporation pond to the tailings impoundment. The water would be transported using a water truck and would be applied to the reclaimed surface of the tailings impoundment. This would help optimize our evaporative loss of West Mine water.

If you have questions or concerns please feel free to contact me at 719-672-4122.

Sincerely,

Ron Zumwalt

Ron Zumwalt

cc: Bill Lyle
Dan Robertson
File

ATTACHMENT 4

999

STATE OF COLORADO

DIVISION OF MINERALS AND GEOLOGY
Department of Natural Resources
1313 Sherman St., Room 215
Denver, Colorado 80203
Phone: (303) 866-3567
FAX: (303) 832-8106

DIVISION OF MINERALS & GEOLOGY
RECLAMATION MINING-SAFETY

Bill Owens
Governor

Greg E. Walcher
Executive Director

Michael B. Long
Division Director

August 16, 1999

For Your Correspondence File

Mr Ron Zumwalt
Battle Mountain Resources Inc
PO Box 310
San Luis CO 81152

Re: Approval to Transport Water from the Evaporation Pond to the Tailings Impoundment to Irrigate Vegetated Areas Within the Impoundment, San Luis Project, M-88-112

Dear Mr. Zumwalt:

The Division received and reviewed your July 28, 1999 request to transport water to the tailings impoundment to be used for irrigation of the vegetated areas within the impoundment. As we discussed, you will need to collect a sample from the evaporation pond and have it analyzed before hauling any of the water to the tailings impoundment. You will need to send the lab results to the Division as soon as you receive them. The only use of the water will be for the approved specified purpose; to irrigate the vegetated areas and to allow enhanced evaporation to occur.

You must keep a record of the amount of water (or loads) that is transported to the impoundment and send a copy of the information to the Division after transportation ceases in 1999.

If you have any questions, please give me a call.

Sincerely,

James Dillie

James Dillie
Environmental Protection Specialist

cc: Michael B. Long, DMG
H. Bruce Humphries, DMG
James Stevens, DMG

SHEPHERD MILLER
INCORPORATED

October 7, 1999

SMI #100267

Mr. James Dillie
Colorado Division of Minerals & Geology
1313 Sherman, Room 215
Denver, Colorado 80203

Subject: West Pit Water Management at the San Luis Project

Dear Mr. Dillie:

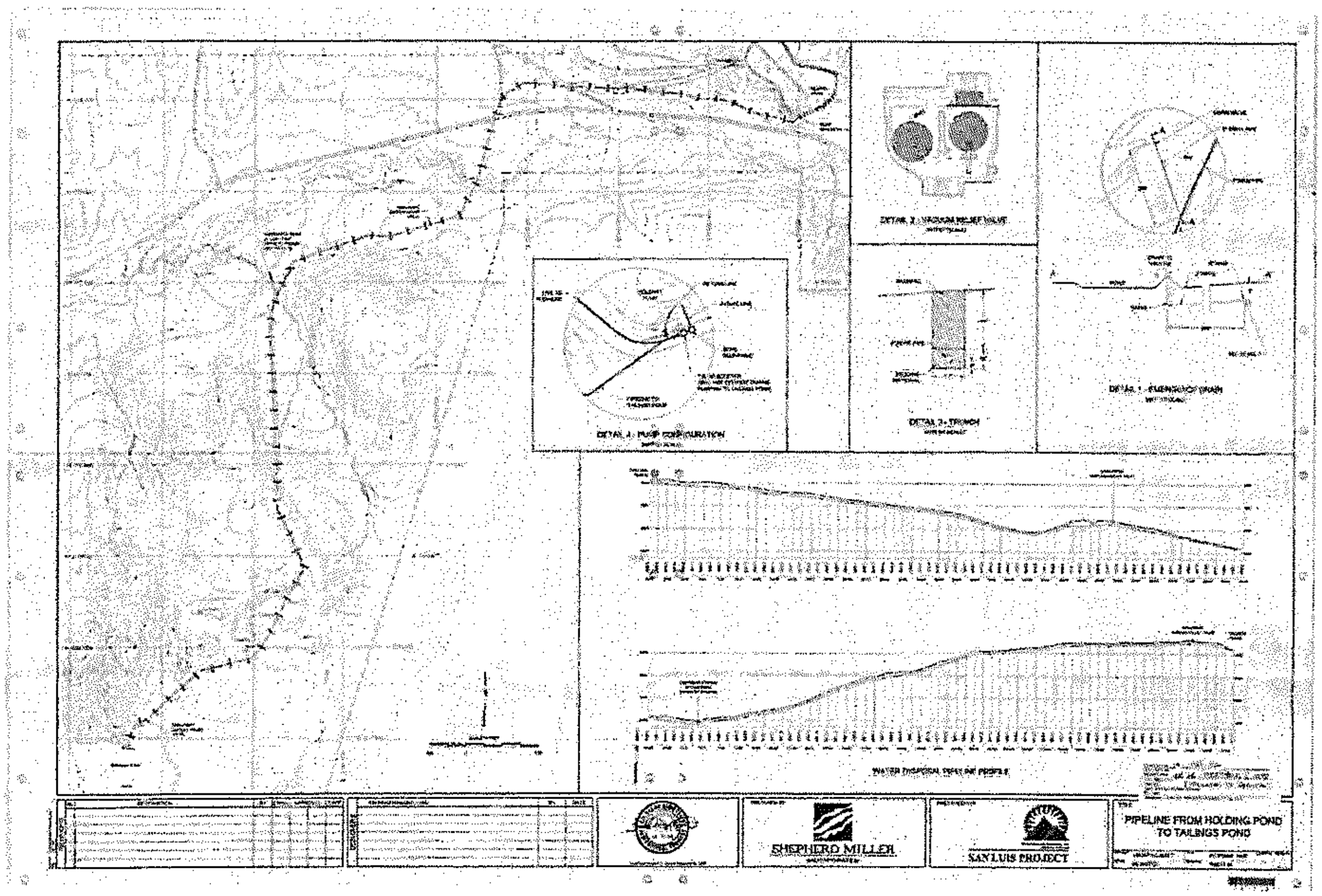
Enclosed is a design drawing for the installation of a pipeline from the holding pond at the West Pit Evaporation Area to the tailing pond at the San Luis Project in Costilla County, Colorado prepared for Battle Mountain Resources, Inc (BMRI). The following is a summary of the design details for the pipeline.

The pipeline will consist of 6-inch diameter HDPE SDR 17 pipe buried a minimum of 6 feet below ground surface for freeze protection. The plan view and profile alignment of the pipeline is shown on the attached drawing. A self-primer centrifugal pump (60 hp – Power Prime) will pump water from the holding pond to the tailings pond at a discharge rate of approximately 250 gpm and a dynamic head of approximately 95 feet (40 psi). The pipeline will stub-out from the existing pipe that feeds the existing evaporator blowers at the evaporation area. The connection will be configured so that the pipeline will drain back into the holding pond as shown on the drawing. The pipeline is approximately 2.75 miles long with two relative low points and two relative high points along the profile as shown on the attached drawing. An emergency drain will be installed at the lowest point of the pipeline so that the pipeline can be drained into water trucks if the need arises. BMRI would notify the DMG prior to draining the pipeline. Two combination air/vacuum valves will be installed at the high points to alleviate pressure on the pipe during filling and prevent collapse during draining. The pipeline will operate only as a backup for the water management system.

If you have questions, please contact me at 970-223-9600 or Mr. Ron Zumwalt of BMRI at 719-672-4122.

Environmental & Engineering Consultants

3801 Automation Way, Suite 100
Fort Collins, CO 80525
Phone: (970) 223-9600
Fax: (970) 223-7171
www.shepmill.com


DETAIL 4 - PUMP CONFIGURATION
DETAIL 3 - TRENCH
WATER DISPOSAL PIPELINE PROFILE
SHEPHERD MILLER
SAN LUIS PROJECT
PIPELINE FROM HOLDING POND
TO TAILINGS POND

999

STATE OF COLORADO

DIVISION OF MINERALS AND GEOLOGY
Department of Natural Resources
1313 Sherman St., Room 215
Denver, Colorado 80203
Phone: (303) 866-3567
FAX: (303) 832-8106

DIVISION OF MINERALS & GEOLOGY
RECLAMATION MINING-SAFETY

Bill Owens
Governor
Greg E. Walcher
Executive Director
Michael B. Long
Division Director

November 2, 1999

Bill Lyle
Battle Mountain Resources Inc
PO Box 1627
Battle Mountain NV 89820

Re: Partial Approval of TR-26, Pipeline Installation, San Luis Project, M-88-112

Dear Mr. Lyle:

The Division completed its review of BMRI's submittal to install a new HDPE SDR 17 pipe from the West pit to the tailings impoundment and does hereby approve the proposed submittal. The old pipeline will remain buried pursuant to the approved reclamation plan.

If you have any questions, please give me a call.

Sincerely,

James Dillie

James Dillie
Environmental Protection Specialist

cc: James Stevens, DMG
Harry Posey, DMG
Lori Potter
Maria Mondragon-Valdez
Mike McGowan
Dan Randolph
Don Holmer, WQCD
Dean Massey

STATE OF COLORADO

DIVISION OF MINERALS AND GEOLOGY
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COLORADO DIVISION OF MINERALS & GEOLOGY
RECLAMATION·MINING SAFETY·SCIENCE

Date: September 14, 2005

To: Bruce Humphries

From: Harry Posey HHP

RE: Review: "Analysis of Pre-mining water quality in the vicinity of the West Pit;" Battle Mountain Resources Inc., San Luis Project, M-1988-112; TR-26

The above-captioned Technical Memorandum (Tech Memo), dated January 3, 2004, was submitted to the Division on February 1, 2005. The Tech Memo was prepared in response to outstanding issues related to TR-26, namely, to answer whether West Pit water quality, after natural flushing and treatment to remove contaminants, has reached either a pre-mining or ambient groundwater condition.

The project at hand was permitted in 1988. As part of the application, the company submitted a set of groundwater quality information collected from exploration drill holes prior to the mine permit application. The existence of such pre-mining baseline data is unusual for permits of this era. Exploration drill holes were mined out by the operation after 1988.

"Ambient Groundwater Quality" is defined in the Rules and Regulations at 1.1(5) as follows:

> "Ambient Groundwater Quality" for mining operations permitted prior to January 31, 1994, ambient groundwater quality shall mean the quality of the groundwater at the mine site as of January 31, 1994. For mining operations permitted on or after January 31, 1994, ambient groundwater shall mean the quality of groundwater at the time of submittal of the permit application. In establishing ambient groundwater quality, an Operator or Applicant shall use available or collected groundwater data sufficient to characterize the site's ambient groundwater quality and submit such information in a form suitable to the Office.

Based on the Division's procedures for establishing ambient conditions at other pre-1994 sites, the San Luis Project data set provides a sound basis for determining pre-mining baseline, even though the actual number of samples is less than that desired for a rigorous statistical assessment. Also, based on principles of weathering and water-rock interactions, it is likely that groundwater quality that existed near the mine while excavation was in progress was more degraded than the groundwater condition prior to mining.

The 2004 Tech Memo provides a synthesis of pre-mining and current West Pit water quality. Based on this assessment, the Tech Memo concluded:

> "Current backfill groundwater concentrations are equal or less than the pre-mining, shallow ground water chemistry in the bedrock aquifer. The concentration of TDS, sulfate, iron, and manganese in the West Pit backfill are statistically less than the average pre-mining concetnrtions in the shallow bedrock aquifer. Current fluoride

concentration in the West Pit backfill is statistically indistinguishable f[rom] pre-mining conditions"

The parameters that raise regulatory questions are TDS, fluoride, sulfate, manganese and iron. In the box and whisker plots (figures 7, 8 and 9), it is visually evident that current water quality as it pertains to iron, manganese, sulfate and TDS, are better today than in the pre-mining samples.

The plot for fluoride does not provide the evidence, visually, to support the Operator's conclusions. Rather, the Division, and the operator, resorted to standard statistical techniques to evaluate the distribution of fluoride in the pre- and post-mining periods. The following table (in mg/L) compares the results:

Fluoride	Mean	Std Dev	Mean - 1 std dev	Mean + 1 std dev
Pre-mining	3.717	0.873	2.844	4.590
Current	4.140	1.067	3.070	5.207

This verifies that the pre-mining and post-mining conditions for fluoride are statistically indistinguishable, based on an assessment of the distribution, and assuming the data are normally distributed. Given the tight range of the data in both the pre- and post-mining data sets, and the strong overlap at the one standard deviation level, there is little statistical indication for a shift in the distribution of fluoride concentrations.

Based on the groundwater regulations, and the conclusion that ambient groundwater conditions have been met, the Division has no basis to require mitigation of groundwater quality.

When the West Pit was backfilled, acid-generating backfill was placed in the pit first then covered with a variable thickness of non-acid generating sediments from the Rito Seco alluvium and/or Santa Fe Formation. Soluble acid salts that formed on the waste rock when exposed above the water table went back into solution upon saturation. In time, provided this rock remains saturated, those salts were removed by incoming groundwater, and such groundwater was treated. Most of the acid-generating backfill was saturated by incoming groundwater and therefore has been rinsed, treated, and discharged. Similar backfill above the maintained water level has not been rinsed as it has not been re-saturated. This rock will continue to form acid salts at a rate commensurate with its exposure to air and water.

To avoid seepage from the West Pit to the Rito Seco, the Operator has maintained a water level in the pit that is at or below the Rito Seco level. It is presumed, based on an assessment of the backfill mineralogy submitted in earlier reports, that backfill for some several feet above the water level that has not been rinsed, will need to remain unsaturated, if current West Pit water quality is to abide. For this reason, it is prudent to develop a system to maintain the current West Pit water level for the far future to preclude seepage to the Rito Seco and to maintain current West Pit water quality. The proposed transmission of West Pit water to the farm west of the mine provides a reasonable solution

Cc: Allen Sorenson
Jim Finley, Telesto
Bill Lyle, Phelps Dodge
Cheryl Linden, AGO

999

Doc Date 10-10-1989

APPENDIX K

WATER BALANCE

ATTACHMENT 6

SAN LUIS PROJECT

DESCRIPTION OF TAILINGS IMPOUNDMENT WATER BALANCE SPREADSHEET COLUMNS

1.	Year/Month	-	Self Explanatory

HYDROLOGICAL DATA

2.	Precip.	-	Average monthly precipitation estimated for the site (inches).
3.	Evap.	-	Average monthly shallow lake evaporation estimated for the site (miles).
4.	H2O Pool Area	-	Assumed surface area of water pool in impoundment (acres).
5.	Tailings Area	-	Estimated areal extent of tailing deposition (acres).

INFLOWS

6.	Runoff	-	Calculated monthly runoff inflow to water pool based on Total catchment area, H2O Pool area, Tailings area, Precip. and the respective Runoff Coefficients (acre ft).
7.	Slurry	-	Calculated monthly inflow of water to tailings pond used to transport the tailings produced in that month. Based on production rate and slurry density (acre ft).

LOSSES

8.	Evap.	-	Calculated monthly evaporation from the water pool surface. Based on shallow lake evaporation applied over the H2O Pool Area (acre ft).

9.	Evap.	-	Calculated monthly evaporation from the active tailings surface. Based on pan evaporation applied over one-half of the Tails Area (acre ft).
10.	Entrain	-	Calculated monthly water Lost to moisture retention within the void spaces of the deposited tailings. Based on production rate and estimated entrained moisture content which is fixed after year one (acre ft).
11.	Return	-	Calculated monthly available free water to return to mill. Based on a summation of inflows and losses; not to exceed the slurry requirement nor to deplete the water pool below the minimum pool requirement (acre ft).

WATER BALANCE

12.	% Return	-	Calculated percentage of return water vs. required slurry water, i.e. Return/Slurry (%).
13.	Net	-	Calculated Net balancing flow for the month. Summation of 6-11 (acre ft).
14.	Accum.	-	Calculated cumulative balancing flow. Summation of 13 over time (acre ft).
15.	Water Pool Vol.	-	Calculated monthly storage of free water in the water pool. Based on Net water balance and previous month Water Pool Vol. (acre ft).
16.	Makeup	-	Calculated monthly required makeup volume to supplement the return flow to supply adequate water for slurry transport; 7+11 (acre ft).

SANLUIS PROJECT 14703
TAILINGS IMPOUNDMENT WATER BALANCE
AVERAGE CLIMATOLOGICAL CONDITIONS
M.J.H.

PRODUCTION RATE, 4,480.00 TPD
SLURRY DENSITY, 50.00 %
ENTRAINED WATER, 40.00 % YR1
ENTRAINED WATER, 32.00 % YRS 2-8
CATCHMENT AREA, 285.00 ACRES
MINIMUM WATER POOL, 50.00 ACRE-FT
RUNOFF COEFFICIENTS: 0.75 NATURAL GROUND
0.40 TAILINGS
PAN EVAP COEFF, 0.70

YEAR/ MONTH	HYDROLOGICAL DATA PRECIP inches	EVAP inches	H2O POOL AREA acres	TAILINGS AREA acres	INFLOWS RUNOFF acre-ft	SLURRY acre-ft	LOSSES EVAP acre-ft	EVAP acre-ft	ENTRAIN acre-ft	RETURN acre-ft	% RETURN %	WATER BALANCE NET acre-ft	ACCUM acre-ft	WATER POOL VOL acre-ft	MAKEUP acre-ft
1 SEP	1.30	4.00	20.00	42.00	15.69	103.43	-6.67	-5.24	-47.32	-59.70	57.72	0.00	0.00	50.00	43.73
OCT	1.30	2.30	20.00	42.00	15.69	103.43	-3.83	-3.01	-47.32	-64.75	62.61	0.00	0.00	50.00	38.67
NOV	0.80	1.50	20.00	42.00	9.66	103.43	-2.50	-1.96	-47.32	-61.10	59.07	0.00	0.00	50.00	42.33
DEC	0.80	0.70	20.00	42.00	9.66	103.43	-1.17	-0.92	-47.32	-63.46	61.36	0.00	0.00	50.00	39.98
JAN	0.70	0.70	20.00	42.00	8.45	103.43	-1.17	-0.92	-47.32	-62.27	60.21	0.00	0.00	50.00	41.15
FEB	0.90	1.50	20.00	42.00	10.86	103.43	-2.50	-1.96	-47.32	-62.31	60.24	0.00	0.00	50.00	41.13
MAR	1.60	2.30	20.00	42.00	19.31	103.43	-3.83	-3.01	-47.32	-68.38	66.11	0.00	0.00	50.00	35.05
APR	1.40	4.40	20.00	42.00	16.90	103.43	-7.33	-5.76	-47.32	-59.71	57.73	0.00	0.00	50.00	43.72
MAY	1.50	5.80	20.00	42.00	18.11	103.43	-9.67	-7.60	-47.32	-56.75	54.87	0.00	0.00	50.00	46.68
JUN	0.90	6.30	20.00	42.00	10.86	103.43	-10.50	-8.25	-47.32	-48.02	46.43	0.00	0.00	50.00	55.41
JUL	2.00	5.70	20.00	42.00	24.14	103.43	-9.50	-7.46	-47.32	-63.09	61.00	0.00	0.00	50.00	40.34
AUG	1.90	5.00	20.00	42.00	22.93	103.43	-8.33	-6.55	-47.32	-63.96	61.84	0.00	0.00	50.00	39.47
2 SEP	1.30	4.00	20.00	57.00	15.77	103.43	-6.67	-8.81	-33.06	-70.67	68.33	0.00	0.00	50.00	32.76
OCT	1.30	2.30	20.00	57.00	15.77	103.43	-3.83	-5.07	-33.06	-77.24	74.68	0.00	0.00	50.00	26.18
NOV	0.80	1.50	20.00	57.00	9.71	103.43	-2.50	-3.30	-33.06	-74.28	71.82	0.00	0.00	50.00	29.15
DEC	0.80	0.70	20.00	57.00	9.71	103.43	-1.17	-1.54	-33.06	-77.37	74.80	0.00	0.00	50.00	26.06
JAN	0.70	0.70	20.00	57.00	8.49	103.43	-1.17	-1.54	-33.06	-76.16	73.63	0.00	0.00	50.00	27.27
FEB	0.90	1.50	20.00	57.00	10.92	103.43	-2.50	-3.30	-33.06	-75.49	72.99	0.00	0.00	50.00	27.94
MAR	1.60	2.30	20.00	57.00	19.41	103.43	-3.83	-5.07	-33.06	-80.88	78.20	0.00	0.00	50.00	22.54
APR	1.40	4.40	20.00	57.00	16.99	103.43	-7.33	-9.68	-33.06	-70.35	68.02	0.00	0.00	50.00	33.08
MAY	1.50	5.80	20.00	57.00	18.20	103.43	-9.67	-12.77	-33.06	-66.13	63.94	0.00	0.00	50.00	37.30
JUN	0.90	6.30	20.00	57.00	10.92	103.43	-10.50	-13.88	-33.06	-56.92	55.03	0.00	0.00	50.00	46.51
JUL	2.00	5.70	20.00	57.00	24.27	103.43	-9.50	-12.55	-33.06	-72.58	70.18	0.00	0.00	50.00	30.84
AUG	1.90	5.00	20.00	57.00	23.05	103.43	-8.33	-11.01	-33.06	-74.08	71.62	0.00	0.00	50.00	29.35
3 SEP	1.30	4.00	20.00	70.00	15.84	103.43	-6.67	-11.90	-33.06	-67.64	65.40	0.00	0.00	50.00	35.79
OCT	1.30	2.30	20.00	70.00	15.84	103.43	-3.83	-6.85	-33.06	-75.54	73.03	0.00	0.00	50.00	27.89
NOV	0.80	1.50	20.00	70.00	9.75	103.43	-2.50	-4.46	-33.06	-73.16	70.73	0.00	0.00	50.00	30.27
DEC	0.80	0.70	20.00	70.00	9.75	103.43	-1.17	-2.08	-33.06	-76.87	74.32	0.00	0.00	50.00	26.56
JAN	0.70	0.70	20.00	70.00	8.53	103.43	-1.17	-2.08	-33.06	-75.65	73.14	0.00	0.00	50.00	27.78
FEB	0.90	1.50	20.00	70.00	10.97	103.43	-2.50	-4.46	-33.06	-74.37	71.91	0.00	0.00	50.00	29.05
MAR	1.60	2.30	20.00	70.00	19.50	103.43	-3.83	-6.85	-33.06	-79.19	76.57	0.00	0.00	50.00	24.24
APR	1.40	4.40	20.00	70.00	17.06	103.43	-7.33	-13.10	-33.06	-67.00	64.78	0.00	0.00	50.00	36.43
MAY	1.50	5.80	20.00	70.00	18.28	103.43	-9.67	-17.26	-33.06	-61.72	59.67	0.00	0.00	50.00	41.71
JUN	0.90	6.30	20.00	70.00	10.97	103.43	-10.50	-18.75	-33.06	-52.09	50.36	0.00	0.00	50.00	51.34
TDS	2.00	5.70	20.00	70.00	24.38	103.43	-9.50	-16.96	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	35.15
AUG	1.90	5.00	20.00	70.00	23.16	103.43	-8.33	-14.88	-33.06	-70.31	67.98	0.00	0.00	50.00	33.12

YEAR/ MONTH	HYDROLOGICAL DATA PRECIP inches	HYDROLOGICAL DATA EVAP inches	RIO POOL AREA acres	TAILINGS AREA acres	INFLOWS RUNOFF acre-ft	INFLOWS SLURRY acre-ft	LOSSES EVAP acre-ft	LOSSES EVAP acre-ft	LOSSES ENTRAIN acre-ft	LOSSES RETURN acre-ft	% RETURN %	WATER BALANCE NET acre-ft	WATER BALANCE ACCUM acre-ft	WATER POOL VOL acre-ft	MAKEUP acre-ft
4 SEP	1.30	4.00	20.00	97.00	15.09	103.43	-6.67	-10.33	-33.00	-61.38	59.33	0.00	0.00	50.00	42.07
OCT	1.30	2.30	20.00	97.00	15.98	103.43	-3.83	-10.54	-33.00	-71.09	69.80	0.00	0.00	50.00	31.44
NOV	0.80	1.50	20.00	97.00	8.84	103.43	-2.50	-6.60	-33.00	-70.84	68.49	0.00	0.00	50.00	32.59
DEC	0.80	0.70	20.00	97.00	9.04	103.43	-1.17	-3.21	-33.00	-75.64	73.32	0.00	0.00	50.00	27.50
JAN	0.70	0.70	20.00	97.00	8.01	103.43	-1.17	-3.21	-33.00	-74.61	72.13	0.00	0.00	50.00	28.02
FEB	0.90	1.50	20.00	97.00	11.07	103.43	-2.50	-8.08	-33.00	-72.07	69.80	0.00	0.00	50.00	31.36
MAR	1.40	2.30	20.00	97.00	16.66	103.43	-3.83	-16.54	-33.00	-75.88	73.17	0.00	0.00	50.00	27.73
APR	1.40	4.40	20.00	97.00	17.28	103.43	-7.33	-28.17	-33.00	-60.69	58.10	0.00	0.00	50.00	43.34
MAY	1.50	5.80	20.00	97.00	18.68	103.43	-9.67	-28.58	-33.00	-52.67	50.83	0.00	0.00	50.00	50.04
JUN	0.90	6.30	20.00	97.00	11.07	103.43	-10.50	-28.04	-33.00	-42.07	40.67	0.00	0.00	50.00	61.30
JUL	2.00	5.70	20.00	97.00	24.00	103.43	-9.50	-28.12	-33.00	-50.35	57.38	0.00	0.00	50.00	44.08
AUG	1.90	5.00	20.00	97.00	23.37	103.43	-8.33	-22.82	-33.00	-62.45	60.42	0.00	0.00	50.00	40.94
5 SEP	1.30	4.00	20.00	124.00	18.14	103.43	-6.67	-24.78	-33.00	-55.80	53.29	0.00	0.00	50.00	48.35
OCT	1.30	2.30	20.00	124.00	18.14	103.43	-3.83	-14.24	-33.00	-68.43	66.17	0.00	0.00	50.00	34.89
NOV	0.80	1.50	20.00	124.00	8.93	103.43	-2.50	-9.29	-33.00	-68.51	66.24	0.00	0.00	50.00	34.81
DEC	0.80	0.70	20.00	124.00	8.92	103.43	-1.17	-4.33	-33.00	-74.80	72.32	0.00	0.00	50.00	28.83
JAN	0.70	0.70	20.00	124.00	8.89	103.43	-1.17	-4.33	-33.00	-73.54	71.12	0.00	0.00	50.00	29.87
FEB	0.90	1.50	20.00	124.00	11.17	103.43	-2.50	-9.29	-33.00	-69.76	67.44	0.00	0.00	50.00	33.69
MAR	1.40	2.30	20.00	124.00	18.88	103.43	-3.83	-16.24	-33.00	-72.18	69.77	0.00	0.00	50.00	31.27
APR	1.40	4.40	20.00	124.00	17.38	103.43	-7.33	-27.24	-33.00	-53.16	51.41	0.00	0.00	50.00	50.25
MAY	1.50	5.80	20.00	124.00	18.62	103.43	-9.67	-35.98	-33.00	-43.62	41.98	0.00	0.00	50.00	60.01
JUN	0.90	6.30	20.00	124.00	11.17	103.43	-10.50	-38.00	-33.00	-32.04	30.94	0.00	0.00	50.00	71.38
JUL	2.00	5.70	20.00	124.00	24.83	103.43	-9.50	-35.28	-33.00	-50.41	48.74	0.00	0.00	50.00	53.02
AUG	1.90	5.00	20.00	124.00	23.58	103.43	-8.33	-30.85	-33.00	-54.87	52.88	0.00	0.00	50.00	48.76
6 SEP	1.30	4.00	20.00	138.00	18.23	103.43	-6.67	-20.18	-33.00	-51.82	50.10	0.00	0.00	50.00	51.81
OCT	1.30	2.30	20.00	138.00	16.21	103.43	-3.83	-10.18	-33.00	-60.89	64.30	0.00	0.00	50.00	36.83
NOV	0.80	1.50	20.00	138.00	9.88	103.43	-2.50	-10.54	-33.00	-67.31	65.08	0.00	0.00	50.00	38.12
DEC	0.80	0.70	20.00	138.00	9.38	103.43	-1.17	-4.02	-33.00	-74.26	71.84	0.00	0.00	50.00	29.18
JAN	0.70	0.70	20.00	138.00	8.73	103.43	-1.17	-4.02	-33.00	-73.02	70.60	0.00	0.00	50.00	30.41
FEB	0.90	1.50	20.00	138.00	11.22	103.43	-2.50	-10.54	-33.00	-68.58	66.20	0.00	0.00	50.00	34.87
MAR	1.40	2.30	20.00	138.00	18.93	103.43	-3.83	-16.18	-33.00	-70.34	68.00	0.00	0.00	50.00	33.09
APR	1.40	4.40	20.00	138.00	17.48	103.43	-7.33	-30.90	-33.00	-49.50	47.95	0.00	0.00	50.00	53.84
MAY	1.50	5.80	20.00	138.00	18.73	103.43	-9.67	-40.74	-33.00	-38.07	37.39	0.00	0.00	50.00	64.78
JUN	0.90	6.30	20.00	138.00	11.22	103.43	-10.50	-44.28	-33.00	-28.84	25.85	0.00	0.00	50.00	78.58
JUL	2.00	5.70	20.00	138.00	24.94	103.43	-9.50	-40.04	-33.00	-45.78	44.26	0.00	0.00	50.00	57.85
AUG	1.90	5.00	20.00	138.00	23.61	103.43	-8.33	-35.12	-33.00	-50.61	48.93	0.00	0.00	50.00	52.82
7 SEP	1.30	4.00	20.00	152.00	18.20	103.43	-6.67	-31.43	-33.00	-40.58	46.95	0.00	0.00	50.00	64.87
OCT	1.30	2.30	20.00	152.00	16.28	103.43	-3.83	-18.07	-33.00	-64.75	61.61	0.00	0.00	50.00	38.07
NOV	0.80	1.50	20.00	152.00	10.62	103.43	-2.50	-11.78	-33.00	-66.11	63.92	0.00	0.00	50.00	37.32
DEC	0.80	0.70	20.00	152.00	10.02	103.43	-1.17	-5.50	-33.00	-73.73	71.28	0.00	0.00	50.00	28.70
JAN	0.70	0.70	20.00	152.00	8.77	103.43	-1.17	-5.50	-33.00	-72.47	70.07	0.00	0.00	50.00	30.05
FEB	0.90	1.50	20.00	152.00	11.20	103.43	-2.50	-11.78	-33.00	-67.34	65.13	0.00	0.00	50.00	34.07
MAR	1.40	2.30	20.00	152.00	20.05	103.43	-3.83	-18.07	-33.00	-68.51	66.24	0.00	0.00	50.00	34.82
APR	1.40	4.40	20.00	152.00	17.54	103.43	-7.33	-34.87	-33.00	-48.01	44.48	0.00	0.00	50.00	57.42
MAY	1.50	5.80	20.00	152.00	18.78	103.43	-9.67	-45.57	-33.00	-33.03	33.60	0.00	0.00	50.00	69.50
JUN	0.90	6.30	20.00	152.00	11.28	103.43	-10.50	-49.56	-33.00	-21.45	20.67	0.00	0.00	50.00	81.19
JUL	2.00	5.70	20.00	152.00	25.06	103.43	-9.50	-44.79	-33.00	-43.16	38.70	0.00	0.00	50.00	62.20
AUG	1.90	5.00	20.00	152.00	23.81	103.43	-8.33	-39.29	-33.00	-48.58	43.01	0.00	0.00	50.00	55.87

YEAR/ MONTH	HYDROLOGICAL DATA PRECIP inches	EVAP inches	H2O POOL AREA acres	TAILINGS AREA acres	INFLOWS RUNOFF acre-ft	SLURRY acre-ft	EVAP acre-ft	LOSSES EVAP acre-ft	ENTRAIN acre-ft	RETURN acre-ft	% RETURN %	WATER BALANCE NET acre-ft	ACCUM acre-ft	WATER POOL VOL acre-ft	MAKEUP acre-ft
5 SEP	1.30	4.00	20.00	155.00	18.30	103.43	-6.87	-32.14	-33.06	-47.84	46.28	0.00	0.00	50.00	55.56
OCT	1.90	2.30	20.00	155.00	16.30	103.43	-3.83	-18.48	-33.06	-64.36	62.23	0.00	0.00	50.00	38.07
NOV	0.80	1.50	20.00	155.00	10.93	103.43	-2.50	-12.05	-33.06	-65.85	63.67	0.00	0.00	50.00	37.56
DEC	0.80	0.70	20.00	155.00	10.63	103.43	-1.17	-5.63	-33.06	-73.61	71.17	0.00	0.00	50.00	29.82
JAN	0.70	0.70	20.00	155.00	8.76	103.43	-1.17	-5.63	-33.06	-72.39	69.96	0.00	0.00	50.00	31.07
FEB	0.90	1.50	20.00	155.00	11.20	103.43	-2.58	-12.05	-33.06	-67.10	64.88	0.00	0.00	50.00	34.32
MAR	1.60	2.30	20.00	155.00	20.87	103.43	-3.83	-18.48	-33.06	-68.12	61.00	0.00	0.00	50.00	35.31
APR	1.40	4.40	20.00	155.00	17.86	103.43	-7.33	-35.36	-33.06	-45.24	43.74	0.00	0.00	50.00	58.13
MAY	1.50	5.80	20.00	155.00	18.81	103.43	-9.67	-47.81	-33.06	-32.91	31.82	0.00	0.00	50.00	70.51
JUN	0.90	6.30	20.00	155.00	11.20	103.43	-10.58	-50.63	-33.06	-20.53	19.85	0.00	0.00	50.00	82.96
JUL	2.60	5.70	20.00	155.00	25.08	103.43	-9.50	-45.80	-33.06	-40.13	38.82	0.00	0.00	50.00	63.25
AUG	1.90	5.40	20.00	155.00	23.03	103.43	-8.33	-40.18	-33.06	-45.08	46.17	0.00	0.00	50.00	57.76

EXHIBIT D - MINE PLAN

Exhibit D of the approved San Luis permit is being amended to change the method of ore beneficiation. The currently approved permit allows half of the ore to be milled in a conventional mill circuit with cyanidation of the concentrates and dry tailings disposal and the other half of the ore to be subjected to leaching in a cyanide heap leach. This amendment proposes to extract the gold from the ore through the use of a carbon in leach circuit in the mill with disposal of the tailings through managed thin layer deposition. This exhibit also addresses revisions to the mill process description as a result of the change and revisions to three of the waste rock disposal areas. The mining plan remains unchanged from the approved permit and is therefore not discussed in this amendment. The mining plan for the San Luis Project can be found in Section D.2 of the approved permit.

D.1 Site Geology and Seismicity

The geology and seismicity of the site are as described in Section D.1 of the approved permit. The pseudostatic coefficient used in the reclaimed tailings disposal area configuration stability calculations remains unchanged from the approved permit value of 0.08 g, however a more conservative coefficient of 0.15 g has been used to evaluate the stability of the tailings disposal area during the operational period.

D.2 Mine Plan

The mine plan for the San Luis Project remains unchanged from the plan approved in the permit and is as described in Section D.2 of the approved permit.

The mill will be a closed circuit with backup systems to ensure that no cyanide solutions will escape the mill. Mill facilities design specifications will be submitted to the Division upon completion. Cyanide will be stored in a secured area. The area will include a concrete base with curbs to ensure containment in the event of a spill. Cyanide will be shipped to the site in Flo-Bins. Flo-Bins are specially designed, heavy metal containers used by DuPont for shipment of sodium cyanide. Flo-Bins are accepted by the Department of Transportation as a safe shipping container for cyanide. The Flo-Bins are returnable and will not be disposed on site. Each Flo-Bin is numbered and the numbers are tracked by DuPont to ensure that each container is returned.

D.6 Tailings Disposal

D.6.1 General Design Concepts

The tailings from the mill circuit will be disposed in a slurry form from the processing and treatment facilities. The slurry will be delivered to the tailings disposal area by pipeline using gravity and pumped delivery. The disposal system has been designed as a closed circuit, zero discharge facility. The solid and liquid portions of the tailings will remain contained within the facility. The proposed management of the facility will alleviate the potential of a detrimental impact to the surface water and groundwater of the project area and vicinity. The facility is capable of containing up to and including the probable maximum precipitation event during operations. The disposal area will be constructed with a liner system which has been chosen to provide containment and collection of the tailings water.

The tailings will be deposited by spigotting around the perimeter of the disposal area. The proposed method of tailings deposition is the managed thin layer deposition technique. This technique promotes deposition of thin layers of tailings which are then allowed to dewater and consolidate before the next layer of tailings is placed. The dewatered, consolidated tailings will serve as a relatively impermeable layer for placement of the next lift of tailings. The thin layer deposition method will also promote achievement of as high an average tailings density as possible to make the best use of the disposal area capacity, producing a low permeability in the tailings and minimizing the amount of residual water trapped within the tailings. By progressively changing the portion of the perimeter at which deposition is performed, each layer of tailings can undergo loss of entrained water from evaporation. Approximately 50 percent of the disposal area will be under deposition at any time. The remaining area will be allowed to drain and dry by natural processes. By producing a relatively dense, solid tailings mass, reclamation upon mine closure will be easier to achieve.

The site selected for tailings disposal is located immediately south of the mill and support facilities in the approximate area of the currently approved heap leach. The tailings disposal site is shown on Figure C-1. The site is located in an arroyo tributary to Culebra Creek and is not located within the Rito Seco drainage.

The proposed tailings disposal facility will consist of the following components:

1. A tailings delivery and distribution pipeline and associated pump station;

2. A lined tailings disposal area and associated embankments;
3. A free water pool and water reclaim system from the tailings disposal area to the mill including intakes, pumps and pipelines;

4. An internal collection and drainage system to enhance tailings dewatering and convey the water through a lined ditch to a lined collection pond downstream of the disposal site;

5. A lined collection pond and associated ditches downstream of the tailings disposal area with a pump and pipeline system for return of water to the free water pool; and

6. A 100 year 24 hour stormwater diversion ditch system around the tailings disposal area.

A main embankment will be constructed to contain the tailings solids as shown on Figure C-1. The main embankment will consist of material which is permeable relative to the tailings product. The drainage of water from the tailings into the embankment will promote consolidation of the tailings adjacent to the embankment allowing construction of subsequent raises. The tailings disposal area behind the main embankment will be developed in two phases. Phase 1 will consist of two disposal areas, referred to as the upper disposal area and lower disposal area, separated by a splitter embankment. The splitter embankment is located as shown on Figure C-3. By splitting the disposal area into two segments during the initial disposal period when the disposal area approximates the valley floor and is at the narrowest point. the rate of rise of each part of the disposal area can be minimized thereby allowing the maximum amount of tailings consolidation to occur between deposition of lifts. In order to operate each area of tailings disposal during the Phase 1 operations, the volumes of tailings deposited in each area will differ. On average approximately 33 percent of the total tailings volume will be placed in the upper area with the remainder placed in the lower area. In this manner the relative elevations of the two areas will be equal at the end of Phase 1 operations.

Phase 2 will consist of two raises to the main embankment and creation of a single disposal area by deposition of the tailings over the top of the splitter embankment. All embankment construction will be performed using native soils as the construction material. The Phase 2 disposal area is shown on Figure C-4.

A synthetic liner will be placed beneath the main embankment and the entire tailings disposal area. Liner placement will occur on a prepared foundation consisting of fine-grained native soils which have been compacted to 95 percent maximum Proctor density. The liner material will be a 40-mil very low density polyethylene (VLDPE). VLDPE is a highly flexible and ultraviolet resistant liner material which has demonstrated the ability to accommodate field conditions such as settlement and conform to coarse grained materials without puncture. The liner system has been designed to collect water draining from the tailings and route this water to a downgradient collection pond system.

The liner material beneath the disposal area and main embankment will be covered with a drain layer of relatively coarse-grained native soils to provide a drainage layer for tailings dewatering. This layer will be two feet thick over the entire disposal area. A network of 4, 6, 8 and 10-inch diameter perforated ADS pipe will be placed in the drain layer to facilitate drainage.

Tailings deposition will be performed using managed thin-lift deposition. Tailings will be spigotted peripherally around the disposal area to allow free water drainage toward the center adjacent to the splitter embankment in the Phase 1 operations and the center of the disposal area in Phase 2 operations. Two free water pools will be created in Phase 1 while during Phase 2 the two pools will be combined into one pool.

Dewatering of the tailings will occur through two methods, underdrainage into a drain layer over the liner and through the main embankment to a lined collection pond, and evaporation and water reclaim from the free water pool on top of the tailings for reuse in the mill. Water within the drainage layer will be directed to a lined collection ditch at the downstream toe of the embankment. The ditch will route flows to a collection pond located downgradient of the main embankment. Because of the potential for continuous high hydraulic heads, the pond will be double-lined with a leak detection layer between the liners. From the double-lined storage pond, water will be recycled to the free water pool in the tailings disposal area using an automatic pump and pipeline system. The designs for the drainage layer are discussed in detail in Section D.6.5.2. The collection pond is discussed in detail in Section D.6.5.4.

Two diversion systems around the southern and eastern end of the disposal area have been designed to safely conduct the calculated flows from the 100-yr recurrence interval, 24-hr duration storm event. The runoff from the undiverted catchment area, and precipitation falling directly on the disposal area from the design storm event are accommodated in normal operation. The diversion design is discussed in Section D.6.5.5. The project water balance is contained in Section D.6.7.

Two additional embankments will be constructed along the perimeter of the disposal area. The first embankment will be constructed as part of Phase I. The embankment, designated as the East Dike, will be constructed on the upper end of the disposal area on the east side to contain tailings and to divert storm flow from Catchment Area D. The second embankment, designated as the North Dike, will be constructed during Phase

II on the northern perimeter of the disposal area to contain tailings. Details of these embankments are contained in Section D.6.5.3.

D.6.2 <u>Site Description</u>

The tailings disposal site is located immediately adjacent to a topographic saddle near the midpoint of a dry drainage tributary to Culebra Creek, and south of the Rito Seco. The upper portion, or eastern half of the site is the area of the heap leach pad in the approved permit. The lower portion of the tailings disposal site is the area of the solution collection ponds for the heap leach in the approved permit.

The disposal site is located on the saddle and along the bottom and flanks of the valley immediately downgradient and to the south of the saddle. The gradient of the natural ground surface along the bottom of the valley is approximately 3.5 percent. The valley sidewall slopes are typically 10 to 25 percent with some areas as steep as 33 percent locally. The total area encompassed by the tailings disposal area is approximately 192 acres.

Vegetation at the site is characterized as sagebrush on the saddle and valley bottom and pinyon-juniper woodlands along the valley flanks. Soils in this area are primarily the Blackhall gravelly sandy loam. Exhibits I and J of the approved permit contain a complete discussion of soils and vegetation within the project area including the tailings disposal site.

There are four existing intermittent drainages which join the arroyo in the area which will be encompassed by the tailings disposal facility. These drainages will be diverted around the disposal area during operations as shown on Figures

C-3 and C-4. Upon reclamation these drainages will be rerouted across the reclaimed tailings surface as discussed in Exhibit E Reclamation Plan.

D.6.3 Site Material Characteristics

During June and July 1988, a total of seven test pits were excavated in the tailings disposal area. Three boreholes were also drilled in this area. Logs for the test pits and boreholes, as well as an exploration location map are contained in Appendix C of the approved permit. Standpipe piezometers were installed in boreholes BH-6 and BH-8 as part of the field exploration program. The completion details for these piezometers are included in Appendix E of the approved permit. A geotechnical laboratory testing program was completed on selected samples taken from the test pits and boreholes. The results of the laboratory testing program are included in Appendix D of the approved permit.

Based on the results of the subsurface exploration program and the geotechnical laboratory program, the subsurface profile in the vicinity of the tailings disposal facility consists of relatively deep deposits of alluvial sediments, composed predominantly of poorly consolidated silty and gravelly sands with a measurable higher silt content and lower gravel content in the near surface soils located in the upper five to ten ft of the profile. Natural clay content is generally low in all of the native soils with the majority occurring in discontinuous pockets of topsoil and as scattered lenses interbedded with sands at depth. Relatively clean sands and gravels exist locally where intermittent stream action has occurred. Higher up on the slopes, the Santa Fe Conglomerate is exposed. Hard, non-rippable bedrock materials were not encountered in any of the boreholes or test pits.

Some aeolian (wind-blown) deposits were identified locally during the exploration program. Nuclear density testing indicated low density and, therefore, a high void ratio (up to 1.0) for some of these deposits. Nuclear density test results are included in Appendix D of the approved permit. Due to the relatively shallow depth and infrequency of occurrence, these aeolian deposits will be excavated during site grading.

Data on the extent of the alluvial/colluvial soils and the nature of the underlying Santa Fe Conglomerate in the area of the tailings disposal facility is presented in Appendices C and D of the approved permit. The borehole and test pit logs indicate that the alluvial/colluvial soils range in thickness from 0 to 60 ft. The soils range from sandy clays to clean sand and gravels. The same range of material types was noted in the Santa Fe formation except that the formation is generally lightly cemented and denser.

Data on the permeability of the alluvial soils and underlying Santa Fe Conglomerate is presented in Appendix E of the approved permit. The permeability values range from 1×10^{-5} cm/sec to 5×10^{-8} cm/sec for the Santa Fe formation and are typically 1×10^{-4} cm/sec for the alluvial/colluvial soils.

Additional information on the permeability of both the soils and Santa Fe was obtained during a supplemental borehole program in September 1989. The supplemental program was used to gain additional information on the permeabilities of subsurface materials in the vicinity of the tailings disposal area and on groundwater in the area. The groundwater information will be further discussed in Exhibit G of this report. Four borings were drilled immediately downgradient of the collection pond. The borings were drilled in a staggered line at a spacing of approximately 10 feet between each boring. The subsurface material in each boring was similar and logs for the two deepest boreholes, BH-12 and BH-13 are included in Appendix A. The borings were developed as monitoring wells and well completion data is included in Appendix B. Upon completion of well construction, a permeability test was conducted in each boring to determine existing permeabilities. BH-12 was tested using a standard pump test method, while the remaining borings were tested using a falling head test. Permeability test results are contained in Appendix C. The wells will be incorporated into the ongoing monitoring as discussed in Exhibit G.

The supplemental drilling penetrated the water table at a depth of approximately 178 feet below the ground surface. The pump test completed in the water bearing zone of the Santa Fe Conglomerate, BH-12, demonstrated a permeability of 9×10^{-5} cm/sec. The falling head tests were conducted in unsaturated materials in the Santa Fe Conglomerate in BH-13 and BH-14. As the material progresses from an unsaturated to saturated condition the measured permeabilities decreased. The permeabilities at the end of testing in BH-13 was measured as 6×10^{-7} cm/sec. In BH-14 the permeability was measured at 1.1×10^{-4} cm/sec. The falling head test completed in the alluvial/colluvial soils, BH-15, showed a permeability greater than 2.2×10^{-4} cm/sec.

D.6.4 Tailings Characteristics

D.6.4.1 General

A sample of the tailings material from the San Luis ore was generated at Battle Mountain Gold Company's Battle Mountain, Nevada laboratory. The sample was processed at bench scale using a simulated procedure similar to that described for the milling operation in Section D.5 of this report.

The tailings sample was tested for physical, depositional, and geochemical characteristics. Summaries of the testing programs along with the test results are included in Appendices D, E, and F, respectively, of this report.

D.6.4.2 Physical Tests

Physical testing of the tailings consisted of gradation tests and specific gravity tests. Atterberg limits tests were not completed as the tailings were observed to be non-plastic. The gradation tests indicate that the whole tailings material classifies as a sandy silt or ML according to the Unified Soil Classification System (USCS). The sand fraction composes approximately 32 percent by weight of the sample with the remainder being silt. Samples of the coarser and finer materials were obtained from the sample barrel and tested to evaluate the potential gradational variation in a water deposition environment. The coarser samples were classified as silt and sand (ML) with 38 to 45 percent sand. The finer sample was classified as silt (ML) with zero percent sand. The specific gravity of the tailings was determined to be 2.72. Test results are contained in Appendix D.

D.6.4.3 Deposition Modeling

The deposition modeling program consisted of column tests, a tailings box study, and a consolidation test. The purpose of the column and consolidation tests was to evaluate the possible range of settled tailings densities and the rate of consolidation. The purpose of the tailings box study was to indicate beach angles, settled densities achieved in beach deposition and subsequent desiccation and gradational variation along the beach. In addition, a test program was developed for the tailings box to attempt to determine the amount of volatilization of cyanide which could be expected to occur from a tailings beach.

For the column deposition tests, samples of the total tailings product were slurried into five-inch diameter columns. The tailings were deposited in three lifts. Two columns were used; one column with bottom drainage and one without. At the conclusion of the settlement studies the columns were charged with deionized water and values of permeabilities were calculated for the column having bottom drainage.

Test results indicate a range of densities, depending on whether bottom drainage was allowed during deposition and subsequent settlement. The settled dry density values ranged from 75 pcf with no bottom drainage to 85 pcf with bottom drainage. The permeabilities ranged from 2.5×10^{-5} cm/sec to 5.0×10^{-6} cm/sec.

The tailings box tests involved the deposition of the tailings in a similar manner to that which would occur on the impoundment beach. The tests were performed by placing a number of thin lifts of tailings. Observation was made during the test of the physical movement of the material. Measurement of the resulting beach angle, material segregation, and density of the deposited slurry with time were then made.

The tailings were observed to beach at an average slope across the box of 2.9 percent with a range from 0.3 to 5.5 percent. In-place dry densities following initial sedimentation of the tailings solids were measured at between 69.4 pcf to 75.6 pcf. Material segregation tests indicated a decrease in grain size from the discharge point with the sand fraction remaining adjacent to the discharge point.

In addition, the tailings box was sealed to allow control of the air flow over the tailings. The air was cycled at a controlled rate through the box and then through a trap filled with a sodium hydroxide solution. The sodium trap was designed to capture the free cyanide in the air and allow measurement of the amount of volatilization of cyanide which could be expected to occur along the beach. Testing for the cyanide loss from the tailings has not been completed. The cyanide quantity collected in the sodium hydroxide trap will be compared to the quantity of cyanide left in the tailings. Both of these values will then be compared to the initial quantity of residual cyanide in the tailings to estimate the amount of volatilization. The results of this testing program will be submitted within two to three weeks to the MLRD for incorporation in the document review process.

In addition to physical testing of tailings material, an evaporation and consolidation study was performed using laboratory derived characteristics of tailings material and climatic data for the project. Results of the study are shown on Table D.6-1. From the laboratory tailings tests the initial deposited tailings void ratio and dry unit weight are estimated at 1.42 and 70 PCF, respectively. For the analysis a maximum desiccated density of 90 pcf was adopted.

The results of the analysis indicate that following the first year of operation, during which the higher rates of rise are occurring, sufficient evaporative loss occurs to produce the desiccated dry density of 90 pcf.

Deposition modeling test results are contained in Appendix B.

D.6.4.4 Geochemical Characteristics

The geochemical testing program for the tailings consists of the following test series:

1. Acidification/neutralization potentials;
2. Leachability;
3. Column tests; and
4. Humidity cell testing.

SAN LUIS P[illegible] 14705 28-Sep-89
TAILINGS IMPOUNDMENT EVAPORATION/CONSOLIDATION MODEL

Table D.6-1

RATE OF RISE (ft/yr)

	UPPER	LOWER
YEAR1	14	10
YEAR2	12	21
YEAR3	13	12
YEAR4	11	11
YEAR5		8
YEAR6		7
YEAR7		5
YEAR8		3

PRODUCTION RATE		1,813,333	TPY
DEPOSITION SPLIT			
	UPPER	593,333	TPY
	LOWER	1,220,000	TPY

INITIAL DRY UNIT WT	70.00	PCF	
MAXIMUM DRY UNIT WT	90.00	PCF	
SPECIFIC GRAVITY	2.72		
INITIAL VOID RATIO	1.42	POROSITY	0.59
FINAL VOID RATIO	0.89	POROSITY	0.47

MONTH	ADJUSTED PAN EVAP* inches	YEAR1 UNIT WT pcf UPPER	LOWER	TOTAL	YEAR2 UNIT WT pcf UPPER	LOWER	TOTAL	YEAR3 UNIT WT pcf UPPER	LOWER	TOTAL	YEAR4 UNIT WT pcf UPPER	LOWER	TOTAL	YEAR5 UNIT WT pcf TOTAL	YEAR6 UNIT WT pcf TOTAL	YEAR7 UNIT WT pcf TOTAL	YEAR8 UNIT WT pcf TOTAL
JAN	1.50	73.76	71.10	71.80	90.00	72.03	77.91	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00
FEB	1.83	90.00	71.35	77.45	90.00	72.49	78.22	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00
MAR	3.15	90.00	72.33	78.11	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00
APR	5.20	90.00	88.00	90.00	90.00	80.85	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00
MAY	6.83	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00
JUN	8.12	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00
JUL	8.33	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00
AUG	7.20	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00
SEP	5.51	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00
OCT	3.96	90.00	72.88	78.53	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00
NOV	2.13	90.00	71.44	77.85	90.00	73.04	78.59	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00
DEC	1.70	90.00	71.25	77.39	90.00	72.31	78.10	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00
TOTAL	55.40																

* ADJUSTED PAN EVAPORATION ACCOUNTS FOR 150% OF THE PAN EVAPORATION RATE OCCURING OVER 50% OF THE IMPOUNDMENT AREA WHICH IS COVERED WITH TAILINGS.

Testing is currently ongoing on the treated tailings liquid and solids. The results of tailings geochemical test program will be submitted upon completion but are not expected to vary significantly from tailings geochemical characteristics presented in Appendix F of the approved permit.

D.6.5 Facilities Design

D.6.5.1 Liner System

The liner system consists of several components which provide for total containment for the liquid portion of the tailings. These components are: the tailings, the drainage collection system above the geomembrane liner, and a composite liner system including a geomembrane liner and compacted site subsoils. The combination of these components will create a liner system which both limits the available water reaching the drainage collection layer and reduces the hydraulic head over the composite liner.

As tailings are deposited, the initial tailings contacting the drainage layer will commence to consolidate under the loading of subsequent layers of tailings. As these tailings consolidate, their permeability will be reduced so that a restriction to flow will result. The water released during consolidation will be passed through the drainage layer and will be collected in the drainage pipe network. As the consolidation takes place and the permeability is reduced, the flow rate from the tailings will decrease. The drainage system has been designed so that all water from the tailings will be removed from above the composite liner. By designing a drainage collection to quickly pass all water to the collection pond, the hydraulic head on the composite liner will be limited, thereby reducing the potential for leakage through the liner.

The adoption of a composite liner consisting of a high quality installation of a geomembrane over compacted fine-grained native material will provide a high level of confidence in the containment capability of the liner. The potential for permeation of water through the geomembrane material is minimal. Installation of the geomembrane can however, be anticipated to include a small number of flaws which could create the potential of limited leakage. By constructing the compacted fine-grained soil liner in contact with the geomembrane, such leakage, if it occurs, will be further limited to nominal levels. The containment capabilities are enhanced this creates a level of redundancy which reduces the risk of leakage.

D.6.5.2 Composite Liner

Selected fine grained native material will be used to construct a 12-inch thick compacted foundation and liner bedding layer. The selected native material will be placed in two-ft lifts within approximately 2% of the optimum moisture content and compacted to 95% of the standard Proctor. A continuous geomembrane of 40-mil VLDPE will be placed on the prepared foundation.

For Phase 1 operations the liner will be anchored at an elevation of 8,590 on a 25 foot wide bench. A 25 foot width of 80-mil HDPE liner will be welded to the disposal area liner at the downgradient edge of the bench and the 80-mil HDPE liner will cover the bench. This segment will serve as a liner for placement of the tailings slurry and water return lines as well as a facilities access road. The heavier liner is necessary to prevent possible damage by road traffic. By initially lining this area, the road and pipelines can be used while placing the next lift of 40-mil VLDPE liner for the Phase 2 disposal area. The 40-mil VLDPE liner for the next lift will be welded to the outside limit of the 80-mil HDPE. Intermediate anchor benches will be provided where the disposal area slopes exceed 5H:1V. The liner placement, anchoring and welding details are shown on Figure C-5.

D.6.5.3 Drainage Layer Design

Tailings water collection will be employed directly over the liner using a subdrainage system beneath the deposited tailings. This system will be constructed of coarse-grained native soil materials and perforated ADS pipe placed over the VLDPE liner. Within the disposal area the drainage layer will be two feet thick while beneath the splitter embankment the layer will be three feet thick. Drainage system characteristics for the main embankment are discussed in detail in Section D.6.5.4. To facilitate collection, perforated ADS pipe wrapped in filter fabric will be placed in a network over the liner surface within these pervious materials and routed to collection laterals running beneath the main and splitter embankments. The subdrainage layers and pipes will discharge into a lined collection ditch along the downstream toe of the main embankment. The ditch will then route flow to the lined collection pond. A pump and pipeline system will be used to reclaim the water from the pond and return it to the free water pool in the tailings disposal area. The drainage network is shown in plan view on Figure C-6. Drainage network details are shown on Figure C-5. The collection ditch and pond are discussed in detail in Section D.6.5.6.

Inclusion of surface drainage pipes above the liner will limit the hydraulic head on the liner. Drainage of interstitial water and consolidation of the tailings immediately above the drain layer will result in a zone of low permeability above the drainage layer. The combined affect of liner drainage system and lower permeability of the tailings will further minimize the hydraulic head on the liner and minimize potential seepage from the facility. The drainage layer will be constructed up side slopes as liner placement progresses. As tailings placement and consolidation occurs the flow into the drainage layer will continue primarily through flow in areas where the tailings thickness is minimal such as the valley sides. Downward movement of water will be restricted by the low permeability of the consolidated tailings.

The tailings underdrain system has been designed and sized to collect water from the overlying tailings and route the flow through a lined ditch system to the lined collection pond. Assuming a tailings permeability of 5×10^{-6} cm/sec at the end of Year 1, a unit hydraulic gradient, and a zone of influence equal to the entire tailings area, approximately 540 gpm will be collected by the tailings underdrain system. Calculations show that the main collector pipe flows will be approximately 310 gpm from the area above the splitter embankment to the lower disposal area and 540 gpm from the lower disposal area to the collection pond. Based upon a permeability of the drainage layer at the base of the disposal area of 5×10^{-4} cm/sec, a drain spacing of 40 ft has been selected. At this spacing, the buildup of a phreatic surface or head on the liner between drain pipes will be limited to less than two ft or the thickness of the drainage layer. Calculations are provided in Appendix G of this report.

D.6.5.4 Embankment Design

The main and splitter embankments will be constructed over the liner and solution recovery system. They have been designed as loosely compacted earthfill structures constructed with various types of native materials which are available at the disposal site. The embankments are shown in plan view on Figures C-3 and C-4 and in cross-sectional view on Figures C-5 and C-7.

D.6.5.4.1 Main Embankment

The main embankment has been designed as a zoned earthfill which will be constructed in three stages.

During Phase 1 of the operations, the embankment will be raised to an elevation of 8,590 feet. Outslopes will be 3H:1V on the downgradient side and 2.5H:1V on the upgradient side. The downgradient side has been designed at 3H:1V to allow concurrent reclamation and will be revegetated upon completion of construction as discussed in Exhibit E. The Phase 1 embankment will have a crest length of 1,450 feet. A 30 foot wide road will be constructed on the crest for tailings distribution lines and an access road. In addition to the access roads, a bench will be constructed at an elevation of 8,550 feet on the upgradient side of the Phase 1 embankment. the bench will be used for initial tailings distribution.

During Phase 2 of operations two additional raises will be constructed on the upgradient side of the main embankment. The raises will occur when the tailings elevations reach 8,582 feet and 8,600 feet. Construction of the raises will occur to provide that sufficient freeboard is available within the disposal area to contain stormwater inflows resulting from the probable maximum rainfall (PMF). Raises will be of an upstream construction type and will be placed on dewatered, consolidated tailings. The results of the deposition modelling and desiccation analyses indicate that the Phase 2 construction over the shallow depth of tailings will be viable. Confirmation of the physical properties and suitability of the tailings will be obtained prior to Phase 2 construction.

The final main embankment will have an ultimate crest length of 1,900 feet and an ultimate elevation of 8,620 feet. The maximum embankment height will be approximately 155 feet.

The main embankment zonation is shown on Figure C-5. The upgradient face of the embankment will be covered with a filter layer to prevent movement of tailings material into the granular embankment fill. The permeable materials will function to drain the tailings immediately adjacent to the embankment to the subdrainage pipe network at the base of the embankment. The pipe network continues under the main embankment and discharges to a lined collection ditch at the downgradient toe. This system, as discussed in Section D.6.5.3, will route tailings water from the base of main embankment to the lined collection pond. Details of the drainage network are shown on Figure C-6. The drainage layer details are shown on Figure C-5. The downgradient portion of the embankment will be constructed with less pervious materials.

Stability of the main embankment is discussed in Section D.6.8.

D.6.5.4.2 Splitter Embankment

A splitter embankment will be constructed concurrently with the main embankment construction. The splitter embankment will be constructed to an elevation of 8,590 with side slopes of 2H:1V. The maximum height of the splitter embankment will be 90 feet. The splitter embankment crest will be 20 feet wide and will serve as an access road. The splitter embankment is shown in plan view on Figure C-3 and in cross-sectional view on Figures C-5 and C-7.

During Phase 1 operations the splitter embankment will serve to divide the tailings facility into an upper and lower disposal area. As tailings deposition proceeds to Phase 2 operations, the splitter embankment will be buried and tailings deposition will occur in a single disposal area.

The purpose of the splitter embankment is to reduce the rate of rise of tailings in the lower portions of the disposal area. The embankment will be constructed using 2H:1V side slopes since this is a temporary structure which will eventually be buried within the tailings. The stability of the splitter embankment was not evaluated since it has no effect on the stability of the disposal area as a whole.

Ramps sloping at 5H:1V will be constructed from the crest of the splitter embankment to the bottom of the upper and lower disposal areas. These ramps will be used for access to skid mounted pump stations for return of water from the free water pool to the milling process.

The entire splitter embankment and access ramps will be constructed of relatively low permeability materials. A three foot thick layer of pervious material will underlie the embankment to serve as liner protection and for routing of the disposal area drainage network.

D.6.5.4.3 Perimeter Embankments

Two perimeter embankments will be necessary to ensure complete containment of the tailings and design storm as well as aiding in diversion of flows from Drainage Area D. Perimeter embankments will be constructed on the north and east sides of the tailings disposal areas and are referred to as the North Dike and East Dike, respectively. These dikes will be constructed with side slopes of 3H:1V. The North Dike will be approximately 10 feet in height with a crest width of 30 feet. The East Dike will be approximately 15 feet in height with a crest width of 20 feet. The embankments will be constructed with locally available material. The internal slopes of this embankment will be lined with a 40-mil VLDPE liner material.

The East Dike must be constructed at the start of operations, however the North Dike will not be needed until approximately Year 3.75.

D.6.5.5 Collection Ditch and Pond Design

The collection ditch at the toe of the main embankment will be an extension of the drainage and filter layer and will collect flows from the drainage/filter layer and convey these flows to the collection pond. The collection ditch will be double lined with a 60-mil HDPE upper liner and a 40-mil VLDPE lower liner. A layer of geonet will be placed between the liners. The collection ditch will be three feet in depth with a five foot bottom width. The ditch side slopes will be 3H:1V to allow liner placement. The maximum ditch capacity with one foot of freeboard is 690 cfs. The ditch will follow the existing 3.3% gradient into the collection pond. Ditch details are shown on Figure C-8.

Based on the worst case drainage layer seepage calculations presented in Appendix E, the ditch design is adequate. The worst case seepage occurs at the initiation of tailings disposal when the tailings are just beginning to consolidate. The calculations assume that a 100 year 24 hour storm event occurs at the onset of disposal and most of the water flows through the drainage layer at a rapid rate.

The collection pond will collect flows from the drainage ditch. The pond will be double lined due to the high hydraulic head which can occur in the pond and the direct exposure to site climatic conditions. The lining will consist of a 60-mil HDPE upper liner and a 40-mil VLDPE lower liner. A layer of geonet will be placed between the liners to collect any leakage from the upper liner and convey the leakage to a secondary recovery sump located on the downgradient side of the collection pond. The collection pond is shown in plan view,on

Figure C-9. The pond liner and secondary recovery system details are contained on Figure C-8.

The collection pond has been designed to contain 10.5 million gallons of water with in excess of the two-ft of freeboard. The pond will have a 500 foot long embankment with a maximum height of 22 feet. The embankment will be constructed of locally available materials, placed in lifts of no more than 12 inches at within 2% of the optimum moisture content and compacted to 95% of the standard Proctor. The pond design is based on the case where the design storm of the 100-yr recurrence interval 24-hr duration event occurs during the startup period of the facility. In this instance the drainage layer will be exposed to the water which will accumulate behind the embankments. Without a cover of tailings the seepage through the drain layer routed to the pond will be at its maximum. It has also been assumed that approximately four ft of dead storage exists in the pond and that a 48-hr loss of pumping capacity coincides with the storm event. The volume of the seepage entering the pond during this period is calculated to be 9.4 million gallons. The approximately three inches of water falling directly on the pond will reduce the freeboard to slightly less than two feet under design storm condition. The design and height capacity relationships for the pond is shown on Figure C-9. These seepage calculations are presented in Appendix G.

The pond will have a pumpback system to pump pond water to the free water pool in the disposal area for recycling back to the mill. The pumpback system will consist of two pumps and a return line with a maximum pumping capacity of 5,000 gpm. The line will be placed within the lined collection ditch along the north side of the main embankment. The pumpback system location is shown on Figures C-3 and C-4.

D.6.5.6 Diversion Ditches

Diversion ditches will be constructed to divert undisturbed area runoff around the south and east sides of the tailings disposal area. The catchment area on the north side of the tailings disposal area is small and runoff will not be diverted but will be captured in the tailings disposal area.

The catchment area on the south side is approximately equal to 0.97 square miles or about 621 acres. Flows from this area are currently routed through one of four ephemeral drainages as delineated on Figure D.6-1. Elevations within the catchment area vary from approximately 8,600 ft at the tailings facility to about 9,582 ft at the southerly limit of the watershed boundary. The watershed slopes in a northerly direction towards the facility at an average gradient of approximately 8.5 percent.

Catchment Areas A, B, and C will be intercepted along the southern perimeter of the tailings disposal area and diverted to the west. Storm flow from these areas will be routed through a diversion ditch along the south side of the tailings disposal area. A corrugated metal pipe will serve as a drop structure to convey flows to the valley bottom to rejoin the existing drainage downstream of the tailings disposal area and collection pond.

Catchment Area D will be intercepted along the eastern perimeter of the tailings disposal area and diverted to the north over the saddle through a diversion ditch.

The diversion ditches have been designed to carry the peak discharge from the 100-yr 24-hr storm. All storm discharges were determined with the computer program WASHED. All analyses were performed using a SCS Type II rainfall intensity curve and a SCS number 70 runoff curve. The 100 year 24 hour precipitation remains unchanged from the approved permit value of 2.90 inches of rainfall. The peak discharge has been calculated to be 292 cfs in the south diversion ditch and 80 cfs in the north ditch (Drainage D).

The diversion ditches are located on Figures C-3 and C-4. Diversion ditch designs are shown on Figure C-10. Figure C-10 also includes designs for the drop structure inlet, the drop structure and the drop structure outlet including the stilling basin. Design calculations are contained in Appendix H.

In the event that the PMF occurs, perimeter diversion ditches will be breached and the PMF inflows could occur into the tailings disposal area. The disposal area has been designed to store the probable maximum flood (PMF) from all upgradient catchments and the tailings disposal area itself. For design purposes, an eight hour Probable Maximum Precipitation (PMP) event producing 14.0 inches of rainfall over the 1.29 mi^2 catchment area has been used. The catchment area includes drainages A through D, the tailings disposal area, and areas peripheral to the disposal area. Peak discharge from this event is predicted to be 9220 cfs.

During Phase I of the operation of the facility, PMF inflows will be contained by the main and upper splitter. During Phase II of the operation of the facility, storm inflows will be contained by the main embankment. Figure D.6-2 shows the freeboard required to contain PMF inflows as a function of the elevation of the tailings. Appendix I contains the PMP inflow calculations.

D.6.6 Construction

Design criteria adopted for the initial disposal area construction were to provide sufficient tailings storage to reduce the rate of rise in the disposal area to below 14 ft/year by the end of year 2. Two additional 15-ft lifts or raises will be constructed on the lower embankment to raise the tailings disposal area to the final elevation of 8,620 ft.

The bulk of all materials to be used in the construction exist within the limits of the disposal area. Figure D.6.2 shows the location from which material will be selectively excavated for construction. The description and criteria defining each material type are given on Table D.6-2. The cut and fill operations will be concurrent during initial construction while some temporary stockpiling of the materials to be placed over the liner will be performed. Similarly, placement of the material to be installed beneath the liner will be performed at locations where borrow denudes this material or it is lacking.

For the purposes of design, it has been assumed that the first raise to 8,605 ft will be constructed when the tailings reaches an elevation of 8,582 ft. Construction of the first raise at this tailings elevation will ensure sufficient freeboard to allow storage of PMF inflows with at least one ft of residual freeboard. The final raise will be constructed when the tailings elevation reaches 8,600 ft.

The northwestern perimeter embankment may be constructed at any time prior to the tailings reaching an elevation of 8,615 ft. The northern perimeter embankment must be constructed during Phase I to divert storm runoff away from the disposal area.

TABLE D.6-2

MATERIAL DESCRIPTION	USCS DESIGNATION	ESTIMATED PERCENT TOTAL VOLUME	ESTIMATED PERMEABILITY cm/s	CONSTRUCTION USE	DESIGNATION
Sandy-gravels	GP/SP	28%	10^{-2} x 10^{-4}	(1) Pervious fill materials - drainage blankets - finger drains (2) Embankment fill	Type 1
Poorly graded sands	SP/GM SP/SM	22%	10^{-3} x 10^{-5}	(1) Pervious fill (2) Filter materials (3) Embankment fill	Type 2
Clayey-silty sands	SM/SC	50%	10^{-4} x 10^{-7}	(1) Semi-pervious fill (2) Liner bedding (3) Embankment fill	Type 3

Note: All of these soils classify as Type 4 material.

MONTHLY WEST PIT DIVERSION ACCOUNTING FORM
BATTLE MOUNTAIN'S SAN LUIS GOLD PROJECT
CASE NUMBER 99CW057

Month/Year: Oct-08

West Pit Pumping 2):		Monthly Meter Reading (gal)		Monthly Volume Diverted		Cumulative Volume Diverted For Water Year (ac-ft)
Well ID	Permit No.	Start	End	gal	ac-ft 1)	
BF-3	52740-F	13,172,100	13,172,100	0	0.00	0.00
BF-4	52741-F	128,529,700	128,539,900	10,200	0.03	1.02
BF-5R	52742-F	394,479,900	402,880,500	8,400,600	25.78	317.33
BF-6	52743-F	237,300	242,400	5,100	0.02	0.11

Rito Seco Alluvium Pumping 3):							Well Use 3)	Injection sum	Treatment sum
French Drain 7)		0	0	0	0.00	0.00	T	0	0
M-18 7)	52744-F	8,905,100	8,905,100	0	0.00	0.00	T	0	0
M-19 7)	52745-F	8,566,900	8,566,900	0	0.00	0.00	T	0	0
M-20 7)	52748-F	2,457,100	2,457,100	0	0.00	0.00	T	0	0
M-28 7)	52746-F	4,320,900	4,320,900	0	0.00	0.00	T	0	0
M-29 7)	52747-F	9,063,400	9,063,400	0	0.00	0.00	T	0	0
M-32	53737-F	60,483,900	60,971,000	487,100	1.49	16.51	T	0	487100
M-33	53738-F	21,708,300	21,923,600	215,300	0.66	7.21	T	0	215300

Tailings Meter:					
	49,906,700	50,500,700	594,000	1.82	20.77

Treatment Plant Effluent:	Monthly Meter Reading (gal) Start	End	Monthly Volume Delivered gal	ac-ft 1)	Previous Month's Delivery (ac-ft)
Deliveries to Rito Seco 4):	449,720,400	457,736,900	8,016,500	24.60	25.28
Deliveries to West Pit 5):	0	0	0	0.00	0.00

Summary

Total Monthly Volume Diverted from West Pit 2):	25.83 ac-ft
Total Monthly Volume Diverted from Alluvium and Injected 3):	0.00 ac-ft
Total Monthly Volume Diverted from Alluvium and Treated 3):	2.16 ac-ft
Total Monthly Volume Discharged from Treatment 6):	24.60 ac-ft
Total Monthly Volume Delivered to Rito Seco 4):	24.60 ac-ft
Total Monthly Volume Reinfiltrated to West Pit 5):	0.00 ac-ft
Cumulative Volume Diverted from West Pit (Water Year) 2):	318.46 ac-ft
Cumulative Volume from Alluvium Injected (Water Year) 3):	0.00 ac-ft
Cumulative Volume from Alluvium Treated (Water Year) 3):	23.72 ac-ft
Cumulative Volume Discharged from Treatment (Water Year) 6):	303.61 ac-ft
Cumulative Volume Delivered to Rito Seco (Water Year) 4):	303.61 ac-ft
Cumulative Volume Reinfiltrated to West Pit (Water Year) 5):	0.00 ac-ft

1) ac-ft = gal/(325,828.8)
2) Water is pumped to treatment plant for treatment and return to Rito Seco or to evaporation pond.
3) Water is either pumped directly into the West Pit "I" or sent to treatment plant "T".
4) Discharge from treatment returned directly to Rito Seco.
5) Discharge from treatment plant reinfiltrated into the West Pit.
6) Total discharge from treatment plant.
7) Water from the West Pit curtain wells and French Drain will not be diverted without notification of the Conservancy District and Division Engineer except for routine water quality sampling.

MONTHLY WEST PIT DIVERSION ACCOUNTING FORM
BATTLE MOUNTAIN'S SAN LUIS GOLD PROJECT
CASE NUMBER 99CW057

Month/Year: Oct-11

West Pit Pumping 2):		Monthly Meter Reading (gal)		Monthly Volume Diverted		Cumulative Volume Diverted For			
Well ID	Permit No.	Start	End	gal	ac-ft 1)	Water Year (ac-ft)			
BF-3	52740-F	13,172,100	13,172,100	0	0.00	0.00			
BF-4	52741-F	131,870,600	131,877,900	7,300	0.02	3.03			
BF-5R	52742-F	687,998,800	697,198,600	9,199,800	28.24	320.89			
BF-6	52743-F	323,700	331,100	7,400	0.02	0.09			
							Well Use 3)	Injection sum	Treatment sum
Rito Seco Alluvium Pumping 3):									
French Drain 7)		0	0	0	0.00	0.00	T	0	0
M-18 7)	52744-F	8,905,100	8,905,100	0	0.00	0.00	T	0	0
M-19 7)	52745-F	8,566,900	8,566,900	0	0.00	0.00	T	-0	0
M-20 7)	52748-F	2,457,100	2,457,100	0	0.00	0.00	T	0	0
M-28 7)	52746-F	4,320,900	4,320,900	0	0.00	0.00	T	0	0
M-29 7)	52747-F	9,063,400	9,063,400	0	0.00	0.00	T	0	0
M-32	53737-F	73,235,900	73,672,600	436,700	1.34	12.19	T	0	436700
M-33	53738-F	27,011,000	27,142,600	131,600	0.40	4.74	T	0	131600
Tailings Meter:									
		115,118,300	121,539,600	6,421,300	19.71	164.91			

Treatment Plant Effluent:	Monthly Meter Reading (gal) Start	End	Monthly Volume Delivered gal	ac-ft 1)	Previous Month's Delivery (ac-ft)
Deliveries to Rito Seco 4):	53,716,908	56,227,900	2,510,992	7.71	5.44
Deliveries to West Pit 5):	439,000	439,000	0	0.00	0.00

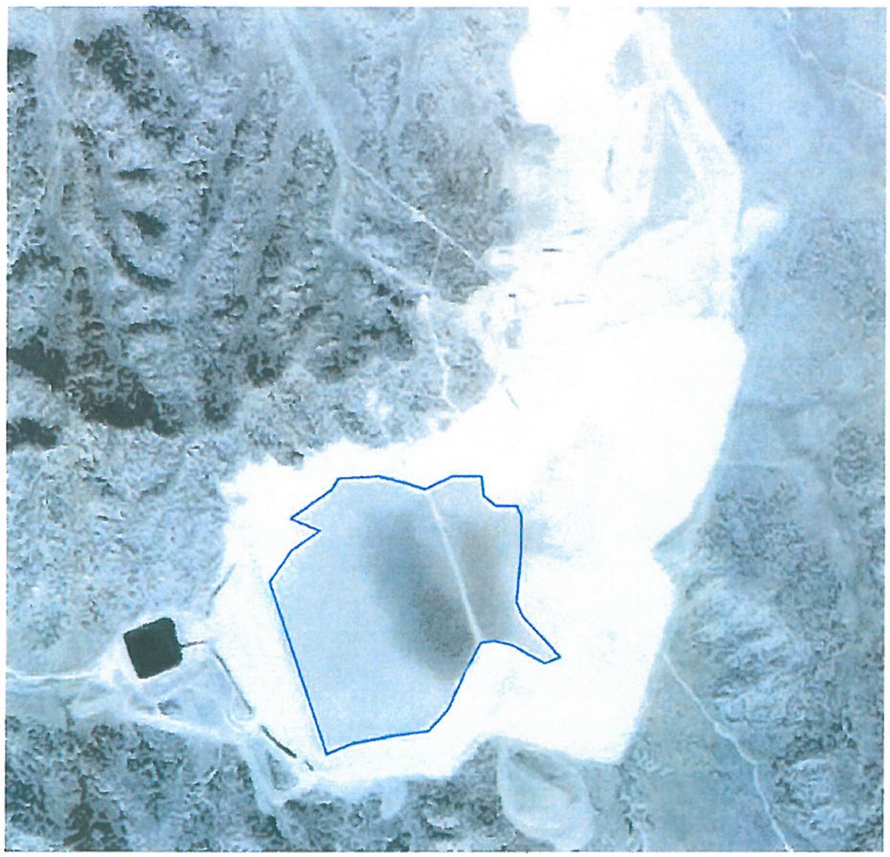
Summary

Total Monthly Volume Diverted from West Pit 2):	28.28 ac-ft
Total Monthly Volume Diverted from Alluvium and Injected 3):	0.00 ac-ft
Total Monthly Volume Diverted from Alluvium and Treated 3):	1.74 ac-ft
Total Monthly Volume Discharged from Treatment 6):	7.71 ac-ft
Total Monthly Volume Delivered to Rito Seco 4):	7.71 ac-ft
Total Monthly Volume Reinfiltrated to West Pit 5):	0.00 ac-ft
Cumulative Volume Diverted from West Pit (Water Year) 2):	324.01 ac-ft
Cumulative Volume from Alluvium Injected (Water Year) 3):	0.00 ac-ft
Cumulative Volume from Alluvium Treated (Water Year) 3):	16.93 ac-ft
Cumulative Volume Discharged from Treatment (Water Year) 6):	155.25 ac-ft
Cumulative Volume Delivered to Rito Seco (Water Year) 4):	155.25 ac-ft
Cumulative Volume Reinfiltrated to West Pit (Water Year) 5):	0.00 ac-ft

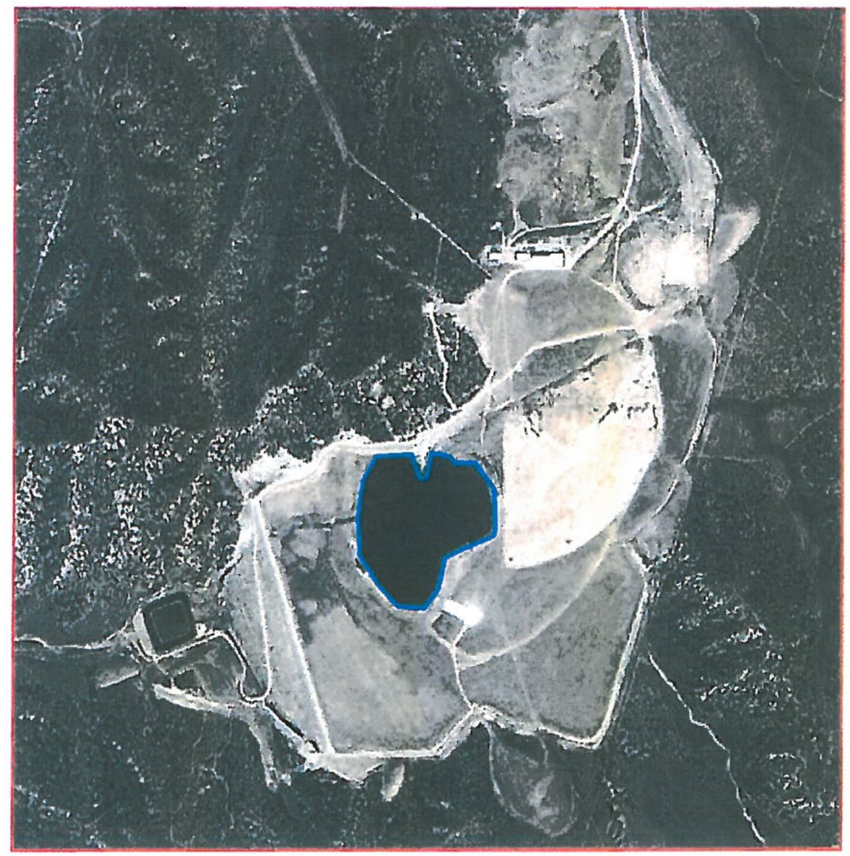
1) ac-ft = gal/(325,828.8)
2) Water is pumped to treatment plant for treatment and return to Rito Seco or to evaporation pond.
3) Water is either pumped directly into the West Pit "I" or sent to treatment plant "T".
4) Discharge from treatment returned directly to Rito Seco.
5) Discharge from treatment plant reinfiltrated into the West Pit.
6) Total discharge from treatment plant.
7) Water from the West Pit curtain wells and French Drain will not be diverted without notification of the Conservancy District and Division Engineer except for routine water quality sampling.

Free Water Surface at Lined Tailings Facility During Mining and Post-Mining

During Mining: 09-23-1994
Area of Free Water Surface: 45 acres



Post Mining: 06-30-2011
Area of Free Water Surface: 17.2 acres



ATTACHMENT 9

STATE OF COLORADO

MINED LAND RECLAMATION DIVISION
Department of Natural Resources
1313 Sherman St., Room 215
Denver, CO 80203
303 866-3567
FAX. 303 832-8106

Roy Romer, Governor
Michael B. Long, Division Director

DATE: April 14, 1992

TO: Larry Oehler

FROM: Allen Sorenson

RE: San Luis Project Tailings Impoundment and Collection Pond

The main features of the tailings disposal area consist of a continuous composite liner system consisting of compacted, low permeability soil and a geosynthetic membrane overlaid with an under-drain system, two major earthern embankments, a seepage collection pond, a tailings delivery pipeline, a runoff diversion channel, and a water return pump back system.

IMPOUNDMENT EXCAVATIONS

The majority of the tailings impoundment was established in cut. Only several localized arroyos were filled to establish the final grade within the impoundment. As a result differential settling of the foundation upon loading will be minimized. If differential settling does occur, the 40 mil VLDPE geomembrane is specified to with stand a 900% change in elongation.

During excavation of the drain blanket channel through the splitter embankment foundation, a perched aquifer was encountered. As a result, the design was modified to raise the channel by 13 feet to be above this saturated zone. The operator performed density tests on the saturated materials and states that they are well consolidated, however no numerical values for the material densities are given. A three-foot deep layer of gravel was installed on the invert of the channel excavation to allow ground water to travel unimpeded under the foundation.

During excavation of the upper impoundment, several localized zones of sandy clay were encountered in the impoundment floor. The materials in these zones were saturated, the zones of saturated materials are described as being "relatively small and localized." These saturated materials, when encountered, were over-excavated and backfilled with clean sands and gravels. Also encountered during excavation of the upper impoundment, was a condemnation drilling hole. Once the excavation was at depth, the steel casing was cut off, and an underdrain trench was constructed from the casing to the splitter embankment underdrain mentioned above. During the final grading operations the drill casing was regrouted and sealed.

In placing the main embankment liner, the splitter embankment liner, and the lower disposal area liner, work crews experienced difficulty making the wedge welders perform adequately. A significant percentage of seams were subsequently capped using extrusion welding techniques. The double wedge welding machines periodically melted holes in seams which resulted in a large number of caps and seams that could not be tested continuously by air testing of the channel. All repairs on the seams and interior areas of the liner were vacuum tested for water tightness prior to acceptance and placement of the cover material.

UNCONTAINED SEEPAGE

Calculations of the amount of seepage that will escape the tailings impoundment through the synthetic liner and underlying compacted soils, are based on a number of assumptions. The first assumption being that potential holes in the liner would be .1 square centimeters in size with a frequency of one hole per acre. These values correspond to values from EPA document "Design and construction of RCRA/CERCLA Final Covers" for a liner installation implemented with a high level quality assurance program. The second assumption is that the hydraulic head applied to the liner will be minimized by the subdrainage layer and piping and will be about one foot. With the known values for permeability of the sub-drainage layer, the compacted soils, and the geomembrane, Darcy's Law predicts total uncontained flow from the tailings impoundment to be approximately 15,000 cu. ft./yr. or 112,000 gallons per year.

CONCLUSIONS

As it is designed, the San Luis Project tailings impoundment seepage rate is low enough that it will not induce unsaturated flow in the underlying material, hence any pollutants that seep through the liner would not reach the water table. This conclusion is based on the values for hydraulic conductivity calculated or specified for the subdrainage layer, the geomembrane, the compacted soil layer and the liner foundation, as well as the quality assurance program followed during liner installation, and the design performance of the subdrainage layer in limiting the head applied to the liner. This conclusion is further based on moisture content and specific retention (5% and 10% respectively) values supplied by the operator for the liner foundation subsoils.

ACS/yjb

2567F

BATTLE MOUNTAIN RESOURCES, INC.

March 31, 2003

Mr. Jim Dillie
State of Colorado
Division of Minerals and Geology
1313 Sherman Street, Room 215
Denver, CO 80203

RECEIVED
APR 0 3 2003
Division of Minerals and Geology

Re: Battle Mountain Resources Inc.
San Luis Project
CMLRB Permit No. M-88-112
Technical Revision (TR) 32 Submittal

PART 1 of TR-32

Dear Mr. Dillie:

Enclosed please find the revised *Reclamation/Post-Reclamation Quality Assurance/Quality Control Protocols for the Collection of Surface and Ground Water Quality Data, San Luis Project, Costilla County, Colorado* prepared by Telesto Solutions, Inc. (Telesto) supporting Battle Mountain Resources, Inc.'s (BMRI's) Technical Revision 32 application. This revised submittal incorporates responses and materials associated with the Division's completeness review of the original application submittal and supercedes the previous submittal such all final information is incorporated within the revised submittal. Telesto has reviewed the exhaustive documentation of previous Technical Revision applications associated with the San Luis Project water quality monitoring program and for purposes of simplicity summarizes BMRI's past and current monitoring obligations in Table 1-1 *Summary of Surface and Ground Water Monitoring at the San Luis Mine*. In addition, Telesto has incorporated references, responses or additional information pertaining to the various Division comments discussed at our December 20, 2002 meeting.

Although this process has been extensive, the completion of the revised Quality Control/Quality Assurance protocols will assist all parties involved with the San Luis Project understand and track the past, present and future monitoring obligations associated with CMLRB Permit No. M-88-112. Should the Division or yourself have any questions, comments or clarifications concerning the enclosed submittal, please either contact Jim Finley, PhD of Telesto (970) 484-7704 or myself at either (303) 324-2630 or (719) 379-0798.

Sincerely,

Bill Lyle
Director of Env. Affairs

Cc: Jim Finley, PhD (w/o enclosures)
Robert Green, CCCD (w/enclosures)
Julio Madrid (w/o enclosures)

Reclamation/Post-Reclamation Quality Assurance/Quality Control Protocols for The Collection of Surface and Ground Water Quality Data San Luis Project, Costilla County, Colorado

Prepared for:

Battle Mountain Resources Inc.

P.O. Box 310

San Luis, Colorado 81152

Prepared by:

Telesto Solutions, Inc.

2636 Midpoint Drive, Suite B

Fort Collins, Colorado 80525

TELESTO SOLUTIONS • INCORPORATED

March 2003

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1.0 INTRODUCTION

Battle Mountain Resources Inc. (BMRI) and Telesto Solutions, Inc. (Telesto) have developed this plan to revise previous reclamation/post-reclamation surface water and ground water quality monitoring programs at the San Luis Project located in Costilla County, Colorado. The San Luis Project is an inactive precious metal mining and milling operation operated by BMRI under Colorado Mine Land Reclamation Board (CMLRB) permit M-88-112 under the regulatory administration of Colorado Division of Minerals and Geology (CDMG). BMRI mined and milled precious metal ore at the facility from 1989 through November 1996 and since 1996 has been performing surface land reclamation and closure of the facility in accordance with the CMLRB permit. Current reclamation and closure activities are associated with completing remaining surface land reclamation of mining and milling facility disturbance, extracting and treating ground water from the West Pit mine operation, and monitoring surface and ground water locations within the CMLRB permit area. Drawing 1 shows all on-site and off-site surface and ground water monitoring locations associated with the QA/QC plan.

Previous reclamation/post-reclamation monitoring programs were prepared by John C. Halepaska and Associates (JCHA) to provide a systematic approach to reclamation/post-reclamation surface and ground water monitoring of the site. The original approach identified the critical monitoring locations and sampling frequencies with relationship to active and inactive mining and milling facilities and final land reclamation. This revised plan incorporates and subsumes the previous systematic approach prepared and presented by JCHA and updates the previous plan to incorporate regulatory changes associated with CMLRB Technical Revisions (TR) twenty-six (26) through thirty-one (31). The revised plan identifies the routine sampling and analysis of fifty monitoring locations including surface water sites, ground water wells, porous cup lysimeters, piezometers, and operational component monitoring.

A summary of surface and ground water monitoring for the San Luis Mine is provided in Table 1-1. Monitoring commitments are listed by CDMG permit approvals beginning with Exhibit E of the amended mine permit through Technical Revision 31. Table 1-2 lists current regulatory Points of Compliance.

Table 1-1 Summary of Surface and Ground Water Monitoring at the San Luis Mine

Document	RS-1		RS-2		RS-3		RS-4		RS-5		RS-6		D87-24	DW-2	M-1	M-2	M-3	M-4	M-4R	M-5	M-6	M-7	M-8
	Flow	Quality	Flow	Quality	Flow	Quality	Flow	Quality	Flow	Quality	Flow	Quality											
Exhibit G	Weekly	Quarterly	Weekly	Quarterly	Weekly	Quarterly	Weekly	Quarterly	Weekly	Quarterly	Weekly	Quarterly	-	-	Quarterly	Quarterly	Quarterly	Quarterly	-	Quarterly	-	-	-
TR-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-6	-	Quarterly	-	Quarterly	-	Quarterly	-	Quarterly	-	Quarterly	-	Quarterly	-	-	Quarterly	Quarterly	-	Quarterly	-	-	Quarterly	Quarterly	Quarterly
TR-6 NOV	-	Quarterly	-	Quarterly	-	Quarterly	-	Quarterly	-	Bi-weekly	-	Bi-weekly	Quarterly	-	Quarterly	Bi-weekly	-	Quarterly	-	-	Bi-weekly	Bi-weekly	Bi-weekly
TR-7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-15	-	-	-	-	-	-	-	-	-	-	-	-	POC/Quart	POC/Quart	Discontinue	Discontinue	-	Quarterly	-	-	POC/Quart	POC/Quart	POC/Quart
TR-16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Discontinued	POC/Quart	-	-	-	-
TR-19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-26	-	Monthly	-	Monthly	-	Monthly	-	-	-	Monthly	-	Quarterly	-	-	-	-	-	-	-	-	-	-	-
TR-27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-31	-	-	-	-	-	-	-	-	-	-	-	-	Discontinue	Discontinue	-	-	-	-	-	-	-	-	-

Table 1-1 Summary of Surface and Ground Water Monitoring at the San Luis Mine

Document	M-9	M-10	M-11	M-11R	M-12	M-13	M-13R	M-14	M-15	M-16	M-19	M-20	M-21	M-22	M-23	M-24	M-25	M-26	M-27	M-30	M-31	M-34
Exhibit G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-6	Quarterly	Quarterly	Quarterly	-	Quarterly	Quarterly	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-6 NOV	Bi-weekly	Quarterly	Quarterly	-	Bi-weekly	Bi-weekly	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-8	-	-	-	-	-	-	Bi-weekly	Installed	Installed	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-15	POC/Quart	Quarterly	Discontinue	POC/Quart	POC/Quart	Discontinue	POC/Quart	POC/Quart	POC/Quart	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-26	-	-	-	Monthly	-	-	-	-	-	Monthly	Monthly	Dropped	Monthly	Monthly	Monthly	Monthly	Dropped	Monthly	-	Monthly	Monthly	POC/Quart
TR-27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-31	-	-	-	-	-	-	-	-	-	Quarterly	-	-	-	-	-	-	-	-	-	Discontinue	-	-

Table 1-1 Summary of Surface and Ground Water Monitoring at the San Luis Mine

Document	BF-1		BF-2		BF-4	BF-6	SF-1	SF-1R	Collection Pond		Tailings Pond	Leak Detection		Lysimeters		Piezometers		Dos Hermanos (Shalom)	San Luis Town Well
	Quality	W.L.	Quality	W.L.					Flow	Quality		Volume	Quality	Volume	Quality	Volume	Quality		
Exhibit G	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-4	-	-	-	-	-	-	-	-	-	-	-	Weekly	-	-	-	-	-	-	-
TR-5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-6	-	-	-	-	-	-	-	-	Monthly	Quarterly	Bi-weekly	Monthly	Monthly	-	Semi-annual	Monthly	Monthly	Semi-annual	Semi-annual
TR-6 NOV	-	-	-	-	-	-	-	-	-	Bi-weekly	Bi-weekly	-	-	Bi-weekly	Bi-weekly	-	-	-	-
TR-7	-	-	-	-	-	-	-	-	-	-	Daily	-	-	-	-	-	-	-	-
TR-8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-10	-	-	-	-	-	-	-	-	-	-	5 to 9 days apart	-	-	-	-	-	-	-	-
TR-11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-15	-	-	-	-	-	-	POC/Quart	-	Monthly	Bi-weekly	Bi-weekly	-	-	-	POC/Quart	-	-	-	-
TR-16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-18	-	Monthly	-	Monthly	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-19	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Monthly	Monthly	-	-
TR-24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-26	-	-	-	-	Monthly	Monthly	Quarterly		-	-	-	-	-	-	-	-	-	Monthly	Monthly
TR-27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-28	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TR-31	-	-	-	-	-	-	-	-	-	Quarterly	Quarterly/Monthly (As)	Quarterly	Quarterly	-	-	-	-	Semi-annual	Semi-annual

ok

Table 1-2 Permit Condition Values for San Luis Points of Compliance (all concentrations in units of mg/L except pH in standard units)

POC	Iron	Manganese	Sulfate	TDS	PH	WAD CN
SF-1	0.30*	0.05*	250*	563	6.50-8.83	N/A
M-4R	0.30*	0.05*	250*	500*	6.50-9.05	0.20*
M-6	0.39	0.05*	250*	500*	6.50-8.50*	0.20*
M-7	0.39	0.05*	250*	500*	6.50-8.50*	0.20*
M-8	0.39	0.05*	250*	500*	6.50-8.50*	0.20*
M-9	0.39	0.05*	250*	500*	6.50-8.50*	0.20*
M-11R	0.30*	0.05*	250*	613	6.50-8.50*	N/A
M-12	0.39	0.12	250*	500*	6.50-8.50*	0.20*
M-13R	0.30*	0.05*	250*	500*	6.50-8.50*	0.20*
M-14	0.30*	0.08	250*	500*	6.50-8.50*	0.20*
M-15	0.30*	0.15	250*	500*	6.50-8.81	0.20*
L-1S	0.39	0.12	250*	500*	6.50-8.50*	0.20*
L-1D	0.39	0.12	250*	500*	6.50-8.50*	0.20*
L-2S	0.39	0.05*	250*	500*	6.50-8.50*	0.20*
L-2D	0.39	0.05*	250*	500*	6.50-8.50*	0.20*
L-3S	0.30*	0.08	250*	500*	6.50-8.50*	0.20*
L-3D	0.30*	0.08	250*	500*	6.50-8.50*	0.20*
M-34	0.30*	0.52	250*	500*	6.19-8.50	N/A

* - Denotes Table Value Standard

1.1 Time-Progressive Monitoring Program

The monitoring plan presented herein is intended to integrate, site-wide monitoring activities in two phases that begin with the approval date of this plan and continuing through site closure. Table 1-3 identifies current CMLRB monitoring obligations. Proposed Phase I monitoring incorporates obligations identified with the current CMLRB permit and associated permit Technical Revisions and proposes monitoring location, monitoring frequency and analytical constituent modifications (Table 1-4). The Phase I plan also addresses current monitoring redundancies or monitoring obligations for which continued monitoring serves no technical, scientific or regulatory purpose as supported by the existing surface and ground water quality database. Proposed Phase II monitoring identifies surface and ground water monitoring following suspension of tailing facility monitoring as required under CMLRB Technical Revision 6 through site closure (Table 1-5).

TABLE 1-3
CURRENT CMLRB MONITORING LOCATIONS AND SAMPLE FREQUENCY

Monitoring Locations	Monitoring Frequency	Parameter List
Surface Water		
RS-1	Monthly/Quarterly	Table 2-3/Table 3-1
	Daily/Weekly	Staff gauge
RS-2	Quarterly	Table 3-1
	Daily/Weekly	Staff gauge
RS-3	Monthly/Quarterly	Table 2-3/Table 3-1
	Daily/Weekly	Staff gauge
RS-4	Quarterly	Table 3-1
	Daily/Weekly	Staff gauge
RS-5	Monthly	Table 3-1
	Daily/Weekly	Staff gauge
RS-6	Quarterly	Table 3-1
	Daily/Weekly	Staff gauge
Ground Water		
M-4R	Quarterly	Table 2-1
M-6	Quarterly	Table 2-1
M-7	Quarterly	Table 2-1
M-8	Quarterly	Table 2-1
M-9	Quarterly	Table 2-1
M-10	Quarterly	Table 2-1
M-11R	Quarterly	Table 2-1
M-12	Quarterly	Table 2-1
M-13R	Quarterly	Table 2-1
M-14	Quarterly	Table 2-1
M-15	Quarterly	Table 2-1
M-16	Quarterly	Table 2-3
M-19	Monthly	Table 2-3
M-21	Monthly	Table 2-3
M-22	Monthly	Table 2-3
M-23	Monthly	Table 2-3
M-24	Monthly	Table 2-3
M-26	Monthly	Table 2-3
M-31	Monthly	Table 2-3
M-34	Quarterly	Table 2-1
BF-4	Monthly	Table 2-3
BF-6	Monthly	Table 2-3
SF-1	Quarterly	Table 2-1
Shalom Ranch	Semi-annual	Table 2-2
San Luis Town Well	Semi-annual	Table 2-2

TABLE 1-3
CURRENT CMLRB MONITORING LOCATIONS AND SAMPLE FREQUENCY

Monitoring Locations	Monitoring Frequency	Parameter List
Operational Monitoring		
TDF Supernatant Pond	Monthly/Quarterly	Arsenic/Table 3-2
Feeder Ditch	Monthly/Quarterly	Volume/Table 3-2
Leak Detection	Monthly/Quarterly	Volume/Table 3-2
Lysimeters		
L-1S	Monthly/Quarterly	Inspected/Table 4-1
L-1D	Monthly/Quarterly	Inspected/Table 4-1
L-2S	Monthly/Quarterly	Inspected/Table 4-1
L-2D	Monthly/Quarterly	Inspected/Table 4-1
L-3S	Monthly/Quarterly	Inspected/Table 4-1
L-3D	Monthly/Quarterly	Inspected/Table 4-1
Piezometers*		
P-6	Monthly	Inspected
P-7	Monthly	Inspected
P-8	Monthly	Inspected
P-9	Monthly	Inspected
P-10	Monthly	Inspected
P-11	Monthly	Inspected
P-12	Monthly	Inspected
P-13	Monthly	Inspected
P-14	Monthly	Inspected
P-15	Monthly	Inspected

*Piezometers are sampled any time greater than 12 inches of standing fluid is measured in the well casing and analyzed for Table 4.1 water quality parameters

TABLE 1-4
PROPOSED PHASE I MONITORING LOCATIONS AND FREQUENCY
(2003- DECEMBER 2005)

Monitoring Locations	Monitoring Frequency	Parameter List
Surface Water		
RS-1	Quarterly	Table 3-3
RS-2	Quarterly	Table 3-3
RS-4	Quarterly	Table 3-3
RS-5	Monthly/Quarterly	Table 3-4/Table 3-3
RS-6	Quarterly	Table 3-3
Ground Water		
M-4R	Quarterly	Table 2-4
M-6	Quarterly	Table 2-4
M-7	Quarterly	Table 2-4
M-8	Quarterly	Table 2-4
M-9	Quarterly	Table 2-4
M-10	Quarterly	Table 2-4
M-11R	Quarterly	Table 2-4
M-12	Quarterly	Table 2-4
M-13R	Quarterly	Table 2-4
M-14	Quarterly	Table 2-4
M-15	Quarterly	Table 2-4
M-16	Quarterly	Table 2-3
M-19	Quarterly	Table 2-3
M-21	Quarterly	Table 2-3
M-22	Quarterly	Table 2-3
M-26	Quarterly	Table 2-3
M-34	Quarterly	Table 2-4
BF-4	Quarterly	Table 2-3
BF-6	Quarterly	Table 2-3
Shalom Ranch	Semi-annual	Table 2-2
San Luis Town Well	Semi-annual	Table 2-2
Operational Monitoring		
TDF Supernatant Pond	Monthly/Quarterly	Arsenic/Table 3-2
Feeder Ditch	Monthly/Quarterly	Volume/Table 3-2
Leak Detection	Monthly/Quarterly	Volume/Table 3-2

TABLE 1-4
PROPOSED PHASE I MONITORING LOCATIONS AND FREQUENCY (2003-2005)

Monitoring Locations	Monitoring Frequency	Parameter List
Lysimeters		
L-1S	Monthly/Quarterly	Inspected/Table 4-1
L-1D	Monthly/Quarterly	Inspected/Table 4-1
L-2S	Monthly/Quarterly	Inspected/Table 4-1
L-2D	Monthly/Quarterly	Inspected/Table 4-1
L-3S	Monthly/Quarterly	Inspected/Table 4-1
L-3D	Monthly/Quarterly	Inspected/Table 4-1
Piezometers*		
P-6	Monthly	Inspected
P-7	Monthly	Inspected
P-8	Monthly	Inspected
P-9	Monthly	Inspected
P-10	Monthly	Inspected
P-11	Monthly	Inspected
P-12	Monthly	Inspected
P-13	Monthly	Inspected
P-14	Monthly	Inspected
P-15	Monthly	Inspected

*Piezometers are sampled any time greater than 12 inches of standing fluid is measured in the well casing and analyzed for Table 4-1 water quality parameters

TABLE 1-5
PROPOSED PHASE II MONITORING LOCATIONS AND FREQUENCY
(January 2006 to Closure)

Monitoring Locations	Monitoring Frequency	Parameter List
Surface Water		
RS-1	Quarterly	Table 3-3
RS-2	Quarterly	Table 3-3
RS-5	Monthly/Quarterly	Table 3-4/Table 3-3
Ground Water		
M-11R	Quarterly	Table 2-4
M-16	Quarterly	Table 2-3
M-19	Quarterly	Table 2-3
M-21	Quarterly	Table 2-3
M-22	Quarterly	Table 2-3
M-26	Quarterly	Table 2-3
M-34	Quarterly	Table 2-4
BF-4	Quarterly	Table 2-3
BF-6	Quarterly	Table 2-3
Shalom Ranch	Semi-annual	Table 2-2
San Luis Town Well	Semi-annual	Table 2-2

1.2 Reporting

If any measurement for any Permit Condition Value set forth in Table 1-2 falls outside the concentration range specified for each Point of Compliance, CDMG will be notified within five (5) working days, and the first verification sample in each instance will be taken within 2 weeks. If results of the first verification sample also fall outside the specified concentration range, a second verification sample will be taken within 2 weeks after receipt of the first verification sample analysis. CDMG will be notified of the first verification sampling results within five (5) working days following receipt of the results. If either verification sample is within the Permit Condition Value(s), CDMG will judge BMRI in compliance and monitoring at the Point of Compliance will resume the stated sampling frequency. However, if both verification samples fall outside the specified concentration range, CDMG will be notified within five (5) working days following receipt of the results for the second verification sample.

Under conditions where both verification samples fall outside the specific concentration range of the Permit Condition Value(s), BMRI will submit a specific response plan, with a schedule for implementation, to the CDMG within 30 days of receipt of the results for the second verification sample. In no case will the plan be implemented without prior approval of the CDMG. Should BMRI fail to fulfill these reporting, verification and response plan obligations, CDMG may issue a Notice of Violation to BMRI for violation of the mine permit.

2.0 PROTOCOL FOR GROUND WATER SAMPLE COLLECTION AND HANDLING

2.1 Water Sample Collection, Handling, and Management

Water sample collection, handling, and management will be conducted in accordance with the following procedures. Table 2-1 presents the current ground water quality parameters analyzed at the on-site monitoring wells, Table 2-4 presents the proposed water quality parameters to be analyzed at the on-site monitoring wells, and Table 2-2 presents the water quality parameters to be analyzed at the off-site monitoring wells. Table 2-3 presents the water quality parameters to be analyzed at the West Pit (TR-26) monitoring wells. Drawing 1 identifies the ground water monitoring locations.

2.1.1 Receive Sample Containers, Laboratory Water and Coolers from Laboratory

These items, when received, will be checked by the field sampling personnel to verify the sampling materials are in compliance with project specifications. Empty environmentally certified sample containers will be received in either coolers or certified shipping containers from either the analytical laboratory or a certified sample container manufacturer or supplier. A chain-of-custody and sample container certification form will be received with the above-mentioned items. The sample containers will be enumerated on the chain-of-custody form. After these items have been inspected and found to be in compliance, the materials will be placed into either the cooler or certified shipping container, or stored on site in a location designated for this purpose.

2.1.2 Collect Samples and Record Field Data

Samples will be collected in accordance with site-specific protocols as defined in Sections 2.2, 3.2, and 4.2. Field data will be recorded at the time of sample collection in the sample collection field logbook. Immediately after a sample is collected, sample identification will be recorded on the sample container and in the sample collection field logbook. The sample container will then be placed in a sealable (e.g., Zip-Lock® type) plastic bag, and placed in an iced cooler. If, at any point, there is deviation from sample collection protocols as outlined in this document, the deviation(s) must be noted on the chain-of-custody form and in the sample collection field logbook.

2.1.3 Transport of Samples

Samples will be transported in iced coolers from the sample collection location to the laboratory. If conditions require samples be held over-night; the samples will be refrigerated at a storage temperature between 1 and 4 degrees Celsius. Chain-of-custody forms will be signed over at the time of sample transfer.

Before signing over the samples, the field sampling personnel will check the following items:

1. That the chain-of-custody and sample containers are in agreement;
2. That the required information has been recorded on the chain-of-custody form, analytical order form, and the sample container;
3. That the sample container is full and tightly sealed, and that the sample has been collected in the correct container;
4. That the sample has been maintained in a sealed plastic bag away from other sample collections;
5. That the sample has been maintained on ice or refrigerated since the time of collection;
6. That sufficient sample quantity has been collected to perform the intended analysis;
7. That there has been no deviation from sampling protocol, or if deviation has occurred that the details of the deviation(s) have been properly recorded;
8. That the actual number of samples collected versus the number of QC samples (i.e., field duplicates, rinse blanks, and field blanks) is checked to ensure that a sufficient number of QC samples have been collected.

2.1.4 Field Quality Control Check

A thorough review of procedures will be made by the field sampling personnel to check that all quality control provisions have been met. If any items are outside the control limits as defined in the above procedures, the field sampling personnel will take corrective action. The action taken shall be of a nature to return the sample back to within control limits. The corrective-action, decision making process will progress in a reverse sequence of the procedures listed in Section 2.1.3, in a descending order until the sample is within control limits. Recollection of a sample will be final means for returning a sample to within control limits. If there is deviation from the sampling procedure and/or sample management program, but this will not sufficiently affect the integrity of the sample to warrant recollection, the sample will continue through the sample management sequence. The field sampling personnel will notify the Site Environmental Coordinator of this situation. In addition, any such deviations from procedure must be noted in the sample collection field logbook and included in subsequent reporting to CDMG.

2.1.5 Filtration of Ground Water Samples, Preservation and Preparation

Ground water samples requiring dissolved analysis will be filtered on site. Filtering techniques are defined in Section 2.2.10. Samples will be filtered with as little delay after collection as practical under field conditions. Samples requiring filtration will be acidified to pH<2 after filtering. Bottles containing filtered samples will be recorded in the sample collection field logbook and on the sample collection container.

Sample preservation and pre-treatment will be performed using preservatives as defined in Table 2-5.

2.1.6 On-Site Storage

When circumstances do not permit sample shipment from the site to the commercial analytical laboratory on the same day as collection, samples will be refrigerated and maintained within a temperature range of 1 to 4 degrees Celsius prior to shipment.

2.1.7 Package Samples for Transport to Laboratory and Prepare Shipping Documents

The sample containers will be packed in iced shipping coolers. The sample chain-of-custody form will be placed in a plastic bag in the cooler with the sample containers or affixed to the exterior of the shipping cooler. Sufficient ice or ice packs will be added to each cooler to maintain the samples at a temperature within 1 to 4 degrees Celsius. Coolers containing samples prepared for shipment will be sealed with security tape or banding.

2.1.8 Review of Paperwork and Sample Integrity

Prior to closure of the shipping cooler, sample containers will be given a final inspection ensuring that the containers are tightly sealed, bottles are not compromised, and the contents are properly packaged for shipment. Chain-of-custody records will be examined as to whether custody has been maintained and is accounted for and that the field sampling personnel has adhered to appropriate filtration, preservation and storage protocols. A final review of shipping documents will be performed to check that the documents have been filled out properly.

2.1.9 Final Quality Control Check

A final QC inspection will be conducted before samples are released for transport to the analytical laboratory. The field sampling personnel will conduct the review to establish that the samples are within the quality control limits. If a situation arises, during this review, where a sample or paper work, falls outside of the control criteria, the field sampling personnel will take appropriate corrective measures. The sequence of sample management events will be reversed until the sample can be brought within control limits.

If a sample cannot be returned to control limits, the field sampling personnel will notify the Site Environmental Coordinator. If, in the opinion of the Site Environmental Coordinator, the deficiency does not warrant recollection of the sample, the flow of sample management will continue. All such deficiencies in sample quality control will be noted in the sample collection field logbook and subsequently reported to CDMG.

2.1.10 Transportation of Sample Collections to the Laboratory

Samples will be delivered by the field sampling personnel or shipped to a U.S. Environmental Protection Agency (EPA) certified analytical laboratory.

2.1.11 Laboratory Review of Sample Integrity and Paperwork

The laboratory will inspect the security seal or banding on the shipping cooler to evaluate the integrity of the samples. After opening the cooler, the laboratory will remove and sign the attached or enclosed chain-of-custody form indicating the time and date the cooler was opened. This chain-of-custody form will be included as part of the laboratory's analysis report. A thorough inspection of the samples will be conducted to evaluate:

1. That the ice or ice pack is still partially frozen and the contents have remained in a chilled condition (in the range from 1 to 4°C) during transport;

2. That the sample containers are full, intact and free from external contamination (if the container is not full, the laboratory will so note on the chain-of-custody form);

3. That the labels affixed to the sample containers are legible and are in agreement with both the chain-of-custody form and the request for analysis form; and

4. The sample temperature is received at or below 4°C.

Having met all these requirements, the laboratory will indicate on the chain-of-custody form that the samples were received in "good" condition. Any broken sample containers, or non-compliance with the above items, will be detailed on the chain-of-custody form.

The laboratory will then check the pH from an aliquot of all preserved samples to ensure that the sample was properly preserved.

2.1.12 Laboratory Quality Control Check

Any nonconformity with the quality control guidelines must be noted on the chain-of-custody form, and the laboratory is required to contact the field sampling personnel by telephone, to inform him/her of such conditions.

All such deviations from procedures will be noted and transmitted to the Site Environmental Coordinator. If no significant deviations from the procedure are encountered, the samples will proceed to analysis. If significant deviations are encountered, additional samples will need to be collected according to the protocols outlined herein and re-submitted to the laboratory for analysis.

2.1.13 Analysis of Samples

At the time the samples are "logged in" by the laboratory, the laboratory's QA/QC program will be initiated. All laboratory QC controls and methodology as defined in the laboratory's *Standard Operating Procedure* (SOP) will be followed. A copy of the relevant sections of the analytical laboratory's SOP document and Statement of Qualifications are attached in Appendix A.

2.1.14 Verify Analysis Performed as Requested

Upon receipt of the laboratory analysis report, the Site Environmental Coordinator will review the report relative to the following criteria:

1. That the analysis has been performed as requested;
2. That the correct analytical methodology was employed;
3. That samples were analyzed within the holding times as defined in Table 2-5;
4. That the in-house laboratory quality control samples fall within prescribed limits and that a sufficient quantity of QC samples were analyzed;
5. That the reporting format is correct; and
6. That the sample identities are reported correctly.

2.1.15 Quality Control Check of Analytical Results

If any items fall outside of the control limits of the quality control check, the Site Environmental Coordinator will contact the laboratory to resolve any discrepancies. If the problem encountered is a typographical error, the laboratory will issue a corrected report. Quality control deficiencies affecting the validity of the analysis will be reported and discussed with the Site Environmental Coordinator to evaluate what corrective measures should be taken. Anomalous values will be rechecked by the laboratory and, if confirmed, will be reported by facsimile letter and by telephone to the CDMG within 5 working days.

2.2 Ground Water Sample Collection

This protocol outlines procedures and equipment for the collection of representative ground water samples from the monitoring wells.

2.2.1 Cleaning of Sampling Equipment

Submersible monitoring equipment (i.e., pumps, pipelines, hoses, etc.), either dedicated or non-dedicated, will be flushed with ground water prior to sampling. These quantities of ground water will be dependent upon the type of pump equipment and sampling techniques used in collecting the representative sample collection. All ground water well sampling will be conducted in accordance with accepted and recommended U.S. EPA ground water sampling protocols.

Micro-purge

In ground water wells fitted with or using low flow, micro-purge pump equipment (i.e., Grundfos, bladder pumps, etc.), well purging will be conducted using in-line flow sensor equipment monitoring pH, electrical conductivity, dissolved oxygen, and temperature. The use of low flow, micro-purge pump equipment and in-line sensor equipment allows field sampling personnel to determine when the chemistry of water withdrawn from the well has stabilized and potential external contamination associated with the pumping equipment or standing well bore water has been rinsed from the sampling train. Field sampling personnel will collect the above identified field parameters using the in-line sensor equipment on regular 3-minute intervals to determine ground water well stabilization. Field sampling personnel will determine that an adequate purge volume has been extracted and the ground water chemistry of the well has stabilized when all field parameters are within plus or minus 10 percent for electrical conductivity, temperature and dissolved oxygen and the in-line sensor pH reading is plus or minus 0.1 standard units from the previous readings collected in the previous 3-minutes. Field personnel will record all in-line sensor measurements in the sample collection field logbook.

Standard Purge (3 Well Bore Volumes)

Ground water monitoring wells not equipped with or using low flow, micro-purge pumping equipment will be evacuated with a minimum of 3.0 well bore volumes or total evacuation of the ground water well to allow equilibration of the ground water chemistry and provide for the removal of potential sample train contamination. Care will be taken to prevent pump and sample train equipment from coming into contact with contaminated surfaces. Non-dedicated pumping and sample train equipment will be stored between sampling events in an area to minimize potential for contamination of the equipment, while dedicated pump equipment will be stored within the ground water well casing. Non-dedicated pumping and sample train equipment external surfaces will be brushed free of loose materials prior to introduction into the ground water well.

Disposable sample collection bailers will be used when necessary to collect samples not accessible or available by submersible pumping equipment.

2.2.2 Sample Containers

Certified environmentally clean sample containers will be used in the collection of samples. The analytical laboratory performing the analysis or an environmentally certified sample container manufacturer or supplier will supply the certified-sample containers. The type of container used for sample collection will be dictated by the parameter(s) for which the sample is to be analyzed. A listing of the appropriate containers and preservatives for specific parameters is presented in Table 2-5.

2.2.3 Sample Collection and Handling

The field sampling personnel will be responsible for the complete documentation of sampling, which will be kept in the sample collection field logbook, in ink, for the preservation of all samples and for maintaining chain-of-custody records for all samples until the sample collections are shipped to the laboratory for analysis.

2.2.4 Ground Water Sampling

It is expected that the condition of the ground water wells and the wells ability to yield water may vary from one location to another due to natural variability in the hydraulic properties of the ground water bearing formation at any given location.

It may be necessary, therefore, for the field sampling personnel to modify procedures as sampling progresses so that ground water samples obtained from monitoring wells are representative of water quality in the water bearing formation penetrated by the well. The general procedures to be used are presented in the following sub-sections. Necessary deviations from these procedures will be fully documented in the sample collection field logbook.

2.2.5 Locking Wells

Wells will be unlocked immediately prior to initiating sampling procedures. All wells will be re-secured when sampling is completed. Access to the wells will be controlled by BMRI.

2.2.6 Water Levels and Measurements

The water level of each well will be measured to calculate the volume of the water column and recorded in the field logbook. Measurements will be made to the nearest 0.01-foot. This measurement will be used with well construction logs identifying the total depth of the completed well and casing diameter to calculate the bore volume evacuation necessary to complete a minimum three well bore volumes.

2.2.7 Well Evacuation

Prior to evacuating water from wells not equipped or using low flow, micro-purge pump equipment, the volume of water in each well will be calculated. Ground water from all wells will be evacuated using submersible pumping equipment prior to commencement of sampling. Normally, a ground water well will not be sampled unless all water standing in the well casing has been replaced by fresh ground water, unless low-flow, micro-purge pumping equipment and sampling techniques are being used. In the cases were low-flow, micro-purge pumping equipment and sampling techniques are being used, stabilization of the ground water chemistry will be determined using the protocol discussed in Section 2.2.1. Ground water wells not equipped with low flow, micro-purge pumping equipment, will be pumped for a minimum of three (3) well bore volumes or the well has been pumped dry prior to sample collection. In no case will sampling using any type of pumping equipment take place more than two hours after the third well bore volume has been removed from the well or low flow, micro-purge pumping equipment using in-line flow sensors determined the ground water chemistry has stabilized.

Wells with low recovery rates will be pumped to dryness and allowed to recover prior to sampling. If this happens, it will be noted in the sample collection field logbook that the evacuation of a minimum three well bore volumes criterion or low flow, micro-purge stabilization was not met for this specific well. Sampling will take place within 24 hours after well evacuation. In the event well recovery has not been completed within a 36-hour period, no sample collection will be completed and BMRI will verbally report the field conditions to the CDMG within 24 hours. BMRI will submit a written report to CDMG concerning such circumstances within 5 working days of determining the inability of the ground water well to sufficiently recover.

If a well that is ordinarily dry contains fluid at a scheduled sampling event, a sample of that fluid will be obtained to evaluate the source of the water. In this special case only, if sufficient volume is not evacuated to meet QA/QC protocols, it will be noted on the chain-of-custody form that QA/QC protocols were not met. Then the sample will be obtained for analysis. The chain-of-custody form will note a prioritization of parameters for analysis should there be insufficient sample for all analyses. Cyanide analyses will be conducted first, followed by metals analyses and the rest of the inorganic parameters, as applicable. In addition, the analytical results will be annotated that QA/QC protocols were not met and, therefore, the results are not valid.

2.2.8 Ground Water Sampling Method

Samples will be obtained after the procedures described in Sections 2.2.1, 2.2.6, and 2.2.7 are completed. Samples will be taken using a submersible pump. Non-dedicated pump and sample train equipment will be cleaned in accordance with cleaning procedures outlined in Section 2.2.1. Care will be taken to prevent pump or appurtenant apparatus from coming into contact with contaminated surfaces.

Ground water samples will be collected from the pump discharge directly into a certified collection container after the well has been adequately purged and stabilized. All samples will be collected in certified, environmentally clean sample containers and appropriately preserved as defined in Table 2-5. Samples requiring filtration will be filtered using an in-line 0.45 μm filter.

If the concentration of constituents of the wells is known, wells will be sampled in an ascending order, with the well containing the lowest concentration of constituents being sampled first and proceeding through the remaining wells starting with the next lowest constituent concentration.

Immediately after collection, all samples must be sealed in a plastic bag and then placed in iced coolers.

Guidelines for sample preservation, pre-treatment, and holding times, as outlined in Table 2-5, will be strictly followed.

2.2.9 Field Parameter Measurements

Standard procedures will be followed to maintain consistent measurements of field parameters. These standard procedures are as follows:

1. Instruments will be calibrated at the beginning of each sample day, using a known standard solution. Field instrumentation calibration procedures are documented in Table 2-6.

2. The samples to be measured will be collected in a sample container that has been rinsed at least three times with either laboratory or commercial grade de-ionized water.

3. All field measurements will be made within as brief a period of time as possible, so that temperature or chemical changes will be minimized.

4. Instrument probes will be rinsed with de-ionized water between each sampling station to prevent possible cross-contamination.

Prior to sampling, while the well is being stabilized by either purge volume or micro-purging stabilization (chemical stabilization), water will either be collected in a separate clean vessel to measure the field parameters of pH, specific conductance and temperature or passed through a in-line field sensor to measure the applicable field parameters. The first sample for field parameter measurement shall be collected after approximately three casing volumes have been removed or will be monitored continuously should micro-purging procedures be employed, recording the field parameter measurements on three minute intervals. All instrument probes or in-line sensor equipment that come in contact with the sample water and the measurement vessel shall be cleaned between uses by rinsing with laboratory/commercial de-ionized water. A minimum of three sets of measurements will be made at each sample location to evaluate whether the field parameters have stabilized using micro-purge sampling techniques.

Under normal micro-purge conditions, samples will not be collected until each parameter has stabilized. If, for whatever reason, field water quality parameters have not stabilized at a sampling location after withdrawal of three casing volumes, this information will be noted on the chain-of-custody form and the sample collection will proceed according to the sampling QA/QC protocols. The criteria for micro-purging stabilization are (±) 0.1 pH unit, (±) 10% specific conductance, (±) 10% dissolved oxygen, and (±) 1°C temperature.

Replicate measurements using the standard three bore volume evacuation protocol will be made at a minimum of one time per sample period in the following manner or sampling personnel will use an in-line flow sensor:

1. Collect a sample of water into measurement vessel;
2. Measure field parameters;
3. Rinse instrument probes in de-ionized water; and
4. Re-measure field parameters in same sample collection.

2.2.10 Sample Filtration

Sampling requiring on-site filtration shall be achieved using a disposable in-line filter apparatus, which filters through a 0.45-μm membrane.

Samples will be preserved directly following filtration.

2.3 Field Quality Control

2.3.1 Field Duplicates

Ground water field duplicates will be collected to evaluate the precision of the analytical technique. One field duplicate will be collected for every ten samples collected or once per quarter depending upon the number of ground water sample collections completed during the specific quarter.

Field duplicates shall be obtained by subsequently collecting ample water from the pump discharge to fill the necessary sample containers.

The duplicate sample will be submitted to a second independent U.S. EPA-certified laboratory for Safe Drinking Water Act protocols, and will be analyzed for the same parameters as the original sample. Identification of the duplicate sample will be recorded in the sample collection field logbook for reference when analyses are completed.

2.3.2 Field Blanks

One field blank, consisting of filling laboratory certified containers with laboratory/commercial-grade de-ionized water in the field will be collected for every ten water quality samples obtained, or a minimum of one for every combined surface, ground and operational water sampling series. The de-ionized water will be either obtained from the EPA certified laboratory or purchased commercially by lot, and identified by lot number. The laboratory supplying the water or BMRI will perform an analysis on each lot to demonstrate that the water is essentially analyte free. Constituents analyzed shall include total dissolved solids, manganese, fluoride, sulfate, copper, zinc, and total cyanide.

2.4 Record Keeping

All field data will be recorded in the sample collection field logbook. These data will include:

1. Temperature;
2. Weather conditions;
3. Sample protocol used (purge volume, micro-purge);
4. Volume of evacuated water;
5. Field stabilization measurements;
6. Static water depth prior to sampling;
7. Total well depth;
8. Casing diameter;
9. Well number or location;
10. Number of bottles collected;
11. Sequence samples were collected; and
12. Sampler's name.

A chain-of-custody form will be completed during sample collection, which will be filed with the laboratory indicating the parameters requested, as well as the collection date of the samples.

Prior to off-site shipment, samples will be inspected to ensure that the bottles are tightly capped, appropriately labeled, and sealed in a plastic bag. Sample containers will be placed into the shipping container, surrounded by ice and/or ice packs. Sufficient ice or ice packs will be added to the cooler to maintain a temperature in a range from 1 to 4°C during transit to the laboratory. Shipping containers will be affixed with a security seal.

TABLE 2-1
CURRENT CMLRB
ON-SITE WELL WATER QUALITY PARAMETERS
GROUND WATER ANALYSIS

Major Cations

Calcium
Magnesium
Potassium
Sodium

Major Anions

Alkalinity
Ammonia
Bicarbonate
Carbonate
Chloride
Fluoride
Hydrogen Sulfide
Silica
Sulfate

Metal Ions (Dissolved)

Aluminum
Arsenic
Barium
Boron
Cadmium
Chromium
Copper
Iron
Lead
Manganese
Mercury
Nickel
Selenium
Silver
Zinc

Radio Chemistry

Gross Alpha(1)
Gross Beta

Organic Constituents

Total Organic Carbon

Miscellaneous

Specific Conductance(2)
pH(2)
Temperature(2)
Dissolved Oxygen(2)
Cyanide (Total and WAD)
Total Dissolved Solids
Hardness(3)

(1) Additional analysis of Radium-226, Radium-228 and Uranium, as required.
(2) Field-measured parameter.
(3) Calculated.

TABLE 2-2
CURRENT CMLRB
OFF-SITE WATER DECREE
WATER QUALITY PARAMETERS
GROUND WATER ANALYSIS

Major Ions
Fluoride

Metal Ions (Total)
Aluminum
Arsenic
Barium
Boron
Cadmium
Chromium
Copper
Iron
Lead
Manganese
Mercury
Molybdenum
Nickel
Selenium
Silver
Zinc

Miscellaneous
WAD Cyanide

TABLE 2-3
PROPOSED
WEST PIT AND PERFORMANCE MONITORING PROGRAM
GROUND WATER PARAMETERS

Dissolved Copper

Dissolved Iron

Dissolved Manganese

Dissolved Sulfate

Total Dissolved Solids

pH[(1)]

Specific Conductance[(1)]

Dissolved Oxygen[(2)]

(1) Field-measured parameter.
(2) Field-measured parameter (ground water only)

TABLE 2-4
PROPOSED
ON-SITE WELL WATER QUALITY PARAMETERS
GROUND WATER ANALYSIS

Major Cations
Calcium
Magnesium
Potassium
Sodium

Major Anions
Alkalinity
Chloride
Fluoride
Silica
Sulfate

Metal Ions (Dissolved)
Aluminum
Arsenic
Barium
Cadmium
Chromium
Copper
Iron
Lead
Manganese
Mercury
Nickel
Selenium
Silver
Zinc

Radio Chemistry
Gross Alpha(1)
Gross Beta

Miscellaneous
Specific Conductance(2)
pH(2)
Temperature(2)
Dissolved Oxygen(2)
Total Cyanide
Total Dissolved Solids
Hardness(3)

(1) *Additional analysis of Radium-226, Radium-228 and Uranium, as required.*
(2) Field-measured parameter.
(3) Calculated.

TABLE 2-5
SAMPLE BOTTLE LIST

Parameters	Bottle Type (1)	Filtered		Preservative	Bottle Volume	Holding Time	Comments
		Yes	No				
Metals (total)	P		X	HNO_3	1 liter	180 days (28 days for Hg)	
Metals (dissolved)	P	X		HNO_3	1 liter	180 days	Filter prior to adding preservative, analysis for iron & manganese only.
Metals (radiochem)	P		X	HNO_3	1 gallon	180 days	
Cyanide	P		X	NaOH	1 liter	$14^{(3)}$ days	
General (anions)	P		X	None	1 liter	(2)	
Nitrite+Nitrite/PO_4	P		X	H_2SO_4	1 liter	28 days	
Oil & Grease	G		X	H_2SO_4	1 liter	28 days	
TOC	G		X	H_2SO_4	70 ml	28 days	
Sulfide	G		X	ZnOAc	1 liter	28 days	

(1) G = amber glass, P = plastic (environmentally certified bottles)
(2) 7 days for TDS, 14 days for carbonate/bicarbonate, 28 days for fluoride, chloride, sulfate
(3) Maximum holding time is 24 hours when sulfide is present. Optionally, all samples may be tested with lead acetate paper before the pH adjustment in order to determine if sulfide is present. If sulfide is present, it can be removed be removed by the addition of cadmium nitrate powder until a negative spot test is obtained. The sample is then filtered and NaOH is added to a pH of 12.

TABLE 2-6
CALIBRATION OF FIELD INSTRUMENTATION

Parameter	General	Calibration
Dissolved Oxygen Membrane	Enter the make, model, serial and/or ID number for each meter in the field logbook.	1. Calibrate meter as instructed by the manufacturer per air calibration. 2. Check membrane for air bubbles, wrinkles and holes. Change membrane and KCl, if necessary. 3. Check leads, switch contacts, etc. for corrosion and shorts if meter pointer remains off scale.
PH Electrode Method	Enter the make, model, serial and/or ID number for each meter in the field logbook.	1. Calibrate the system against three standard buffer solutions of known pH value. These solutions should consist of known 4 s.u., 7 s.u. and 10 s.u. 2. Be on the alert for erratic meter response arising from weak batteries, a cracked electrode, etc. 3. Check response and linearity following highly acidic or alkaline samples. Allow time for equilibration. 4. Rinse electrodes thoroughly with de-ionized water between samples and after calibration. 5. Inspect the electrode for coating by oily materials or buildups of solids. Either of these can impair electrode response and should be removed by gentle wiping and detergent polishing.
Conductivity	Enter the make, model, serial and/or ID number for each meter in the field logbook.	1. Check the cell constant periodically per manufacturer's instructions. If the cell indicates low readings, the probable cause is dirty electrodes. If cleaning does not restore probe performance, replatinizing must be done according to manufacturer's instructions. 2. Rinse cell after each sample to prevent carryover. 3. Check the meter using a KCl standard before taking to the field.
Temperature	Enter the make, model, serial number and temperature range for each thermometer.	1. Check general conditions of the thermometer. 2. At least once per year each thermometer shall be checked at two temperatures against an NBS thermometer. Temperature readings shall agree within1°C or the thermometer shall be replaced or recalibrated.

3.0 PROTOCOL FOR SURFACE WATER SAMPLE COLLECTION AND HANDLING

3.1 Water Sample Collection, Handling, and Management

Surface water sample collection, handling and management will be conducted in accordance with the procedures outlined in Section 2.1. Table 3-1 presents the surface water quality parameters currently analyzed at the on-site surface water monitoring locations and Table 3-2 presents the water quality parameters analyzed at the tailing disposal facility (TDF), Table 3-4 presents the surface water quality parameters proposed with monthly analysis of RS-5, and Table 3-3 presents the water quality parameters proposed with quarterly analysis. Drawing 1 shows the monitoring locations.

3.1.1 Receive Sample Containers, Laboratory Water and Coolers from Laboratory

These items, when received, will be checked by the field sampling personnel to verify that they are in compliance with project specifications. Empty sample containers will be received in either coolers or certified shipping containers from either the analytical laboratory or an environmentally certified, sampling container manufacturer or supplier. A chain-of-custody and sample container certification form will be received with the above-mentioned items. The sample containers will be enumerated on the chain-of-custody form. After these items have been inspected and found to be in compliance they will be replaced into either the cooler or certified shipping container, or stored on site in a location designated for container storage.

3.2 Surface Water Sample Collection

This protocol outlines procedures and equipment for the collection of representative surface water samples from the stream monitoring stations.

Field data will be recorded at the time of sample collection in the sample collection field logbook. Immediately after a sample is collected the sample identification will be recorded on the sample container and in the sample collection field logbook. The sample will then be placed in a sealed plastic bag (e.g., Zip-Lock® type), and placed in an iced cooler following collection. If, at any point, there is deviation from sample collection protocols as outlined in the above-referenced sections, these deviations must be noted on the chain-of-custody form and in the sample collection field logbook.

3.2.1 Cleaning of Sampling Equipment

Surface water samples will be collected either directly into an environmentally certified sample collection container or an environmentally certified disposable beaker to prevent possible cross-contamination associated with re-using dedicated sample collection containers. The certified disposable beaker and sample container will be triple rinsed with the surface water being sampled prior to final sample collection. Sample collections requiring filtration will be collected in a properly rinsed certified collection container and then transferred to a disposable filtration apparatus for final filtration. Care must be taken to ensure an adequate volume of surface water is collected to complete the filtration process.

Surface water sample collections requiring dissolved constituent analysis will be filtered with disposable 0.45-micron filtration equipment to prevent possible cross-contamination.

3.2.2 Sample Containers

Certified environmentally clean sample containers will be used in the collection of samples. The analytical laboratory performing the analysis or a manufacturer or supplier of environmentally certified sample containers will supply the certified-sample containers. The type of container used for sample collection will be dictated by the parameter(s) for which the sample is to be analyzed. A listing of the appropriate containers and preservatives for specific parameters is presented in Table 2-5.

3.2.3 *Sample Collection and Handling*

The field sampling personnel will be responsible for the complete documentation of sampling, which will be kept in the sample collection field logbook, in ink, for the preservation of all samples and for maintaining chain-of-custody records for all samples until the sample collections are shipped to the laboratory for analysis.

3.2.4 Surface Water Sampling Method

Samples shall be collected after procedures described in Section 3.2.1 are completed. Samples will be collected directly into the environmentally certified sample container. The container will be rinsed a minimum of three times with the surface water prior to obtaining the sample collection. The sample collection will be taken from the main flow of the stream, and not from side eddies or stagnant water near the banks.

Care will be taken to prevent the sampling apparatus from coming into contact with contaminated surfaces or materials. All surface water samples will be collected in a manner that will minimize agitation during collection.

Immediately after collection, all capped and sealed sample containers will be sealed in a plastic bag, and placed in an iced cooler. The sample bottles required for each surface water quality parameter are listed in Table 2-5. The protocols for sample preservation, pre-treatment and holding times, as outlined in Table 2-5, will be strictly followed.

3.2.5 Field Parameter Measurements

Standard procedures will be followed to maintain consistent measurements of field parameters. These standard procedures are as follow:

1. Instruments will be calibrated at the beginning of each sample day, using a known standard solution. Field instrumentation calibration procedures are documented in Table 2-6.

2. Field parameters for surface water samples will be measured directly in the stream. Instrumentation probes will be submerged in the stream and field measurements will be completed following instrumentation stabilization.

3. All measurements will be made within as brief a period of time as possible, so that temperature or chemical changes will be minimized.

4. Instrument probes will be cleaned with de-ionized water between each sampling station to prevent possible cross-contamination.

Prior to measuring the field parameters of pH, specific conductance and temperature all instrument probes that come in contact with the surface water shall be cleaned between uses by rinsing with laboratory/commercial-grade de-ionized water. One set of measurements will be made at each sample location.

3.2.6 Sample Filtration

Surface water samples requiring on-site filtration shall be filtered using 0.45-μm filter membranes and a disposable filter apparatus.

Samples will be preserved directly following filtration.

3.3 Field Quality Control

3.3.1 Field Duplicates

Surface water field duplicates will be collected to evaluate the precision of the analytical technique. One field duplicate will be collected for every ten samples collected or once per quarter depending upon the number of surface water sample collections completed during the specific quarter.

The duplicate sample will be submitted to a second independent U.S. EPA-certified laboratory for Safe Drinking Water Act protocols, and will be analyzed for the same parameters as the original sample. Identification of the duplicate sample will be recorded in the sample collection field logbook for reference when analyses are completed.

3.3.2 Field Blanks

One field blank, consisting of filling a laboratory certified containers with laboratory/commercial-grade de-ionized water in the field will be collected for every ten water quality samples obtained, or a minimum of one for every combined surface, ground and operational water sampling series completed during a quarter. The de-ionized water will be either obtained from the EPA certified laboratory or purchased commercially by lot, and identified by lot number. The laboratory supplying the water or BMRI will perform an analysis on each lot to demonstrate that the water is essentially analyte free. This analysis shall include analyzing for total dissolved solids, manganese, fluoride, sulfate, copper, zinc, and total cyanide.

3.4 Record Keeping

All field data will be recorded in the sample collection field logbook. These data will include:

1. Temperature;
2. Weather conditions;
3. Field water quality parameter data;
4. Station number or location;
5. Number of bottles collected;
6. Sequence samples were collected; and
7. Sampler's name.

A chain-of-custody form will be completed during sample collection, which will be filed with the laboratory indicating the parameters requested, as well as the collection date of the samples.

Prior to off-site shipment, samples will be inspected to ensure that the bottles are tightly capped, appropriately labeled, and sealed in a plastic bag. Sample containers will be placed into the shipping container, surrounded by ice and/or ice packs. Sufficient ice or ice packs will be added to the cooler to maintain a temperature between 1 and 4°C during transit to the laboratory. Shipping containers will be affixed with a security seal.

TABLE 3-1
CURRENT CMLRB SURFACE WATER QUALITY PARAMETERS

Major Cations
Calcium
Magnesium
Potassium
Sodium

Major Anions
Alkalinity
Ammonia
Bicarbonate
Carbonate
Chloride
Fluoride
Hydrogen Sulfide
Silica
Sulfate

Metal Ions (Total and Dissolved)
Aluminum
Arsenic
Barium
Boron
Cadmium
Chromium
Copper
Iron
Lead
Manganese
Mercury
Nickel
Selenium
Silver
Zinc

Radio Chemistry
Gross Alpha(1)
Gross Beta

Organic Constituents
Total Organic Carbon
Oil and Grease

Miscellaneous
Specific Conductance(2)
pH(2)
Temperature(2)
Dissolved Oxygen(2)
Cyanide (Total and WAD)
Total Dissolved Solids
Total Suspended Solids
Hardness(3)

(1) Additional analysis of Radium-226, Radium-228 and Uranium, as required.
(2) Field-measured parameter.
(3) Calculated.

TABLE 3-2
TAILING DISPOSAL FACILITY MONITORING PARAMETERS

Total/WAD Cyanide
Total Copper
Total Iron
Total Zinc
Sodium
Calcium

TABLE 3-3
PROPOSED QUARTERLY SURFACE WATER QUALITY PARAMETERS

Major Cations

Calcium
Magnesium
Potassium
Sodium

Major Anions

Alkalinity
Ammonia
Bicarbonate
Chloride
Fluoride
Nitrite/Nitrate
Silica
Sulfate

Metal Ions

Aluminum (Potentially Dissolved)
Arsenic (Total)
Cadmium (Potentially Dissolved)
Chromium (Dissolved)
Copper (Potentially Dissolved)
Iron (Total Recoverable and Dissolved)
Lead (Potentially Dissolved)
Manganese (Total Recoverable and Dissolved)
Mercury (Total Recoverable)
Nickel (Dissolved)
Selenium (Dissolved)
Silver (Potentially Dissolved)
Zinc (Potentially Dissolved)

Radio Chemistry

Gross Alpha[(1)]
Gross Beta

Organic Constituents

Oil and Grease

Miscellaneous

Specific Conductance[(2)]
pH[(2)]
Temperature[(2)]
Dissolved Oxygen[(2)]
Total Cyanide
Total Suspended Solids
Hardness[(3)]

(1) Additional analysis of Radium-226, Radium-228 and Uranium, as required.
(2) Field-measured parameter.
(3) Calculated.

TABLE 3-4
PROPOSED MONTHLY SURFACE WATER MONITORING PARAMETERS

Total Cyanide

Iron (Trec[1], Dissolved)

Manganese (Trec, Dissolved)

Total Sulfate

Specific Conductance[2]

pH[1]

Temperature[1]

(1) "Trec" means total recoverable as defined in the CDPHE Regulation 31 "*The Basic Standards and Methodologies for Surface Water*"
(2) Field-measured parameter

4.0 PROTOCOL FOR POROUS CUP LYSIMETER/PIEZOMETER SAMPLE AND PROCESS SAMPLE COLLECTION AND HANDLING

4.1 Water Sample Collection, Handling, and Management

Lysimeter, piezometer, and tailing sample collection, handling, and management will be conducted in accordance with the procedures outlined in Section 2.1. Table 4-1 presents the water quality parameters to be analyzed in the samples obtained from the porous cup lysimeters and piezometers. Drawing 1 shows the monitoring locations.

4.1.1 Receive Sample Containers, Laboratory Water and Coolers from Laboratory

These items, when received, will be checked by the field sampling personnel to verify that they are in compliance with project specifications. Empty sample containers will be received in either coolers or certified shipping containers from either the analytical laboratory or an environmentally certified sampling container manufacturer or supplier. A chain-of-custody and sample container certification form will be received with the above-mentioned items. The sample containers will be enumerated on the chain-of-custody form. After these items have been inspected and found to be in compliance they will be replaced into either the cooler or certified shipping container, or stored in a designated location for identified for sample container storage.

4.2 Lysimeter and Piezometer Water Sample Collection

This protocol outlines procedures and equipment for the collection of representative ground water samples from the lysimeters.

Field data will be recorded at the time of sample collection in the sample collection field logbook. Immediately after a sample is collected, sample identification will be recorded on the sample container, in the sample collection field logbook. The sample container will then be placed in a sealable (e.g., Zip-Lock® type) plastic bag, and then placed in an iced cooler. If, at any point, there is deviation from sample collection protocols as outlined in the above-referenced sections, these deviations must be noted on the chain-of-custody form and in the sample collection field logbook.

4.2.1 Cleaning of Sampling Equipment

As the lysimeters are self-contained, dedicated units specific to the site, no sampling equipment will be required to be cleaned before sampling or between sampling.

Due to the probable small volume of fluid available for equipment cleaning and sample collection, all evacuated water will be collected in environmentally certified disposable beakers. Non-rinsed environmentally certified sample collection bottles will be used due to the probable lack of water available to follow routine rinsing practices.

4.2.2 Sample Containers

Certified environmentally clean sample containers will be used in the collection of samples. Certified sample containers will be supplied by the analytical laboratory performing the analysis or by a manufacturer/supplier of environmentally certified sample containers. Various size containers, ranging from 100 mL to 1 liter will be provided to account for various sizes of samples that will be collected. The type of container used for sample collection will be dictated by the parameter(s) for which the sample is to be analyzed. A listing of the appropriate containers and preservatives for specific parameters is presented in Table 2-5.

4.2.3 Sample Collection and Handling

The field sampling personnel will be responsible for the complete documentation of sampling, which will be kept in the sample collection field logbook, in ink, for the preservation of all samples and for maintaining chain-of-custody records for all samples until the sample collections are shipped to the laboratory for analysis.

4.2.4 Lysimeter Water Sampling Method

Each lysimeter was assembled in accordance with the manufacturer's instructions, using two continuous lengths of polyurethane tubing to serve as the vacuum and sampling tubes. For ease of identification during lysimeter sampling, black tubes were used for the vacuum line and green tubes were used for the sample line.

Water is drawn into the porous sampling cup by placing a vacuum on the lysimeter. Clamping off the green sampling tube and pumping the black vacuum line creates the vacuum that draws water into the porous sampling cup. The lysimeters should be kept under a vacuum throughout the interval between sampling. Lysimeters will be checked monthly to see if the vacuum is still holding and are evacuated on a quarterly basis. During the monthly inspection if the vacuum is not holding, the vacuum pump will be used to re-evacuate the porous cup and re-establish a vacuum.

Pressurizing the black vacuum line with a hand pump forces any fluid in the porous cup out through the green vacuum line. The discharge from the green sampling tube may be collected directly into the appropriate bottles supplied by the laboratory. Determination of whether sufficient volume has been collected for analysis, including performing all required laboratory QA/QC protocols, will be on the basis of the protocol outlined in Section 6.1.

4.2.5 Tailing and Collection Pond Sampling Method

Samples will be collected from the tailing impoundment area (supernatant pond) and the under drain collection pond feeder ditch using environmentally certified disposable beakers. Grab samples will be obtained from the impoundment area and the collection pond feeder ditch using a clean beaker. For the collection feeder ditch, the sample will be taken from the main flow of the ditch.

Temperature and pH measurements will be made in the field for each of these process samples, in accordance with Section 3.2.5.

Immediately after collection, all samples must be sealed in a plastic bag and placed in an iced cooler. The sample bottles required for each sample site are listed in Table 2-5 (metals, cyanide, etc.). Procedures for sample preservation, pre-treatment and holding times as outlined in Table 2-5 will be strictly followed.

Process point and porous cup lysimeter sample collections will be conducted on separate days from ambient surface water and ground water sample collections to prevent possible sample cross-contamination. These process point, piezometer and porous cup lysimeter sample collections shall be stored separately from ambient surface and ground water samples and transported to the analytical laboratory in a separate shipping container or cooler.

4.2.6 Piezometer Sampling Method

Piezometer monitoring locations will be inspected monthly to determined if or what quantity of water is present in each piezometer. If sampling personnel determine that the well casing contains 12 inches or more of standing water, sampling personnel will attempt to collect the sample using either low-flow micro-purge sampling equipment or dedicated bailers. Sampling personnel will collect all fluids evacuated from the piezometer installation and depending upon the volume collected will follow the protocols described in Section 6.1 (Sample Availability).

Immediately after collection, all samples must be sealed in a plastic bag and placed in an iced cooler. The sample bottles required for each sample site are listed in Table 2-5 (metals, cyanide, etc.). Procedures for sample preservation, pre-treatment and holding times as outlined in Table 2-5 will be strictly followed.

4.2.7 Sample Filtration

Process point or porous cup lysimeter sample collections requiring on-site filtration will be processed using a 0.45-μm filter membrane and a disposable filter apparatus.

Samples will be preserved directly following filtration.

4.3 Record Keeping

All field data will be recorded in the sample collection field logbook. These data will include:

1. Temperature;
2. Weather conditions;
3. Volume of water removed from the lysimeter;
4. Lysimeter designation or location;
5. Number of bottles collected;
6. Sequence samples were collected;
7. Sampler's name; and
8. Condition of the lysimeter.

A chain-of-custody form will be completed during sample collection, which will be filed with the laboratory indicating the parameters requested, as well as the collection date of the samples.

Prior to off-site shipment, samples will be inspected as to whether they are tightly capped, labeled and sealed in a plastic bag. Sample containers will be placed into the shipping container, surrounded by ice and/or ice packs. Sufficient ice or ice packs will be added to the cooler to maintain a temperature between 1 and 4°C during transit to the laboratory. Shipping containers will be affixed with a security seal.

TABLE 4-1
LYSIMETER WATER QUALITY PARAMETERS[1]

Total Cyanide

Fluoride

Arsenic[2]

Barium

Cadmium

Chromium

Copper

Iron

Lead

Manganese

Mercury

Molybdenum

Selenium

Silver

Zinc

(1) Analysis will depend upon the volume of fluid recovered, with cyanide analysis receiving top priority.
(2) Metals are analyzed for dissolved concentrations.

5.0 PROTOCOLS FOR ANALYSIS OF SURFACE WATER AND GROUND WATER SAMPLES

5.1 Sample Handling and Management

Protocols for the handling and management of surface water and ground water samples are described in Section 2.1 of this document.

Specifically, Sections 2.1.11 through 2.1.15 describes the actions to be taken by the analytical laboratory and Site Environmental Coordinator with respect to:

1. Laboratory review of sample integrity and documentation (Section 2.1.11);
2. Laboratory quality control check (Section 2.1.12);
3. Analysis of samples (Section 2.1.13);
4. Verification of analysis performed as requested (Section 2.1.14); and
5. Quality control checks of analytical results (Section 2.1.15).

5.2 Analytical Protocols

The water quality parameters to be analyzed are given in Tables 2-1 through 2-4, 3-1 through 3-4, and 4-1.

The analytical protocols to be used for analysis of surface water and ground water samples are those described in USEPA EPA-600/4-79-020, Revised 1983: (Methods for Chemical Analysis of Water and Wastes). The specific method for WAD cyanide is described in USEPA 821/R-99-013.

5.3 Quality Control

The detail of the quality control procedures to be used by the analytical laboratory are contained in the laboratory's Standard Operating Procedures (SOP), the relevant parts of which can found in Appendix A. These quality control procedures are based on, and developed from, the principles described in USEPA/OSWER SW-846 (1986, 3rd Edition).

The SOP includes descriptions of protocols for the analysis of reference standards, matrix spiking and recovery analysis, analysis of duplicate samples, and analysis of field and rinsate blanks, together with methods for the assessment of the data so generated.

5.4 Analytical Accuracy and Verification

Analytical accuracy, precision, reproducibility and sensitivity will be consistent with the data reported in USEPA EPA-600/4-79-020 or, where these data are unavailable for individual analytical protocols, consistent with data reported in APHA/AWWA "Standard Methods for the Examination of Water and Wastewater," 17th Edition, 1989 ('Standard Methods"). In the absence of data from either of these sources, the analytical laboratory will seek to estimate any or all of these parameters, where appropriate. Detection limits will be consistent with data available in EPA 600/4-79-020 or "Standard Methods."

The data for any monitoring parameter will be subjected to verification procedures where this is considered necessary by the analytical laboratory or the Site Environmental Coordinator. Verification procedures are included in relevant sections of the analytical laboratory SOP (Appendix A).

5.5 Reporting

The analytical laboratory will produce a report that comprises:

1. A statement of the laboratory test results, and

2. A quality assurance report.

The report shall identify the analytical laboratory, the laboratory job number, the client, and the date of the report. Certification is provided by the report being signed and dated by an authorized representative of the analytical laboratory together with their title. If any of the analytical results fail to confirm with the approved permit standards, BMRI will, within 5 working days of receipt of the analytical data, notify the Division.

5.5.1 Analytical Results Report

The analytical test results will be given on the laboratory report that contain the following information:

1. The date of the report and the laboratory performing the analysis;

2. The client identification number, the name of the client and the laboratory identification number;

3. The date and time the samples were collected, the date and time the samples were received, and the date of analysis;

4. A description of the test performed, the final result, the detection limits, and the dilution used (where appropriate), the units of measurement, and the test method employed.

5.5.2 Quality Assurance Report

The quality assurance report will include, at a minimum, the following data:

1. A listing of the analytical methods used and their designations and/or references, as appropriate;
2. The results of the matrix spiking analysis and calculated percentage recoveries;
3. The results of the reference standards analysis and calculated relative percentage differences or actual differences;
4. The results of the duplicate analysis and calculated relative percentage differences or actual differences;
5. The field blank and rinse blank analysis; and
6. Copies of the chain-of-custody forms and any field notes or other documentation provided with the samples.

6.0 PROTOCOLS FOR ANALYSIS OF POROUS CUP LYSIMETER, PIEZOMETER AND PROCESS SAMPLES

6.1 Sample Availability

The nature and operation of the porous cup lysimeters and piezometers dictates three conditions that apply to samples collected for analysis:

1. There is insufficient sample to perform any analysis: (i.e. less than the minimum sample volume of 100 mL required to perform and quantify appropriately QA/QC compatible total cyanide analysis, assuming the autoanalyzer method is used – See Section 6.3);

2. There is insufficient volume to perform other analysis apart from total cyanide analysis; and

3. There is sufficient sample to perform the full analysis of the parameters listed in Table 4-1, including all QA/QC requirements.

In the case of Condition 1, insufficient sample for total cyanide analysis, no analysis will be performed. A report will be issued stating that there was insufficient sample for total cyanide analysis and quantification, including QA/QC requirements.

Where there is sufficient sample for the total cyanide analysis alone, Condition 2, this analysis will be completed according to the procedures described in Section 6.3 and a report on the data, including the QA/QC report, will be issued.

In the case of Condition 3, where there is sufficient sample for analysis of all parameters listed in Table 4-1, the procedures will be the same as those for surface water and ground water samples, given in Sections 5.1 through 5.5. This will apply to all process samples also.

6.2 Sample Handling and Management

Should there be sufficient water in the porous cup lysimeter or piezometer to allow an acceptable sample collection (See Section 6.1), the protocols for the handling and management of porous cup lysimeter, piezometer and process samples are referenced in Section 4.1 and are described in Section 2.1 of this document.

Specifically, Sections 2.1.11 through 2.1.15 describes the actions to be taken by the analytical laboratory and site Environmental Coordinator II with respect to:

1. Laboratory review of sample integrity and documentation (Section 2.1.11);

2. Laboratory quality control check (Section 2.1.12);

3. Analysis of samples (Section 2.1.13);

4. Verification of analysis performed as requested (Section 2.1.14); and

5. Quality control checks of analytical results (Section 2.1.15).

6.3 Analytical Protocols

6.3.1 Full Analysis

If there is sufficient sample for the analysis of all parameters listed in Table 4-1, the analytical protocols to be used for the porous cup lysimeter and piezometer samples will be the same as those given in Section 5.2.

Process samples will be analyzed by the same methods for total cyanide as described in Section 6.3.2. WAD cyanide analyses in the process samples will follow similar protocols as the total cyanide analysis using USEPA Method OIA-1677. Methods for the analysis of copper, zinc, iron, calcium and sodium are the same as those given in Section 5.2.

6.3.2 Total Cyanide Analysis Only

If there is sufficient sample for cyanide analysis only, total cyanide will be determined based on using either of the approved USEPA methods: Method 335.2, the titrimetric, spectrophotometric method or Method 335.4, the semi-automated colorimetry method.

The analytical laboratory will implement appropriate analysis of standards, calibration procedures and other QA/QC issues consistent with USEPA total cyanide Method 335.2 and Method 335.4.

Specifically, all calibration samples will be processed through the entire analytical procedure to compensate for sample matrix effects and the potential presence of reduced sulfur species in the porous cup lysimeter samples. This is effectively a method of standard additions to the sample matrix for calibration through the entire analytical procedure.

6.4 Quality Control

6.4.1 Full Analysis

Where there is sufficient sample for the analysis of all the parameters listed in Table 4-1, then the quality control procedures given in Section 5.3 for the surface water and ground water samples will apply. Quality control procedures for copper, zinc, iron, calcium and sodium are the same as those given in Section 5.3.

6.4.2 Total and WAD Cyanide Analysis Only

The quality control protocols for total cyanide analysis will be consistent with those described in Section 5.3, subject to modification for the specific analytical procedure, as described in USEPA Method 335.2 or USEPA Method 335.4. WAD cyanide analyses in the process samples will follow similar protocols as the total cyanide analysis using USEPA Method OIA-1677.

6.5 Analytical Accuracy and Verification

6.5.1 Full Analysis

Analytical accuracy and verification protocols will be the same as described in Section 5.4 if there is sufficient sample for analysis of all parameters listed in Table 4-1. Analytical accuracy and verification procedures for copper, zinc, iron, calcium and sodium analyses are the same as those given in Section 5.4.

Total and WAD cyanide analyses on the process samples will be consistent with the protocols and data described in Section 6.5.2.

6.5.2 Total Cyanide Analysis Only

The analytical accuracy and verification requirements will be similar to and consistent with Section 5.4.

The reported analytical sensitivity for total cyanide by Methods 335.2 and 335.4 is 0.02 mg/L.

6.6 Reporting

Unless there is insufficient sample for any water quality analysis to be performed (as in Condition 1, Section 6.1), then the analytical laboratory will produce a report that comprises:

1. A statement of the laboratory test results, and
2. A quality assurance report.

The preface to the laboratory report shall identify the analytical laboratory, the laboratory job number, the client, and the date of the report. Certification will be provided by the report being signed and dated by an authorized representative of the analytical laboratory together with their title. If any of the analytical results fail to confirm with the approved permit standards, BMRI will, within 5 working days of receipt of the analytical data, notify the Division.

6.6.2 Analytical Results Report

The analytical test results will be given on the laboratory report form that contains the following information:

1. The date of the report and the laboratory performing the analysis;
2. The client identification number, the name of the client and the laboratory identification number;
3. The date and time the samples were collected, the date and time the samples were received, and the date of analysis; and
4. A description of the test performed, the final result, the detection limits, and the dilution used (where appropriate), the units of measurement, and the test method employed.

6.6.3 Quality Assurance Report

The quality assurance report will include, at a minimum, the following data:

1. A listing of the analytical methods used and their designations and/or references, as appropriate;
2. The results of the matrix spiking analysis and calculated percentage recoveries;
3. The results of the reference standards analysis and calculated relative percentage differences or actual differences;
4. The results of the duplicate analysis and calculated relative percentage differences or actual differences;
5. The field blank and rinse blank analysis;
6. Copies of the chain-of-custody forms and any field notes or other documentation provided with the samples; and
7. Laboratory certification and CDMG notification.

Should BMRI elect to change the commercial analytical laboratories, BMRI shall provide CDMG with written notice of such determination 30-days prior to commencing analytical testing at the new laboratory. BMRI shall include with this notification, the date which BMRI plans to initiate analytical testing with the new laboratory, a copy of the laboratory's SOP and a copy of the laboratory's EPA certification. Should CDMG determine the laboratory's SOP or certification does not fully comply with the conditions of this QA/QC Plan, CDMG will notify BMRI of such a determination within 10-days prior to the scheduled initiation date provided in the BMRI notice.

Permit #: M-1988-112 Confidental?: N
Class: REVISION Type-Seq.: TR-32
From: BATTLE MTN RESOURCES To: DMG
Doc. Name: PART TWO OF TR-32
Doc. Date (if no date stamp): 4-3-03

APPENDIX A

Analytical Laboratory Standard Operating Procedures

2002

SVL ANALYTICAL, INC.

Quality Assurance Plan

One Government Gulch • P.O. Box 929
Kellogg, ID 83837
Phone (800) 597-7144 Facsimile (208) 783-0891
http://www.svl.net

Laboratory Director's Signature

Date

Table of Contents

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1. INTRODUCTION

Quality assurance and quality control measures are integral parts of the established quality system at SVL Analytical, Inc.

This manual describes the quality assurance program (QAP) at SVL Analytical, Inc. (SVL). This program has the unqualified support of SVL management as well as the agreement, acceptance and adherence of the laboratory staff.

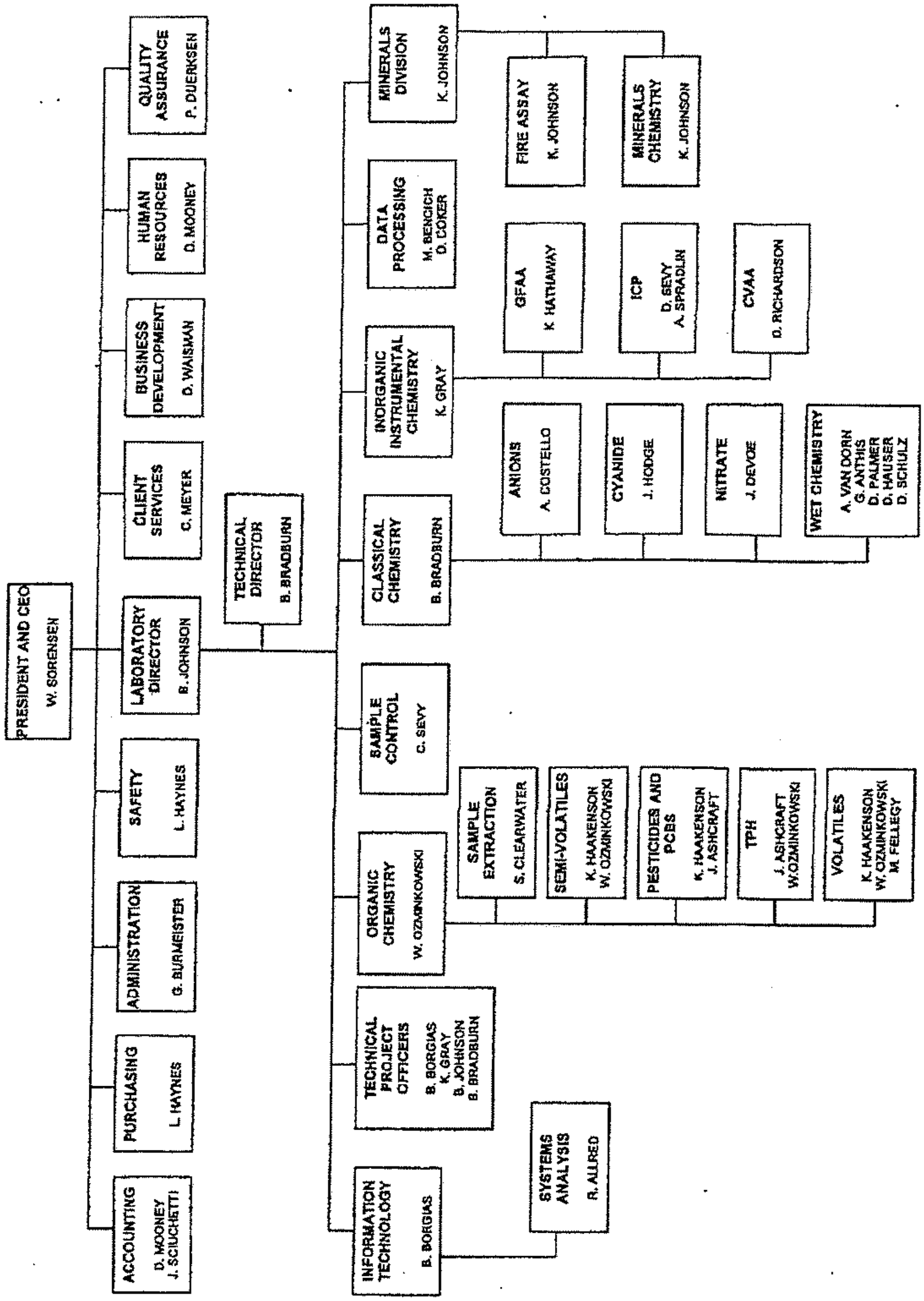
SVL is an analytical laboratory specializing in the performance of tests and parameters used in the characterization of environmental and mining samples. Since 1972, SVL has analyzed water, soil, sediment, sludge, oil, paint, rock, fish and other animal tissues, vegetation, air filters, and other sample types.

SVL occupies modern facilities specifically designed and organized to ensure an efficient mode of operation. The 25,000 square foot laboratory building has been modified to the specific needs of our large capacity analytical laboratory. Building access, security and safety features have been carefully considered. Access through the outside laboratory entrance and to internal areas is limited to laboratory and other essential personnel. Each laboratory division is plumbed and wired separately with easily accessible shut-off stations.

1.1 Organizational Chart

The organizational structure of SVL follows a traditional scheme of management with a few modifications. The President and CEO is at the top of the chain of command followed by the Laboratory Director. The Safety, Quality Assurance, Client Services, and Business Development divisions report directly to the CEO; all other lab employees report to the Laboratory Director. A complete organizational chart for SVL Analytical, Inc. is contained on the following page.

ORGANIZATIONAL CHART



1.2 Personnel

Position	Employee	Degree	Lab Experience
President	Wayne Sorensen	BS 1962	36
Laboratory Director	J. Blake Johnson	Ph.D. 1971	18
Technical Director	Bruce Bradburn	MS 1990	11
Supervisor Inorganic Instrumental Chemistry	Kirby Gray	BS 1972	18
Supervisor Organic Chemistry	Wendy Ozminkowski	BS 1997	4
Inorganic Instrument Operator (IC)	Ann Costello	BS 1971	16
ICP Spectroscopist	Anne L. Spradlin	BA 1983	17
Inorganic Instrument Operator (ICP)	Danny Sevy		15
Inorganic Instrument Operator (GFAA)	Kevin Hathaway		15
Classical Chemistry Department Analyst	James L. Hodge		30
Classical Chemistry Department Analyst	Alice Van Dorn		11
Classical Chemistry Department Analyst	Janice DeVoe	BS 1977	20
Classical Chemistry Department Analyst	Dean Palmer	BS 1979	5
Classical Chemistry Department Analyst	Gordon Anthis		13
Classical Chemistry Department Analyst	Debbie Schulz		1
Classical Chemistry Department Analyst	Kay Johnson		13
Classical Chemistry Department Chemist	David Hauser	BS 1996	1
Organic Chemistry Department Chemist	Kristine Haakenson	BS 1991	10
Organic Chemistry Department Chemist	Stephanie Clearwater	BS 2000	1
Organic Chemistry Department Analyst	Mark Fellegy		13
Organic Chemistry Department Analyst	Judy Ashcraft		33
Quality Assurance Coordinator	Paul Duerksen	BS 1977	21
Safety Director	Lee Haynes		12
Document Control Manager	Melba Bencich		14
Client Services Manager	G. Christine Meyer		
Business Development Manager	Dave Waisman	MS 1985	
Information Technology Manager	Brandan Borgias	Ph.D. 1985	22
Systems Analyst	Russell Allred		19
Accounts Receivable	Donella Mooney		
Accounts Payable	Joyce Sciuchetti		
Sample Receiving	Crystal Sevy		1
Document Processing and Reporting	Dee Coker		

1.3 Resumes

WAYNE R. SORENSEN

PROFESSIONAL EXPERIENCE:

1973 - PRESENT **SVL Analytical, Inc. - Kellogg, ID**

President: Owner and founder of the laboratory. Administers company policies and formulates business strategies.

OCT 1969 - APR 1973 **The Bunker Hill Company - Kellogg, ID**

Supervised a large integrated mine, mill and smelter analytical laboratory and trained personnel.

MAR 1968 - OCT 1969 **Kennecott Copper, Ray Mines Division**

Chief Chemist: Supervised an assay lab, trained assayers for new analytical methods and conducted applied research.

MAY 1965 - MAR 1968 **Kennecott Copper, Western Mining Division Research Center**

Analytical Chemist: Analytical methods development and applied metallurgical research on copper.

EDUCATION:

1958-1962 **Utah State University - Logan, UT**

B.S. Chemistry (minor: mathematics, physics)

1965 **Salt Lake Trade Tech - Salt Lake City, UT**

Basic Industrial Statistics

1966 - 1967 **University of Utah - Salt Lake City, UT**

MBA program

1968 **Arizona State University - Tempe, AZ**

Modern Industrial Spectroscopy

1969 **Arizona State University - Tempe, AZ**

Creative Management

WAYNE R. SORENSON (continued)

PUBLICATIONS:

"A Study of Variables Affecting the Quality of Electrowon Copper" paper presented at the 1968 meeting of the Electrolytic Process Committee and the 1969 National AIME Conference.

PATENTS:

Electrolyte circulation system for an electrolytic cell.

J. BLAKE JOHNSON

PROFESSIONAL EXPERIENCE:

JAN 1990 - PRESENT **SVL Analytical, Inc. Kellogg, ID**

Laboratory Director – Manages and directs the activities of the laboratory.

AUG 1989 - JAN 1990 **Consultant - Spokane, WA**

JUL 1979 - AUG 1989 **Baroid Corporation - Houston, TX**

Director of Exploration and Property Management – Managed and directed all geological investigations, worldwide, and managed all domestic production properties.

DEC 1978 - JUL 1979 **Baroid Corporation - Houston, TX**

Assistant Director of Exploration.

MAR 1973 - DEC 1978 **NL Industries - Golden, CO**

Chief Geochemist – Planned and implemented all geochemical investigations, worldwide.

FEB 1972 - MAR 1973 **Geosensors - Spokane, WA**

Geochemist – Investigated the relationships between airborne radiometric data and uranium deposits and petroleum reservoirs.

JUN 1969 - FEB 1972 **Vanguard Exploration - Spokane, WA**

Geochemist – Performed laboratory and field investigations as applied to mineral exploration.

EDUCATION:

1967-1969 **University of Idaho - Moscow, ID**

Ph.D. Geology (minor in Chemistry)

1963-1967 **Whitworth College - Spokane, WA**

B.S. Geology (minor in Chemistry)

PUBLICATIONS:

"Geochemistry of Belt Supergroup Rocks, Coeur d'Alene District, Shoshone County, Idaho"; unpublished Ph.D. dissertation, University of Idaho, April 1971.

"Studies on the Molecular Weight of Petroleum Asphaltenes Via the Vapor Pressure Osmometer"; paper presented of the Northwest Regional Meeting of the American Chemical Society, at Richland, Washington, June 1967.

G. CHRISTINE MEYER

PROFESSIONAL EXPERIENCE:

1993 - PRESENT **SVL Analytical - Kellogg, ID**

Client Services Manager -- Secures commercial contracts; confers with technical staff and assigns project management for contracts. Primary in-house service representative, responsible for developing and distributing company literature to existing and potential clients.

JUN 1978 - 1993 **SVL Analytical - Kellogg, ID**

Project Manager, Minerals Division -- Secured contracts with clients; supervised data generation and reporting to ensure quality control, expedited deliverables, and maintained customer service. Monitored all phases of Minerals Division projects.

1977 - 1978 **Gary's Drug Center - Kellogg, ID**

Pharmaceutical Aide -- Assisted in dispensing prescriptions.

1975 - 1977 **Shoshone School District #391 - Kellogg, ID**

Substitute Teacher -- Classroom instruction.

1975 **Idaho State Department of Lands - Kingston, ID**

Office Manager -- Responsible for fire dispatch, clerical duties, payroll, and customer service.

EDUCATION:

1973 - 1974 **North Idaho College - Coeur d'Alene, Idaho**

Social services studies

1989 **Customer service training seminar**

1990 **MS-DOS Computer class**

PRESENTATIONS:

"Everything You Always Wanted to Know About Fire Assaying, But Were Afraid to Ask", Geological Society Meeting, 1992.

BRANDAN A. BORGIAS

PROFESSIONAL EXPERIENCE:

1991 - PRESENT **SVL Analytical, Inc. - Kellogg, ID**

Systems Manager, Computational Chemist – Responsibilities include developing and implementing SVL's Laboratory Information Management System (LIMS).

JUN 1989 - MAR 1990 **Cray Research - San Ramon, CA**

Software Technical Support Analyst – Co-administrator of network composed of eight file servers and over 50 client work stations distributed throughout the western U.S. Unix (Sun OS and Cray UNICOS) operating systems experience.

1985 - 1989 **University of California, UCSF - San Francisco, CA**

Postdoctoral Scholar – Developed computer programs (FORTRAN) for the refinement and analysis of macromolecular structure. VAX, Sun, and Cray computers and VMS and UNIX operating systems.

1979 - 1985 **University of California, Berkeley - Berkeley, CA**

Graduate Research and Teaching Assistant – Dissertation on coordination isomers of highly efficient chelating agents for Fe. Teaching Assistant for X-ray Crystallography, and General, Analytical, and Biophysical Chemistry.

EDUCATION:

1979 - 1985 **University of California, Berkeley - Berkeley, CA**

Ph.D. Chemistry, 12/85 - Elected to Sigma Xi.

1975 - 1979 **Reed College - Portland, OR**

BA Chemistry/Physics, 5/79 - Elected to Phi Beta Kappa, 1979.

COMPUTER/PROFESSIONAL TRAINING

AUG 1996 **Competitive Edge Environmental Management Systems**

Introduction to ISO14000

APR 1995 **North Idaho College**

Intermediate Access

BRANDAN A. BORGIAS (continued)

FEB 1993 **Clarion Software**

Upgrading to Clarion Professional Developer 3.0.

MAR 1992 **ACS Short Course**

Laboratory Information Management Systems: From Problem Definition to System Evaluation.

AUG 1989 - DEC 1989 **Cray Research**

Cray Y-MP Series System Architecture for Systems Analysts. Designing For Speed. Advanced Fortran Features and Optimization.

SUMMER 1988 **National Center for Supercomputing Applications (NCSA)**

NSF Summer Institute in Supercomputing.

SPRING 1988 **Pittsburgh Supercomputing Center**

NIH Biomedical Super-computing Workshop.

FALL 1979 **Reed College**

Fortran Programming.

PUBLICATIONS:

The Characterization & Structure of $[H_7O_3]^+[As(catecholate)_3]^-$ p-dioxane, B.A. Borgias, G.G. Hardin and K.N. Raymond, Inorg. Chem., (1986) **24**, 1057-1060.

Structural Chemistry of Gallium(III). Crystal Structures of $K_3[Ga(catecholate)_3]\cdot 1.5H_2O$ and $[Ga(benzohydroxamate)_3]\cdot H2O\cdot CH_3CH_2OH$, B.A. Borgias, S.J. Barclay and K.N. Raymond, J. Coord. Chem. (1986) **15**, 109-123.

Isomerization and Solution Structures of Desferrioxamine B Complexes of Al and Ga, B.A. Borgias, A.D. Hugi and K.N. Raymond, Inorg. Chem, (1989), **28**, 3538-3545.

COMATOSE: A Method For Constrained Refinement of Macromolecular Structure Based on Two- Dimensional Nuclear Overhauser Effect Spectra, B.A. Borgias and T.L. James, J. Magn. Reson. (1988) **79**, 493-512.

2D NOE Complete Relaxation Matrix Analysis, B.A. Borgias and T.L. James, in NMR in Enzymology, **176** in Methods in Enzymology (N.J. Oppenheimer and T.L. James, eds.) Academic Press, Orlando, 169-183 (1989).

MARDIGRAS: Matrix Analysis of Relaxation for DIscerning GeometRy of an Aqueous Structure, B.A. Borgias and T.L. James, J. Magn. Reson. (1990) **87**, 475-487.

DAVE WAISMAN

PROFESSIONAL EXPERIENCE:

APR 1993 - PRESENT **SVL Analytical, Inc. - Kellogg, ID**

Business Development Manager

MAR 1988 - APR 1993 **Hecla Mining Company - Republic, WA**

Senior Exploration Geologist – Managed Exploration Office. Responsible for project cost tracking, drilling performance tracking, supervision of abandonment and reclamation of drill sites, design, budget and management of exploration efforts.

APR 1987 - NOV 1987 **Golder Associates, Inc. - Seattle, WA**

Geologist, Geotechnical Engineer – Well-site geologist for water monitoring wells at Hanford Nuclear Reservation. Well construction and QA review for Test and Operating Procedures for Basalt Waste Isolation Project.

MAY 1985 - JAN 1987 **Consulting Geologist - Missoula, MT**

Geological consulting in SW Montana for two major mining companies. Responsibilities included property evaluations, mapping and sampling. Experienced in reverse circulation and diamond drilling, and trace element geochemistry.

JUN 1984 - JAN 1985 **Meridian Minerals Co. - Billings, MT**

Geologist – Conducted precious metals reconnaissance in Belt and volcanic rocks of SW Montana, property submittal evaluations, trace element geochemistry.

EDUCATION:

1982 - 1985 **University of Montana, Missoula MT**

MS Geology 1985

1975 - 1979 **Colorado State University, Fort Collins**

BS Geology 1979

PUBLICATIONS:

Waisman, D.J., 1990, "Hecla's Golden Eagle Deposit, Republic Mining District", presented at the 96th Annual Northwest Mining Association Convention, 1990.

Waisman, D.J., 1992, "Minerals of the Black Pine Mine, Granite County, Montana", The Mineralogical Record, December 1992 (Vol. 23, No. 6, pp, 477-483).

M. LEE HAYNES

PROFESSIONAL EXPERIENCE:

NOV 1989 - PRESENT **SVL Analytical, Inc. - Kellogg, ID**

Safety Director -- Responsible for corporate health and safety policy, implementation of *Chemical Hygiene Plan, waste disposal, and recycling.*

1992 - PRESENT **SVL Analytical, Inc. - Kellogg, ID**

Purchasing Officer -- Responsible for purchasing, receiving, and verifying orders with vendors.

JAN 1991 - PRESENT **Private Instructor**

Hazardous Materials, Hazardous Waste, and Emergency Response -- Edwards & Associates

SEP 1978 - OCT 1989 **Shoshone County Assessor's Office - Wallace, ID**

Senior Appraiser, Director of Disaster Services

EDUCATION:

MAR 1997, 1998-99 **OSHA**

40 Hour Hazardous Waste Operation & Emergency Response Course and Refreshers

1996 **UPS**

HM126F - Shipping Hazardous Materials

1996 AND 1995 **J.T. Baker**

Laboratory Safety/Hazardous Chemicals Safety/Spill Response/Hazardous Chemicals

1989 **Emergency Management Institute**

Basic Course 3 and 4/Hazmat-Advanced course/PDS Capstone on National Security

1988 **Shoshone County Hospital**

Emergency Medical Technician

1988 **Emergency Management Institute**

Management Principles/Exercise Design

M. LEE HAYNES, cont.

1977 **Dale Carnegie Course**

Graduated 1977

1970 **Burroughs Computer School - Chicago, IL**

Diploma

1967 **Officers Candidate School - U.S. Army**

Commissioned - 2nd Lieutenant

KIRBY L. GRAY

PROFESSIONAL EXPERIENCE:

MAR 1987 - PRESENT **SVL Analytical, Inc. - Kellogg, ID**

Inorganic Instrumental Chemistry Department Supervisor -- Responsible for sample analysis by ICP, GFAA, FLAA, IC and CVAA.

SEP 1986 - MAR 1987 **Radersburg Mining Co. - Toston, MT**

Chemist: -- Responsible for fire assay, FLAA, and sample preparation.

MAY 1984 - MAY 1986 **Sunshine Mining Co. - Kellogg, ID**

Chemist -- Responsible for fire assay, FLAA, and classical chemistry.

AUG 1983 - AUG 1983 **IDHW, State of Idaho - Kellogg, ID**

Environmental Technician: --Operated X-ray fluorescence meter and collected soil samples.

MAY 1972 - MAY 1982 **The Bunker Hill Co. - Kellogg, ID**

Material Recovery Supervisor -- Responsible for operation and maintenance of water treatment plant, sulfuric acid plant, baghouse, cadmium refinery, and electric reverbatory furnace at a lead smelter.

EDUCATION:

SEP 1968 - MAY 1972 **University of Idaho - Moscow, ID**

B.S. Geological Engineering

SEP 1966 - JUN 1968 **North Idaho College-Coeur d'Alene, ID**

Engineering major

BRUCE BRADBURN

PROFESSIONAL EXPERIENCE

APR 2001 - PRESENT **SVL Analytical, Inc. - Kellogg, ID**

Technical Director and Classical Chemistry Department Supervisor – Supervises inorganic analyst staff; responsible for ion chromatography, alkalinity, residues, turbidity, COD, fluoride, nitrate, nitrite, TKN, ammonia, cyanide, sulfur, sulfide, TCLP, SPLP, pH, flashpoint.

OCT 1997 – APR 2001 **Spokane Tribe of Indians – Spokane, WA**

Laboratory Manager – Supervised and trained staff; developed analytical methods; acquired EPA and WDOE certifications; wrote quality assurance plan; maintained laboratory instruments; reviewed data; analyzed samples by ICP-AES, CVAA, FAA, GFAA.

JUL 1995- NOV 1997 **SVL Analytical, Inc. – Kellogg, ID**

Inorganic Chemist – Analyzed samples by ICP; GFAA, and FAA; developed computer programs for laboratory instrumentation

APR 1994- JUL 1995 **American Analytical Laboratories, Inc. – Seattle, WA**

Laboratory Manager – Supervised staff chemists; developed analytical methods; maintained laboratory instrumentation; analyzed samples for pesticides and PCBs; conducted ICP-AES, GC, FAA, and IC analyses.

MAR 1991 – NOV 1993 **Northwest Laboratories of Seattle – Seattle, WA**

Chemist – Analyzed and certified raw materials; conducted ICP, GC, and FTIR analyses.

EDUCATION:

JULY 1996 **Jobin-Yvon Emission**

ICP Applications

1987 - 1990 **University of New Mexico – Albuquerque, NM**

M.S. Chemistry

1982 - 1987 **Western Washington University – Bellingham, WA**

B.S. Chemistry

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PAUL E. DUERKSEN

PROFESSIONAL EXPERIENCE:

DEC 1999 - PRESENT **SVL Analytical, Inc. - Kellogg, ID**

Quality Assurance Coordinator -- Coordinates quality assurance and training programs for the laboratory, maintains laboratory accreditations, writes standard operating procedures, calibrates equipment, reviews data, conducts audits, performs root cause analysis.

MAY 1998 - DEC 1999 **Private Consultant - Silverdale, WA**

Provided instruction in math and science courses

1995 - MAY 1998 **Environmental Science Department, Washington State University - Richland, WA**

Graduate coursework in Environmental Science

OCT 1995- FEB 1996 **Northwest Technical Resources - Richland, WA**

Quality Assurance Coordinator -- Conducted audits of environmental laboratory; prepared analytical data packages; maintained training records.

MAR 1990 - MAY 1995 **Hanford Environmental Health Foundation -Richland, WA**

Quality Assurance Coordinator -- Prepared and reviewed written procedures; conducted audits of industrial hygiene laboratory; conducted technical training courses; created document control and records handling systems; conducted audits of suppliers and sub-contractors

1987- MAR 1990 **Brown and Caldwell Analytical Laboratories - Glendale, CA**

Quality Assurance Coordinator -- Reviewed written procedures; prepared analytical data packages; coordinated performance evaluation sample program.

JAN 1983 - 1987 **Brown and Caldwell Analytical Laboratories - Glendale, CA**

Chemist -- Analyzed water, wastewater, soil, and waste samples for trace metals by inductively coupled plasma and graphite furnace atomic absorption spectroscopy; calibrated and maintained analytical instrumentation; directed work activities for two technicians.

NOV 1980 - JAN 1983 **Jacobs Laboratories - Pasadena, CA**

Chemist -- Analyzed water, wastewater, soil, and waste samples for trace metals by atomic absorption spectroscopy; analyzed wastewater samples for cyanide, BOD, and COD.

EDUCATION:

1995 - 1998	**Washington State University – Richland, WA** 40 credits coursework toward M.S. in Environmental Science
1995	**Columbia Basin College – Richland, WA** Occupational Instruction
1993	**Columbia Basin College – Richland, WA** Principles of Industrial Hygiene
1992	**U.S. Department of Energy – Richland, WA** Introduction to Root Cause Analysis
1990	**U.S. Department of Energy– Richland, WA** Auditing for Lead Auditors
1973 - 1977	**University of California - Berkeley** B.S. Chemistry, June 1977

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JAMES L. HODGE

PROFESSIONAL EXPERIENCE:

MAR 2001 - PRESENT **SVL Analytical, Inc. - Kellogg, ID**

Classical Chemistry Department Analyst – Performs analysis of total and WAD Cyanide.

OCT 1995 – MAR 2001 **Sunshine Mining and Refining Co. – Kellogg, ID**

Analyzed samples for silver and gold by fire assay; conducted atomic absorption and ICP analysis

SEP 1993 – OCT 1995 **Morrison Knutdson Corporation**

Conducted soil sampling; tested and maintained respirators; operated Bobcat loader

JUL 1991 – SEP 1993 **Pintlar Corporation**

Environmental and Health & Safety Manager—Responsible for health and safety; wrote health and safety plans; oversaw environmental and reclamation projects

JUN 1983- JUL 1991 **Bunker Limited Partnership**

Laboratory Manager-- Operated water treatment plant; oversaw environmental reclamation projects

JUN 1967- OCT 1982 **Bunker Hill Mining Co.**

Laboratory Technician – Analyzed samples by fire assay; conducted wet *chemical and atomic absorption analysis*

EDUCATION:

APR 1993 **Urie Environmental Health, Inc.**

40-hour Hazardous Materials

JUL 1993 **MCS Environmental**

40-hour Asbestos Contractor Supervisor

APR 1993 **Urie Environmental Health, Inc.**

80-hour Industrial Hygiene

DEAN PALMER

PROFESSIONAL EXPERIENCE:

MAR 1996 - PRESENT **SVL Analytical, Inc. - Kellogg, ID**

Classical Chemistry Department Analyst -- Prepares water samples for analysis by ICP and GFAA (extracts and distillates) using SW-846 and EPA 200 series methods.

1983 - 1994 **Northern States Power Company - Welch, MN**

Prairie Island Nuclear Plant Training Center, Production Engineer -- Instruction of employees in the areas of math and physics as well as general employee training. Developed and taught course on site orientation, power plant fundamentals, industrial safety, radiological protection and respirator use.

1980 - 1982 **Kerr-McGee Nuclear - Grants, NM**

Associate Mechanical Engineer: -- Design and modification of mine mechanical equipment such as pumping, hydraulics, noise abatement, hoisting.

EDUCATION:

1969 - 1972 **North Dakota State University - Fargo, ND**

B.S. Social Science - Secondary Ed; Minor - Mathematics

1976 - 1979 **South Dakota School of Mines and Technology - Rapid City, SD**

B.S. Mechanical Engineering

JANICE B. DeVOE

PROFESSIONAL EXPERIENCE:

MAR 1990 - PRESENT **SVL Analytical, Inc. - Kellogg, ID**

Classical Chemistry Department Analyst -- Conducts Nitrate, Nitrite, and Ammonia analyses by Autoanalyzer; experienced in Chloride, Sulfate, Nitrate, Nitrite, and Fluoride analyses by ion chromatography and in analysis for Alkalinity, COD, and Phenolics

SEP 1980 - MAR 1984 **Ferry County Memorial Hospital - Republic, WA**

Medical Technician

NOV 1979 - JUN 1980 **Good Samaritan Hospital - Phoenix, AZ**

Medical Technician

AUG 1978 - AUG 1979 **Ferry County Memorial Hospital- Republic, WA**

Medical Technician

AUG 1977 - JUL 1978 **Harris Laboratories - Lincoln, NE**

Laboratory Technician

EDUCATION:

JAN 2001 **OI Corporation**

Operation of FS-3000 Auto-analyzer

1973-1977 **Fort Lewis College - Durango, CO**

B.S. Biology

ALICE VAN DORN

PROFESSIONAL EXPERIENCE:

MAY 1990 - PRESENT **SVL Analytical, Inc. - Kellogg, ID**

Classical Chemistry Department Analyst – Conducts TDS, TSS, TVS, pH, Turbidity, and Conductivity analyses; digests samples for metals analysis; air filter monitoring and digestions.

EDUCATION:

1970 **Green River Community College - Auburn, WA**

General Studies

1970 - 1972 **Southwestern Oregon Community College - Coos Bay, OR**

AA Business Science; including Biology course work.

GORDON ANTHIS

PROFESSIONAL EXPERIENCE:

JUL 1988 - PRESENT **SVL Analytical, Inc. - Kellogg, ID**

Classical Chemistry Department Analyst – Conducts TCLP and SPLP extractions, and meteoric water mobility studies; assists in sample receipt and chain-of-custody.

1986 - 1988 SEASONAL **U.S. Forest Service – Bonners Ferry**

Fought forest fires; planted trees

1986-1988 SEASONAL **Coeur d'Alene Tree Nursery – Coeur d'Alene, ID**

Harvested and sorted trees

SEP 1985- NOV 1985 **Enternal Line – Mullan, ID**

Flagger for road crew

SEP 1984- JUL 1985 **Astoria Oil Services–Astoria, OR**

Building construction, framing, sheet rock.

EDUCATION:

1999 **North Idaho College – Coeur d'Alene, ID**

Course work in Algebra, Computer Programs

1998 **Kellogg North Idaho College – Kellogg, ID**

Windows 95

1997 **Edwards & Associates–Wallace, ID**

Hazardous Materials and Hazardous Waste

1983- 1984 **North Idaho College–Kellogg, ID**

Diesel Mechanics

DAVID HAUSER

PROFESSIONAL EXPERIENCE:

AUG 2001- PRESENT **SVL Analytical, Inc. – Kellogg, ID**

Classical Chemistry Department Chemist – Analyzes samples for Fluoride, Flashpoint, Specific Conductivity, Hardness, Phenols, and Phosphate; operates LECO instrument to analyze samples for ABA and Sulfur Forms

AUG 1997- AUG 2000 **North Idaho Fitness – Coeur d'Alene, ID**

Developed training and nutrition programs for customers; assessed customer progress

EDUCATION:

1993- 1996 **University of Idaho – Moscow, ID**

B.S. Secondary Education

1979- 1993 **North Idaho College – Coeur d'Alene, ID**

A.A.S. Secondary Education

MARK FELLEGY

PROFESSIONAL EXPERIENCE:

OCT 2001- PRESENT **SVL Analytical, Inc. – Kellogg, ID**

Organic Chemistry Department Analyst – Repairs and calibrates gas chromatographs and analytical instrumentation

AUG 1979- MAY 2001 **Cargill, Inc. – Wayzata, MN**

Instrument Specialist VII – Installed, repaired, and maintained analytical instrumentation, including gas chromatographs and mass spectrometers; developed analytical methods for pesticide residues and olfactory and flavor compounds

EDUCATION:

JUL 1974- JUL 1975 **South Hennepin Technical College – Eden Prairie, MN**

Environmental Technology Program

APR 2001 **Agilent Technologies**

HP 5973 GC-MSD Troubleshooting and Maintenance (H2294-A)

MAR 2001 **Transportation Skills Program, Inc.**

Hazardous Materials and Waste

AUG 2000 **Training Masters**

High Performance Liquid Chromatography

MAY 2000 **Minnesota Chromatography Forum**

Mass Spectral Interpretation

MAR 1998 **Enigma Analytical**

Applied Statistics and QC/QC Principles

STEPHANIE CLEARWATER

PROFESSIONAL EXPERIENCE:

JUNE 2001-PRESENT **SVL Analytical, Inc. - Kellogg, ID**

Organic Chemistry Department Chemist – Performs sample extractions for 608, 625, 8081A, 8141A, and 8270C analyses

NOV 2000-JUN 2001 **Christian Supply – Spokane, WA**

Sales Associate – assisted customers, sold merchandise

JUN 2000-SEP 2000 **USDA Forest Service – Avery, ID**

Forestry Technician – located timber sales; sprayed for noxious weeds, maintained vehicles

JUN 1999-OCT 1999 **Christian Supply – Spokane, WA**

Sales Associate – assisted customers; maintained book stock; faxed customer orders

MAY 1997-SEP 1998 **EyeMasters – Spokane, WA**

Lab Technician – fashioned prescription eyewear; maintained and calibrated equipment

EDUCATION:

SEP 1998-JUN 2000 **Eastern Washington University – Cheney, WA**

B.S. Environmental Biology

KRISTINE B. HAAKENSON

PROFESSIONAL EXPERIENCE

JUL 1998 - PRESENT **SVL Analytical, Inc. - Kellogg, ID**

Organic Chemistry Department Chemist -- GC/MS Operator: Responsible for analysis of environmental matrices for organic compounds according to standard EPA procedures using GC and GC/MS systems. Experienced in EPA methods 504.1, 524.2, 601/602, 608, 624, 625, 8015, 8021B, 8260B, 8270C, and the associated sample preparation requirements of the analyses. Duties include instrument set-up and maintenance, methods development, and report generation.

OCT 1997 - JUL 1998 **Bayer Corporation - Spokane, WA**

Quality Control Chemist -- Executed analytical assays of injectable finished products and raw materials according to Standard Operating Procedures (SOP) and Good Manufacturing Practices (GMP) to ensure product specifications are met. Utilized various analytical instrumentation to perform analytical assays: HPLC, GC, and UV/VIS spectrophotometer.

SEP 1992 - OCT 1997 **Analytical Sciences Laboratory, University of Idaho - Moscow, ID**

Senior Organic Chemist -- Supervised and managed the organic analytical laboratory division under all principles of Good Laboratory Practices (GLP) and EPA regulations for the routine determination of pesticides, herbicides, and various volatile and semi-volatile organic compounds in water, soil, environmental, and veterinary samples. Delegated and organized all analytical chemists' daily routine and non-routine analyses in the organic analytical group. Primary responsible person for the operation, maintenance, and troubleshooting of all primary analytical instrumentation in the organic laboratory including: GC's, GC/MS, HPLC, UV/VIS spectrophotometer, purge and trap with cryofocusing, high pressure gel permeation chromatograph. Primary responsible person for the performance of method validation and method detection limit studies for all EPA regulated and non-regulated methods under full GLP compliance. Responsible for performing standard recertification studies to guarantee the integrity of all pesticide, herbicide, and residue standards.

EDUCATION:

1987 - 1991 **Arizona State University - Tempe, AZ**

BS Chemistry, Emphasis in Biochemistry

1992 **Northwest Quality Symposium**

Good Laboratory Practices Tutorial

1995 **University of Idaho**

Hazardous Waste Management

WENDY OZMINKOWSKI

PROFESSIONAL EXPERIENCE:

JAN 2002 - PRESENT **SVL Analytical, Inc. - Kellogg, ID**

Supervisor Organic Chemistry Department – Responsible for analyses of soil and water samples for organic contaminants; reviews and approves data; operates GC and GC/MS instruments; interprets and reports data.

DEC 1998 – JAN 2002 **SVL Analytical, Inc. - Kellogg, ID**

Organic Chemistry Chemist -- Performs analyses of soil and water samples for volatile organic compounds; operates GC and GC/MS instruments; interprets and reports data.

JUN 1998 - AUG 1998 **Quality Coatings – Post Falls, ID**

Laboratory technician – Developed Chemical Hygiene Plan, standardized chemical solutions; conducted titrimetric analyses, controlled pH, temperature, and chemical concentrations of industrial processes.

JAN 1997 - AUG 1999 **A.C. Data Systems – Post Falls, ID**

Mechanical assembly worker – Performed component soldering and mechanical assembly of panels and circuitry quality inspections, training, developed process documentation.

SEP 1993 - AUG 1995 **North Idaho College – Coeur d'Alene, ID**

Lab Assistant -- Prepared reagents for laboratory demonstrations, standardized chemical solutions, conducted chemical and equipment inventory, supervised students, set-up laboratory demonstrations

EDUCATION:

1997 - 1998 **North Idaho College – Coeur d'Alene, ID**

A.S. in Premedical Studies 1998

1994 - 1996 **University of Idaho – Moscow, ID**

B.S. in Chemistry 1996

1991 - 1995 **North Idaho College – Coeur d'Alene, ID**

A.S. in Chemistry 1995

JUDY ASHCRAFT

PROFESSIONAL EXPERIENCE:

NOV 1994 - PRESENT **SVL Analytical, Inc. - Kellogg, ID**

Organic Chemistry Department Analyst – Analyzes samples for Pesticides, PCBs, Petroleum Hydrocarbons, TOC, TOX, and Ethylene Glycol; performs solid phase extractions, liquid/liquid extractions of soil, water, and waste.

1968 - 1994 **Minnesota Valley Testing Laboratories, Inc. - New Ulm, MN**

GLP Laboratory Technician – Performed organic extractions including liquid-liquid partition, solid phase extraction, gel permeation, and open column chromatography. Matrices included soil, water, plants, and food products. Performed routine record keeping and data entry as well as training lab personnel.

Previous positions with this employer included:

Soils Lab Assistant to the Nutrients and Minerals supervisor and experience in the inorganic lab covering areas such as domestic & waste water, plant nutrients & minerals, feed nutrients, and used oil analysis.

Training included: techniques in "Good Laboratory Practices Standards" (GLP) as delineated in 40 CFR, Part 160 (US EPA), Laboratory Safety, Quality Assurance, and familiarity with the following instruments: color spectrophotometer, atomic absorption spectrophotometer, ultrasonic processor, electric kiln, flash point detector, analytical balances, pH meters, vacuum box, centrifuge, heating & distilling units, rotary evaporator, steam water bath, and gas chromatography (limited).

EDUCATION:

1968 **Mankato Commercial College - Mankato, MN**

General Business Course work

KEVIN HATHAWAY

PROFESSIONAL EXPERIENCE:

MAR 1987 - PRESENT

SVL Analytical, Inc. – Kellogg, ID

Inorganic Instrument Operator – Operates GFAA instruments; also trained in Ion Chromatography and Mercury analysis by Cold Vapor Atomic Absorption.

EDUCATION:

1993 - 1994

North Idaho College – Coeur d' Alene, ID

Basic Concepts in Chemistry

ANNE L. SPRADLIN

PROFESSIONAL EXPERIENCE:

MAR 1997 - PRESENT **SVL Analytical, Inc. - Kellogg, ID**

Inorganic Instrument Operator -- Operates ICP utilizing standard methods of analysis such as SW846 as well as USEPA CLP procedures.

1993 - 1997 **Quanterra Environmental Services - Richland, WA**

Chemist III -- Operated radiation detection instrumentation such as Alpha Spectrometers, Gamma detectors, Gas Proportional Counters and Liquid Scintillation analyzers. Utilized computers in acquisition and reporting of data and performed data review.

1985 - 1993 **National Environmental Testing, Inc. - Dallas, TX**

Supervisor Metals Department -- Supervised analysts, delegated work distribution, implemented company QA/QC program, evaluated accuracy of reported data, trained new employees. Analyzed for metals utilizing Thermo Jarrell-Ash ICP, Perkin Elmer 5000 ICP, Perkin Elmer 5000 AA, Hitachi Z-9000 and Perkin Elmer 3030 graphite furnaces. In addition, performed Cold-vapor Mercury Analyses, sample prep, routine maintenance and troubleshooting of instrumentation. Also performed Wet Chemistry analyses for two years; parameters included BOD, COD, cyanide, TPH and many other common wet chem analyses. Interpreted and reported data.

1984 - 1985 **Environment Protection Laboratories - St. Cloud, MN**

Performed wet chemistry and microbiological analyses.

EDUCATION:

1979 - 1981 **Concordia College, Moorhead, MN**

General Studies

1981 - 1983 **Saint Cloud State University - Saint Cloud, MN**

B.A. Biology (with emphasis in Microbiology)

ANN MARIE COSTELLO

PROFESSIONAL EXPERIENCE:

NOV 1991 - PRESENT **SVL Analytical, Inc. - Kellogg, ID**

Inorganic Instrument Operator – Analyzes samples by Ion Chromatography; operates GFAA using USEPA CLP procedures. Also trained in the operation of the ICP instrument for CLP samples of both water and soil matrices.

1979 - 1980 **Energy Laboratories - Billings, MT**

Lab Technician – Plant and soil analysis using classical chemistry and AA techniques.

1975 - 1977 **Chen Northern - Billings, MT**

Lab Technician – Plant and soil analysis using classical chemistry and AA techniques.

1972 - 1975 **Montana State University Plant Research Center - Bozeman, MT**

Lab Technician – Plant and soil analysis using classical chemistry and AA techniques.

EDUCATION:

1967-1971 **Montana State University, Bozeman, MT**

B.S. Microbiology

DANNY J. SEVY

PROFESSIONAL EXPERIENCE:

1996 - PRESENT **SVL Analytical, Inc. - Kellogg, ID**

Inorganic Instrument Operator -- Performs metals analysis by ICP and GFAA using SW846 and CLP methodology; also trained in Cyanide analysis by autoanalyzer.

1994 - 1996 **SVL Analytical, Inc. - Kellogg, ID**

Classical Chemistry Analyst -- Performed classical Wet Chemistry analyses on water and soil samples using CLP procedures. This included the preparation and analysis of Cyanide and Nitrate/Nitrate (as N) tests for soil and water samples.

1988 - 1994 **SVL Analytical, Inc. - Kellogg, ID**

Instrument Operator -- Analyzed samples using Cold Vapor Atomic Absorption and Ion Chromatography

APR1987 - 1988 **SVL Analytical, Inc. - Kellogg, ID**

Laboratory Technician -- Performed inorganic sample preparation and operated CVAA and GFAA instruments.

EDUCATION:

JAN 2001 **OI Corporation**

Operation of FS-3000 Auto-analyzer

1989 - 1990 **North Idaho College - Coeur d' Alene, ID**

Chemistry and Mathematics courses

KAY JOHNSON

PROFESSIONAL EXPERIENCE:

JUN 1992-PRESENT **SVL Analytical, Inc. - Kellogg, ID**

Classical Chemistry Department Analyst – Performs fire assays of ore and mineral samples; analyzes ore and mineral samples for metal content by atomic absorption

1967- 1969 **Idaho Bureau of Mines and Geology – Moscow, ID**

Lab Technician – performed sample preparation and chemical analysis

EDUCATION:

1964-1965 **Whitworth College – Spokane, WA**

Evening courses

1959-1960 **Spokane Community College – Spokane, WA**

Dental Technician program

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MELBA BENCICH

PROFESSIONAL EXPERIENCE:

FEB 1988 - PRESENT **SVL Analytical, Inc. - Kellogg, ID**

Document Control Manager – Supervises data reporting, utilizing USEPA CLP procedures for deliverables and compliance screening.

1984-1988 **Shoshone Insurance - Kellogg, ID**

Duties included accounting, customer service relations and updating manuals.

1982 - 1984 **Time To Travel - Wallace, ID**

Travel Consultant

1974 - 1981 **The Bunker Hill Company - Kellogg, ID**

Data Control Analyst

EDUCATION:

1967 - 1968 **North Idaho College - Coeur d' Alene, ID**

General Studies

1980 **International Correspondence School**

Mathematics

RUSSELL L. ALLRED

PROFESSIONAL EXPERIENCE:

SEP 1987 - PRESENT **SVL Analytical, Inc. - Kellogg, ID**

Programmer Analyst – Provides computer and systems analysis, maintenance and repair. Novell certified administrator, trained Novell certified internet professional. Service and maintain in-house phone switching equipment. Perform accounting audits and prepare company financial statements.

1981 - SEP 1987 **Cook Lumber - Murray, UT**

Computer Analyst – Maintained a multi-user system that affected all aspects of the business and trained employee users.

EDUCATION:

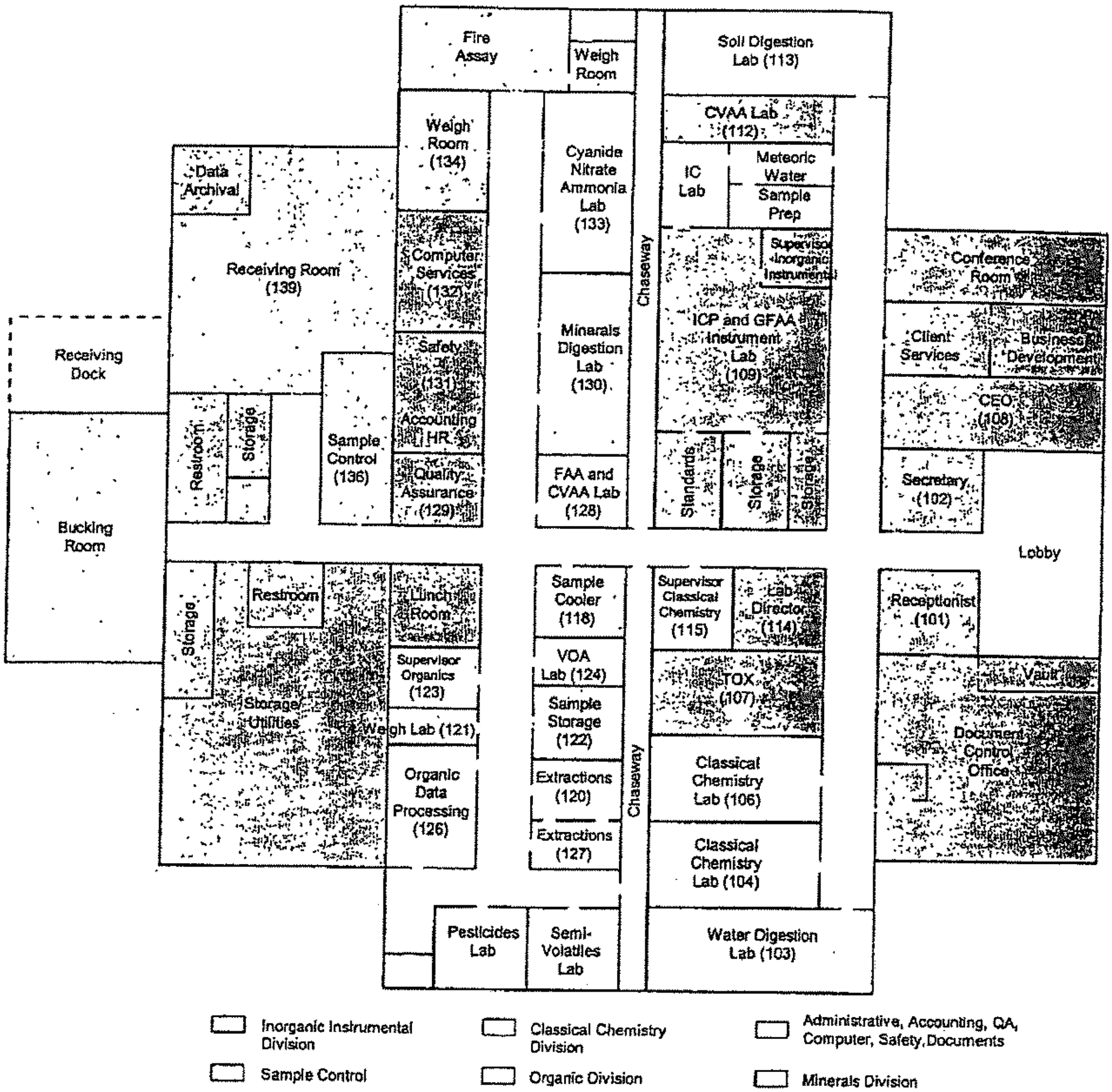
1987 **Salt Lake Community College - Salt Lake City, UT**

Computer Science

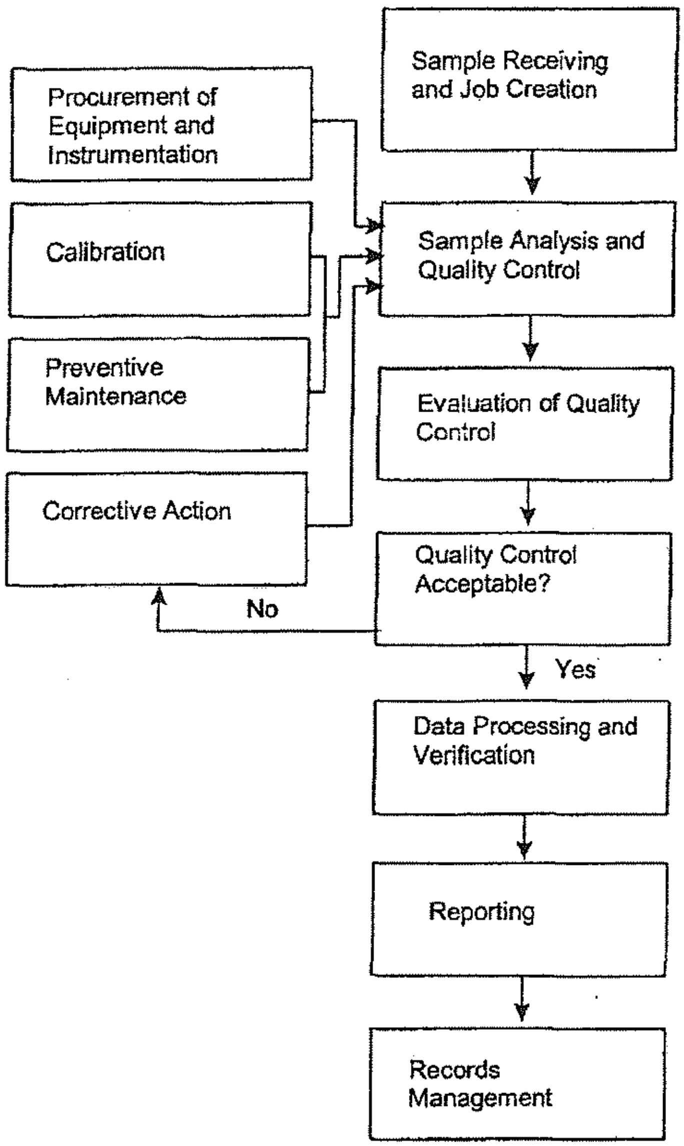
1978-1986 **University of Utah, Salt Lake City, UT**

Computer Science

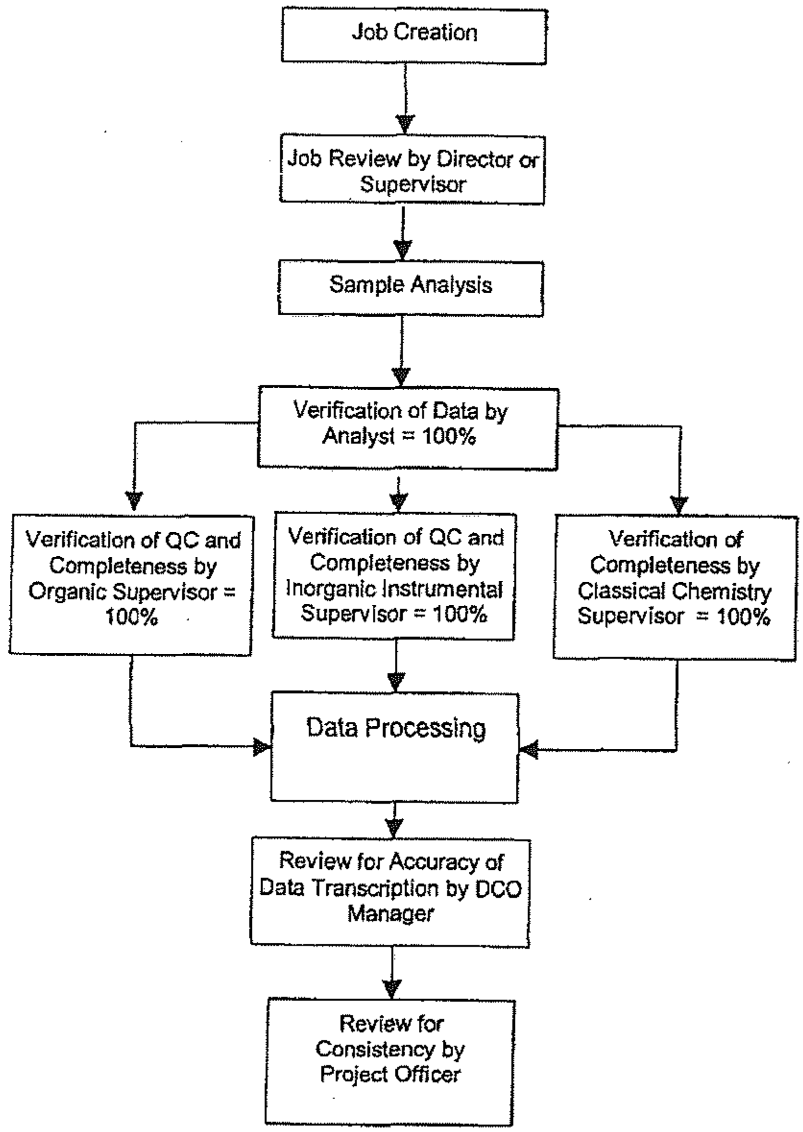
1.4 SVL Analytical, Inc. Laboratory Layout



1.5 Laboratory Analysis Flow Chart



1.6 Data Review Flow Diagram



2

2. INSTRUMENTATION AND ANALYSIS

SVL is equipped with state-of-the-art instrumentation, for all of your analytical needs

2.1 INSTRUMENTS FOR TRACE METAL ANALYSIS

INSTRUMENT	MANUFACTURER	MODEL
Inductively Coupled Plasma Spectrometer	Perkin-Elmer	Optima
Inductively Coupled Plasma Spectrometer	Perkin-Elmer	Optima
Atomic Absorption Spectrometer with Graphite Furnace Atomizer	Varian	SpectrAA 300Z
Atomic Absorption Spectrometer with Graphite Furnace Atomizer	Varian	SpectrAA 300Z
Atomic Absorption Spectrometer with Graphite Furnace Atomizer	Varian	SpectrAA 400Z
Atomic Absorption Spectrometer with Graphite Furnace Atomizer	Varian	SpectrAA 40Z
Atomic Absorption Spectrometer with Graphite Furnace Atomizer	Varian	SpectrAA 20
Atomic Absorption Spectrometer with Vapor Generation Assembly	Varian	SpectrAA 20
Atomic Absorption Spectrometer with Vapor Generation Assembly	Varian	SpectrAA 20
Mercury Analyzer	CETAC	M-6000A
ICP/MS	Perkin-Elmer	ELAN 5000

2.2 Instruments for Organic Analysis

INSTRUMENT	MANUFACTURER	MODEL
Gas Chromatograph with Dual ECD Detectors and Autosampler	Hewlett-Packard Hewlett-Packard	5890 HP 7673
Gas Chromatograph with FID and NPD Detectors and Autosampler	Hewlett-Packard Hewlett-Packard	5890A HP 7673A
Gas Chromatograph with FID Detector and Autosampler	Hewlett-Packard Hewlett-Packard	5890A HP 7673
Gas Chromatograph with PID and Hall Detectors and Liquid Sample Concentrator/Autosampler	Hewlett-Packard Tekmar	5890A LSC 2000/ ALS 2016
Gas Chromatograph with MS Detector and Purge and Trap Concentrator	Hewlett-Packard Tekmar	5890E with 5972 MS Purge and Trap
Gas Chromatograph with PID and ELCD Detector with Liquid Sample Concentrator/Autosampler	Hewlett-Packard OI	5890 4560/ MPM-16
Gas Chromatograph with MS Detector and Purge and Trap Concentrator	Hewlett-Packard Tekmar	5890 with 5971 MSD LSC 2000/ ALS 2016
Gas Chromatograph with MS Detector and Autosampler	Hewlett-Packard Hewlett-Packard	5890 7673
Gas Chromatograph with MS Detector	Hewlett-Packard	5890A with 5870 MSD
Gas Chromatograph with NPD and FPD Detectors And Autosampler	Agilent Agilent	6890A 7683
HPLC	Agilent	1050
Accelerated Solvent Extractor	Dionex	ASE200
Zero Head Space Extractor	Millipore	
Carbon Analyzer (TOC)	Shimadzu	TOC-5000A
Organic Halogen Analyzer (TOX)	MCI (Mitsubishi)	TOX-10

2.3 Instruments for Inorganic Analysis

INSTRUMENT	MANUFACTURER	MODEL
Ion Chromatograph	Dionex	2000i
Ion Chromatograph	Dionex	DX-100
Ion Chromatograph	Dionex	4000i
Automated Flow Analyzer with Autosampler	Alpkem	FS300
Automated Flow Analyzer with Autosampler	Alpkem	FS300
MIDI Distillation Unit	BSL	
MIDI Distillation Unit	BSL	
MIDI Distillation Unit	BSL	
Auto Titrator with Autosampler	Brinkmann	Titrino 716
Auto Titrator with Autosampler	Brinkmann	Titrino 716
UV/Visible Spectrophotometer	Bausch & Lomb	501
Turbidimeter	Hach	2100
COD Reactor	Hach	COD
COD Reactor	Hach	COD
pH Meter	Corning	150
pH/Ion Meter	Corning	450
Dissecting Microscope	Nikon	104
Polarizing Microscope	Nikon	106
Conductance Meter	YSI	32
Dissolved Oxygen Meter	YSI	50B
Elemental Analyzer	LECO	SC444

2.4 Routine Analyses Performed

ANALYTE	METHOD	TECHNIQUE
Aluminum	EPA 200.7, 6010B	ICP
Antimony	EPA 200.7, 6010B	ICP
Antimony	EPA 204.2, 7040	GFAA
Antimony	EPA 200.9	GFAA
Arsenic	EPA 200.7, 6010B	ICP
Arsenic	EPA 206.2, 7060A	GFAA
Arsenic	EPA 200.9	GFAA
Barium	EPA 200.7, 6010B	ICP
Beryllium	EPA 200.7, 6010B	ICP
Boron	EPA 200.7, 6010B	ICP
Cadmium	EPA 200.7, 6010B	ICP
Cadmium	EPA 213.2, 7131A	GFAA
Cadmium	EPA 200.9	GFAA
Calcium	EPA 200.7, 6010B	ICP
Chromium	EPA 200.7, 6010B	ICP
Chromium	EPA 218.2, 7191	GFAA
Chromium	EPA 200.9	GFAA
Cobalt	EPA 200.7, 6010B	ICP
Copper	EPA 200.7, 6010B	ICP
Gold	EPA 231.2	GFAA
Iron	EPA 200.7, 6010B	ICP
Lead	EPA 200.7, 6010B	ICP
Lead	EPA 239.2, 7420	GFAA
Lead	EPA 200.9	GFAA
Magnesium	EPA 200.7, 6010B	ICP
Manganese	EPA 200.7, 6010B	ICP

ANALYTE	METHOD	TECHNIQUE
Mercury	EPA 245.1, 7470A, 7471A	CVAA
Nickel	EPA 200.7, 6010B	ICP
Potassium	EPA 200.7, 6010B	ICP
Selenium	EPA 200.7, 6010B	ICP
Selenium	EPA 270.2, 7740	GFAA
Silica	EPA 200.7	ICP
Silver	EPA 200.7, 6010B	ICP
Silver	EPA 272.2, 7761	GFAA
Sodium	EPA 200.7, 6010B	ICP
Strontium	EPA 200.7, 6010B	ICP
Thallium	EPA 200.7, 6010B	ICP
Thallium	EPA 279.2, 7840	GFAA
Tin	EPA 200.7, 6010B	ICP
Titanium	EPA 200.7, 6010B	ICP
Vanadium	EPA 200.7, 6010B	ICP
Zinc	EPA 200.7, 6010B	ICP
Acidity	SM 2310B	Titration
Alkalinity	SM 2320B	Titration
Ammonia	EPA 350.3	Ion Specific Electrode
Biochemical Oxygen Demand	SM 5210B	D.O. Meter
Bromide	EPA 300.0	Ion Chromatography
Chemical Oxygen Demand	EPA 410.4	Colorimetry
Chloride	EPA 300.0	Ion Chromatography
Corrosivity	SM 2330 (B)	Langlier Index
Cyanide, Total	EPA 335.4	Automated Colorimetry
Cyanide, Total	EPA 335.2, 9012A	Automated Colorimetry
Cyanide, WAD	SM 4500 CN (I)	Automated Colorimetry

ANALYTE	METHOD	TECHNIQUE
Fluoride	EPA 300.0	Ion Chromatography
Fluoride	EPA 340.2	Ion Specific Electrode
Hardness	SM 2340B	ICP Sum
Hexane Extractable Materials	EPA 1664	Gravimetric
Nitrate	EPA 300.0	Ion Chromatography
Nitrate	EPA 353.2	Automated Colorimetry
Nitrate + Nitrite	EPA 353.2	Automated Colorimetry
Nitrite	EPA 300.0	Ion Chromatography
Nitrite	EPA 353.2	Automated Colorimetry
Oil & Grease	EPA 1664	Gravimetric
ortho-Phosphate	EPA 365.1	Colorimetry
pH	EPA 150.1	Electrometric
Phenolics, Total	EPA 420.1	Colorimetric
Phosphate, Total	EPA 365.2	Persulfate Digestion
Residue, Filterable	EPA 160.1	Gravimetric
Residue, Filterable	SM 2540C	Gravimetric
Residue, Nonfilterable	EPA 160.2	Gravimetric
Specific Conductance	EPA 120.1	Wheatstone Bridge
Sulfate	EPA 300.0	Ion Chromatography
Sulfide	EPA 376.1	Titrimetric
TCLP	EPA 1311	Extraction
Total Dissolved Solids	EPA 160.1	Gravimetric
Total Dissolved Solids	SM 2540C	Gravimetric
Total Kjeldahl Nitrogen	EPA 351.4	Ion Selective Electrode
Total Organic Carbon	EPA 415.1	Combustion
Total Organic Halides	EPA 450.1	Adsorption-Pyrolysis, Titrimetric
Total Suspended Solids	EPA 160.2	Gravimetric

ANALYTE	METHOD	TECHNIQUE
Aromatic Volatile Compounds	EPA 602	GC/PID
Organochlorine Pesticides and PCBs	EPA 608	GC/ECD
Organochlorine Pesticides	EPA 8081A	GC/ECD
PCBs	EPA 8082	GC/ECD
Semivolatile Organic Compounds	EPA 625	GC/MSD
Semivolatile Organic Compounds	EPA 8270C	GC/MSD
Volatile Organic Compounds	EPA 524.2	GC/MSD
Volatile Organic Compounds	EPA 624	GC/MSD
Volatile Organic Compounds	EPA 8260B	GC/MSD
Halogenated Organic Compounds	EPA 601	GC/ELCD
Volatile Organic Compounds	EPA 8021B	GC/PID/ELCD
Total Petroleum Hydrocarbons--Gasoline	EPA 8015	GC/FID
Total Petroleum Hydrocarbons--Diesel	EPA 8015	GC/FID

3

3. ANALYTICAL PROCEDURES

SVL Analytical, Inc. uses established procedures whenever possible

Analysis of samples is performed according to SVL Standard Operating Procedures (SOPs). The SOPs are created using established procedures such as those referenced in the following section.

3.1 References

Methods for Chemical Analysis of Water and Wastes, revised March 1983, EPA-600/4-79-020.

Methods for the Determination of Organic Compounds in Drinking Water Supplement I, EPA/600/4-88/039, July 1990.

Methods for the Determination of Organic Compounds in Drinking Water Supplement III, EPA/600R-95-131, August 1995.

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW 846), Third Edition, Update III, December 1996.

Standard Methods for the Examination of Water and Wastewater, 16th Edition, 1985

Standard Methods for the Examination of Water and Wastewater, 19th Edition, 1995.

ASTM Book of Standards, part 31

USEPA CLP Inorganic Statement of Work ILM04.0.

4. ETHICS AND DATA INTEGRITY AGREEMENT

We are committed to providing our clients with accurate and defensible data

SVL Analytical, Inc. is committed to providing its clients with accurate and defensible data and meeting all client requirements for data quality and integrity. To achieve this commitment, and as a condition for employment, all employees agree to follow SVL's policy regarding ethics and data integrity which is characterized in the items listed below.

All work performed shall be in accordance with appropriate work order agreements, specified methods, SOP's, and contracts.

All reported data, including analysis dates and times, shall represent actual values obtained and are not modified, or manipulated in any manner which is not described in the referenced method.

Analysts performing technical methods in the name of SVL shall not represent work which was performed by other individuals as their own.

Client results shall be kept strictly confidential and released to a third party only with written permission by the client.

Violation of these standards is grounds for disciplinary action as stated in section II of SVL's Employee Handbook, including termination.

5

5. QUALITY ASSURANCE AND QUALITY CONTROL

The procedures outlined in this manual are the basis of the SVL Analytical, Inc. quality assurance plan (QAP)

SVL recognizes that an effective and vigorously pursued quality program is key to providing analytical data which is legally defensible, technically accurate, and scientifically meaningful.

At SVL, quality control begins once the objectives of a survey are defined and proceeds through data reporting. Control procedures are defined for every step of the program and detailed in current standard operating procedures (SOPs).

SVL realizes that without these controls in all phases of the laboratory and analytical process, data becomes suspect and hence, of less value to our client. Therefore, SVL is dedicated to providing data of the highest quality, usability, and defensibility for every project we undertake.

5.1 Quality Assurance Policy and Objectives

The primary emphasis of the QAP is twofold. The first of these is to define quality control procedures for all activities that take place in the laboratory. These include the following: receipt, handling, and storage of samples; preparation and maintenance of standards, reagents, gases, and water; calibration and maintenance of analytical equipment; performance, and evaluation of analytical methodologies (in conformance with the parameters defined by the appropriate regulatory agency; and the compilation and generation of reportable data packages.

The other emphasis of the QAP is to characterize the documentation practices utilized in all facets of the laboratory process. The objective is to provide a uniform basis for instrument maintenance, document control, analytical methodologies, data generation, quality assurance, and quality control.
The procedures outlined in this manual are the basis of the SVL Analytical Quality Assurance Plan (QAP).

5.2 Quality Assurance Management

SVL employs one full time Quality Assurance Coordinator who reports directly to the President and CEO, providing independence from the routine operation of the individual departments of the laboratory. The Quality Assurance Coordinator is responsible for the management and implementation of the quality assurance program. He is responsible for monitoring the overall adequacy of the program as well as determining departmental conformance to the QA program. The QA Coordinator is responsible for recommending corrective actions as necessary.

In addition, the Quality Assurance Coordinator develops quality control programs; monitors quality assurance activities to determine conformance with policies and procedures; evaluates and maintains records of data quality and other pertinent performance information; and coordinates investigations of quality problems. Supervisors are responsible for seeing that their staff receive adequate training in and follow the specific procedures outlined in this QAP.

5.3 Sample Collection and Handling

This section describes the quality control procedures to be followed in the collection and handling of samples for SVL. These procedures are recommended to all clients submitting samples for chemical analysis. Glassware preparation is included in this section because it is an integral part of any sampling program. It is assumed that the objectives of a study for which samples are to be collected have been stated and the number of samples, types of samples, frequency of collection, and duration of the sampling program have been established. Finally, it is assumed that all personnel involved in sample acquisition are aware of the above factors.

If utilized, the procedures characterized here result in more confidence in the data produced and the samples are processed more efficiently. The result of standardizing sample collection and handling procedures is less confusion for the project manager, field personnel, and laboratory staff.

The most important aspects of quality control for sample collection and handling are sample integrity and representivity.

5.3.1 Sample Integrity

Sample preservation is critical for sample integrity given the potential for transportation delays and hold ups. Chemical reactions may occur and some chemical species begin to change upon sample collection. Unfortunately, for most samples immediate analysis is neither economically feasible or logistically possible. Although no miracle chemical preservative valid for every parameter exists, SVL strongly recommends the preservation methods, container type, sample size and estimated maximum holding times for collection of water and wastewater samples summarized in Table 5-1.

Solid samples are best preserved by refrigeration at 4 °C ± 2 °C. Analysis begins as soon as possible after lab receipt of samples. SVL does its utmost to ensure that all holding times are met for water samples as listed in Table 5-1. A complete record is maintained on each sample to provide a history of handling from the time of collection through analysis and sample disposal.

Table 5-1 Recommendation for Sampling and Preservation of Aqueous Samples

Analysis	Vol. Req. (mL)	Container	Preservative	Holding Time
PHYSICAL PROPERTIES				
Color	50	P,G[1]	Cool 4 °C	48 Hours
Conductance	100	P,G	Cool 4 °C	28 Days
Hardness	100	P,G	HNO_3 to pH<2	6 Months
Odor	200	G only	Cool 4 °C	24 Hours
pH	25	P,G	None Req.	Analyze Immediately
Temperature	1000	P,G	None Req.	Analyze Immediately
Turbidity	100	P,G	Cool 4 °C	48 Hours

Table 5-1 Recommendation for Sampling and Preservation of Aqueous Samples

Analysis	Vol. Req. (mL)	Container	Preservative	Holding Time
RESIDUES				
Filterable (TDS)	100	P,G	Cool 4 °C	7 Days
Non-Filterable (TSS)	100	P,G	Cool 4 °C	7 Days
Total	100	P,G	Cool 4 °C	7 Days
Volatile	100	P,G	Cool 4 °C	7 Days
Settleable Matter	1000	P,G	Cool 4 °C	48 Hours
METALS				
Dissolved	200	P,G	Filter on site HNO_3 to pH<2	6 Months
Suspended	200	P,G	Filter on site	6 Months
Total	100	P,G	HNO_3 to pH<2	6 Months
Chromium (VI)	200	P,G	Cool 4 °C	24 Hours
Mercury, Dissolved	100	P,G	Filter HNO_3 to pH<2	28 Days
Mercury, Total	100	P,G	HNO_3 to pH<2	28 Days
INORGANIC				
Acidity	100	P,G	Cool 4 °C	14 Days
Alkalinity	100	P,G	Cool 4 °C	14 Days
Bromide	100	P,G	None Req.	28 Days
Chloride	50	P,G	None Req.	28 Days
Cyanide	500	P,G	Cool 4 °C NaOH to pH>12	14 Days
Fluoride	300	P	None Req.	28 Days
Iodide	100	P,G	Cool 4 °C	24 Hours
Ammonia	400	P,G	Cool 4 °C H_2SO_4 to pH<2	28 Days
Total Kjeldahl Nitrogen	500	P,G	Cool 4 °C H_2SO_4 to pH<2	28 Days
Nitrate plus Nitrite	100	P,G	Cool 4 °C H_2SO_4 to pH<2	28 Days
Nitrate	100	P,G	Cool 4 °C	48 Hours
Nitrite	50	P,G	Cool 4 °C	48 Hours
Ortho-Phosphate Dissolved	50	P,G	Filter on site Cool 4 °C	48 Hours
Total Phosphate	50	P,G	Cool 4 °C H_2SO_4 to pH<2	28 Days
Total Dissolved Phosphate	50	P,G	Filter on site Cool 4 °C H_2SO_4 to pH<2	24 Hours
Silica	50	P only	Cool 4 °C	28 Days
Sulfate	50	P,G	Cool 4 °C	28 Days
Sulfide	500	P,G	Cool 4 °C add 2 mL zinc acetate plus NaOH to pH>9	7 Days
Sulfite	50	P,G	None Req.	Analyze Immediately

Table 5-1 Recommendation for Sampling and Preservation of Aqueous Samples

Analysis	Vol. Req. (mL)	Container	Preservative	Holding Time
ORGANICS Group I				
COD	50	P,G	Cool 4 °C H_2SO_4 to pH<2	28 Days
Oil & Grease	1000	G only	Cool 4 °C H_2SO_4 to pH<2	28 Days
Organic Carbon	25	P,G	Cool 4 °C H_2SO_4 or HCl to pH<2	
Phenolics	500	G only	Cool 4 °C H_2SO_4 to pH<2	28 Days
MBAS	250	P,G	Cool 4 °C	48 Hours
ORGANICS Group II				
Volatile Organics 8010/8020/8260	2x40ml/ 1x4oz	G,T	Cool 4 °C HCl pH<2	14 days
Semi-volatile Organics 8270/8080	1 L / 1x8 oz	G,T	Cool 4 °C No Preserv.	7/14 days
TPH - Total Petro. Hydrocarbons				
THP-Gas	2x40 mL/ 1x4 oz	G,T	Cool 4 °C	14 days
TPH-Diesel	1 L / 1x8 oz	G,T	Cool 4 °C	14 days
TPH-IR	1 L / 1X8 oz	G,T	Cool 4 °C	14 days

NOTES: - [1]Plastic (P), Glass (G), Teflon-lined cap (T). For metals, polyethylene with a polypropylene cap (no liner) is preferred.
Preservation: - Sample preservation should be performed immediately upon sample collection. For composite samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, the samples may be preserved by maintaining at 4 °C until compositing and sample splitting is completed.
Holding Time: - Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid.

5.3.2 Sample Representivity

Sampling precision is determined in the initial phase of a long-term sampling program. It is checked thereafter with a single duplicate sample per batch of samples, and usually with every sample delivery group.

Field blanks allow identification of systematic and random sample contamination which may result from the sampling equipment, storage containers, sampling agents, or chemicals added to preserve samples. This contamination can be checked by filling a randomly selected sample container with distilled water and the appropriate chemical preservative. Field blanks are analyzed as samples and therefore, are treated exactly as samples: all aliquots, preservation, filtration, storage and handling procedures are performed as if the field blanks are samples. To achieve accurate and meaningful data, field blank "sample" containers are filled at the sampling site, not after returning to the field laboratory.

Two general classifications of contamination exist; random and systematic. Random contamination causes imprecision in analytical results as noted by significant differences between results of duplicate analyses. Systematic contamination generally results in consistent shifts in baseline concentrations; this is demonstrated through the use of field blanks. Systematic contamination is much easier to eliminate and to address when interpreting the data. The best way to restrict contamination of the systematic type is to treat every sample, blank, or replicate identically. The vast majority of contamination of this type occurs at trace levels.

Sources of possible sample contamination exist including the following: contaminated sample containers; unclean glassware and filters; impure solvents and reagents; use of cleaning products inappropriate for the proposed analysis; inadequate rinsing of glassware during the cleaning process; and inadequate pre-sample rinsing (the sample bottle should be rinsed two to three times with small volumes of the sample before the bottle is filled to overflowing). Pre-sample rinsing is not possible for certain parameters when pre-preserved bottles are used. Hair, tobacco smoke, and dust are also appreciable sources of contamination, so sampling should be conducted in as careful a manner as possible.

Before filtering samples, the filter paper should be rinsed with deionized or distilled water and with a small portion of sample. The filtration apparatus should also be rinsed with deionized or distilled water between samples. Handle filter paper only on the edge, using appropriate forceps (plastic for trace metals analysis, metal for organic analysis).

Use the proper sample container for the parameter specified. Trace metals samples must not come into contact with any metallic surface; samples for organic analysis must not come into contact with any plastic surface.

5.3.3 Cleaning Procedures for Sample Containers

Immerse glassware in a solution of synthetic detergent. Scrub it with a brush, rinse it several times with tap water, and then with deionized water. Glassware for samples to be analyzed for trace metals may also require treatment with hot nitric and hydrochloric acids (see SOP 4013). Glassware for samples to be analyzed for organic analysis may also require solvent rinses and baking (see SOP 3001).

5.3.4 Sample Receipt and Handling

Sample receipt and handling procedures at SVL are based upon the CLP guidelines to ensure efficient generation of high quality analytical results. SVL SOPs cover all sample handling procedures and are easily accessible to the sample custodian and staff.

5.3.4.1 Requesting Analysis

A request for analysis shall be completed by the field personnel. It is imperative that the Order for Analytical Services (SVL's is in the form of a chain-of-custody, see example located in Appendix A) or an equivalent be provided which defines analytical requirements and enables the lab to meet sample holding times.

5.3.4.2 Chain-of-Custody

Laboratory custody conforms to procedures established for the USEPA Contract Laboratory Program (CLP). Improper sample and data handling and inadequate chain-of-custody procedures affect the credibility and acceptability of analytical results, regardless of their accuracy and precision. Therefore, it is essential that all samples be properly collected, handled, and analyzed. It is imperative that a chain-of-custody be maintained to document the proper processing of samples, from the time of collection to the time of analysis. Use of a Chain-of-Custody or an equivalent form is required to document this process.

All pertinent information is obtained and recorded on the chain-of-custody (as filled out by the field/sample collectors). At a minimum, the following information is recorded: sampling conditions, date and time of sample collection, type of sampling device, type of sample container, number and size of samples and other information required by the laboratory for proper sample handling and analysis. To prevent tampering, sample seals may be used.

5.3.4.3 Sample Handling

SVL is in communication with a client designated individual (designee) as necessary throughout the process of sample scheduling, shipment, analysis and data reporting to ensure that samples are properly processed. This communication includes immediate notification of the designee of anomalies and irregularities with samples or sample paperwork which is received by SVL and discrepancies or problems encountered in sample analysis that will affect the data produced.

A temperature reading is taken by the SVL sample custodian for all sample shipping containers (coolers) upon initial receipt and opening. Each sample is checked for visible damage and the presence of an intact custody seal. Each sample is assigned a unique sample identification number batched with other samples which have been received from the same client and assigned a Job number (for details, please see the next paragraph). After initial sample check-in and generation of sample labels, additional sample/client information is logged into SVL's laboratory information management system (LIMS). Samples are stored in a secured area.

100001 Client: Client Sample ID SVL JOB #: 90001 Recv Date: 01/15/00

Figure 5-1 Sample Label

Client Sample ID SVL #: 00001 Matrix: WATER JOB #: 60001 Case #: XXXX SDG #: XXXXXXXXXX ICAP ANALYZE BY: 02/2/00

Figure 5-2 Digestate Label

Each batch of samples received at SVL is given a unique job number (e.g., "90001"). This job number remains with the sample throughout the analytical process. Each sample is also given a unique, sequential laboratory identification number (e.g., "200001"). The sequential nature of the laboratory identification numbers allows for quick identification of job and sample status during the analytical process. Samples are labeled with sample and Job identification numbers before being stored. For labeling examples, see Fig. 5-1. Identification labels are also affixed to digestates which contain information pertinent to analysis (for example, see Fig. 5-2).

5.3.4.4 Sample Storage and Security

Samples which require refrigeration are stored in a walk-in cooler at 4 ± 2 °C, except at times of sample preparation or analysis. Samples which do not require refrigeration are stored in a sample storage annex. Samples are retained at SVL for a minimum of 30 days (or longer if required by the client) after a data report is issued to the client. At the end of the specified period, samples are returned to the client or discarded according to the procedures outlined in the SOP SVL 1001.

5.4 Reagents, Standards, Gases, and Water

In an effort to keep contamination to a minimum, SVL recognizes the importance of using quality materials in the analytical process. Detailed below are descriptions of the procedures practiced at SVL to maintain contaminant free reagents, standards, gases, and water.

5.4.1 Reagent Chemicals

The most significant source of sample contamination for trace metal and organic analyses results from the acids and solvents used in digestion and extraction, respectively. To minimize this potential for contamination, SVL uses BAKER INSTRA-ANALYZED™ or better grade reagents for all environmental analyses. Solvents used for organic analyses are of GC grade purity.

Analysts are trained in the proper procedures for handling reagents to avoid accidents and contamination. The practice of these few simple rules will prevent bulk contamination: scoopulas, spatulas, pipettes are never used in reagent bottles; an approximate amount of reagent required is dispensed into a secondary vessel; reagents are never dispensed directly from the reagent container; and excess reagent is discarded, not returned to the bottle.

5.4.2 Standards

The sources and quality of all standards, reagents, and chemicals used by SVL are documented. A record is maintained which indicates the name of the person preparing a standard, the source of the standard being used, weight or volume measurements, units, and dilutions. A separate laboratory equipped with sink and hood is dedicated to standard preparation. Standards are not stored in either the standard preparation or sample storage areas.

External reference standards are routinely obtained from commercial sources. A Certificate of Analysis is required. These standards are used to check and document the concentration of calibration standards and for method validation.

5.4.3 Laboratory Gases

All carrier, oxidant, and fuel gases used by SVL meet or exceed instrument manufacturers' specifications. Gases are stored in a remote, secure area of the laboratory. Appropriate precautions are taken to prevent attaching incorrect cylinders to manifold systems. Each manifold is labeled and used for one type of gas only. Carrier gas supply lines for organic analyses include in-line purifier traps.

5.4.4 Laboratory Water

The primary general use water in the laboratory is furnished by a reverse osmosis system followed by a micropore filter with an ion-exchange resin cartridge. This satisfies the specifications of ASTM Type II water. When Type I (16.67 MΩ-cm) water is required, SVL uses a four-cartridge ion-exchange system. Reagent water used for organic analyses is obtained via a Nano-Pure™ water purifier system. This water source is regularly screened for method specific contaminants.

5.5 Calibration and Maintenance of Analytical Equipment

The following are descriptions of key instruments of concern which detail the routine calibration and maintenance procedures employed at SVL.

5.5.1 Analytical Balances

The calibration of each balance is checked each day of use with a single class "A" weight and weekly with a set of three class "A" weights. The balances are checked monthly with three Class "S" weights. They are calibrated annually by an independent contractor. Upon completion of this annual calibration, a calibration status label is affixed to each balance.

5.5.2 UV/Visible Spectrometers

Spectrometers are operated in accordance with the manufacturer's instructions. Calibration of these instruments is performed annually by an independent contractor. In addition the following steps are taken to ensure instrument control: Instruments are checked for proper wavelength and optical alignment, all absorption cells are optically matched and kept scrupulously clean, free of scratches, fingerprints, smudges, and evaporated film residues. Method specific verification or confirmation is performed as prescribed by each method.

5.5.3 Atomic Absorption Spectrometers

Maintenance of Atomic Absorption Spectrophotometers is performed according to manufacturer's recommendations and recorded in an instrument specific maintenance logbook. Calibration curves are established from analysis of three standards. The initial calibration verification (ICV) is made from a second source standard. A continuing calibration blank (CCB) and a continuing calibration verification (CCV) are analyzed at a frequency of 10%.

5.5.4 Inductively Coupled Plasma Spectrometers

Maintenance of the Inductively Coupled Plasma Spectrometers is performed according to manufacturer's specifications and recorded in an instrument specific logbook. The calibration procedure includes the establishment of a two point calibration curve, a CCB, CCV, and a second source ICV. Check samples are performed at a frequency of 10%.

5.5.5 Ion Chromatographs

The Ion Chromatographs are operated in accordance with manufacturer's instructions. The instrument is calibrated with a minimum of four standards after maintenance of the instrument and after significant retention time drift. The calibration curve is verified daily with a standard from an independent source. In addition, a CCB and a CCV are performed at a frequency of 10%.

5.5.6 Gas Chromatographs

Operation and maintenance of the various Gas Chromatographs are detailed in standard operating procedures (SOPs). Recommended manufacturer's maintenance schedules are followed and documented in the instrument-specific logbooks. A routine GC & GC/MS calibration consists of: an initial multi-point calibration to establish the calibration curve, a daily or continuing calibration to verify the calibration, and a calibration verification at the end of the analytical sequence. The frequency of the continuing calibration for the GC is, at a minimum, once every twenty samples. Continuing calibration for the GC/MS occurs at least every twelve hours.

5.6 Quality Control Parameters

SVL offers three levels of data report packages. A Level 1 report consists of analytical results; associated QC data are not included in this report. A Level 2 report consists of a standard report of analytical results with associated QC data (blank, replicate, spike, and control standard, as appropriate). A Level 3 report is virtually identical to a USEPA CLP data package.

5.6.1 Blanks

Preparation blanks are analyzed with every batch of twenty or fewer samples or each matrix type, whichever is more frequent. A preparation blank consists of laboratory pure water that is processed through all procedures, materials, and labware used for sample preparation and analysis. In cases of non-aqueous samples, reagent blanks serve as preparation blanks. Sample batches that contain contaminated blanks are routinely re-prepared, if sufficient sample remains.

5.6.2 Laboratory Control Samples

A laboratory control sample (LCS) is a sample of known value, usually from a source different from the calibration standards, used to validate the analytical procedure. One LCS is analyzed with every batch of twenty or fewer samples or each matrix type, whichever is more frequent. Sample batches containing LCS's that are out of control limits are re-analyzed, if sufficient sample remains. Control limits for solid LCS's are set by the supplier. Water or other aqueous LCS's have control limits of 80% to 120%, or as specified in the standard operating procedure.

5.6.3 Sample Replicates

These are aliquots made in the laboratory of the same sample, each aliquot is treated exactly the same throughout the analytical method. The relative percent difference (RPD) between the values of the duplicates, as calculated below, is taken as a measure of the precision of the analytical method.

$$RPD = \frac{|S - D|}{(S + D) \div 2} \times 100$$

where RPD = Relative Percent Difference
S = First Sample Value (original)
D = Second Sample Value (duplicate)

One duplicate sample or matrix spike duplicate is analyzed with every batch of twenty or fewer samples or each matrix type, whichever is more frequent. The tolerance limit for RPD is typically less than 20%. However, the duplicate is also a measure of the homogeneity of the sample matrix. An abnormally high RPD may be an indication of a non-homogeneous sample.

5.6.4 Check Standards and Controls

A check standard is prepared in the same manner as a calibration standard. The concentration is usually mid-range for the specific calibration curve. Controls are used to validate an existing calibration curve, and also typically fall mid-range on the calibration curve. The control is from a different source than that of the calibration standards or check standard. The USEPA CLP program identifies a "control" as the "initial calibration verification standard" (ICV) and the "check standard" as the "continuing calibration verification standard" (CCV). Check standards are run at a frequency of 10%. The check standard provides information on the accuracy of instrumental performance and response consistency independent of sample matrix and preparation.

For organic analysis, a calibration check standard is analyzed at regular intervals as specified by the method, usually every twelve hours of run time. The results of the calibration check standard are evaluated to ensure that instrument calibration is within acceptable limits. This standard solution is prepared from the same reference materials as the initial calibration standards.

5.6.5 Matrix Spikes and Surrogates

A matrix spike is prepared by adding a known amount of a pure compound to the sample prior to digestion or extraction. The calculated percent recovery of the matrix spike is considered to be a measure of the relative accuracy of the total analytical method, i.e., sample preparation and analytical procedure.

An analytical spike is prepared by adding a known amount of analyte to a digestate or extract of a sample for which the analyte concentration has been determined. This spike reveals the interferences found in the prepared sample matrix. The calculated percent recovery of the analytical spike is considered to reflect the accuracy of the analytical procedure only. Both the matrix spike and the analytical spike are also an indication of the effect of the sample matrix on the ability of the methodology to detect the specific analyte. When no change in volume due to the spike occurs, it is calculated as follows:

$$\% \text{ Recovery} = \frac{(SSR - SR)}{SA} \times 100$$

where SSR = Spiked Sample Result
SR = Sample Result
SA = Spike Added

Tolerance limits for percent recoveries are established by client data quality objectives, but are usually 80-120% or 75-125%. Matrix spike samples are prepared for every batch of twenty or fewer samples.

Surrogates measure extraction or preparation efficiency. They must be a compound not expected to be present in the sample. The recovery of a surrogate compound must meet the control limits specified in the standard operating procedure.

5.6.6 Low Level Standards

As detection limits continue to drop and risk-assessment based criteria are used more frequently, it is increasingly important to have reliable data near the instruments detection limit. Standards at the reporting limit are employed to better assess the quality of data at these concentrations.

5.6.7 Interference Check Samples

For analytes determined by ICP spectroscopy, an interference check sample (ICS) is analyzed at the beginning and at the end of an analysis sequence. This sample consists of elements (usually Ca, Mg, Al, and Fe) at elevated levels to check for interferences due to common matrix elements. In cases where no analyte is present in the ICS, instrumental values should be ±5x the IDL, otherwise the instrumental value should be within ±20% of the true value.

5.6.8 Completeness and Usability

Completeness describes the percentage of measurements that meet quality control acceptance criteria for requested determinations. Percentage completeness is defined by client data quality objectives, but SVL strives for 100% completeness of calibration verification, laboratory control samples, blanks, interference check samples, and low-level standards. For spikes, duplicates, duplicate spikes, and other QC samples that are matrix dependent, SVL follows CLP guidelines to qualify data. Clients may define more rigid acceptance limits and corrective action. A completeness criteria of 90% is used for aqueous matrices, excluding Sb and Ag.

Usability describes the percentage of measurements that can be used for making decisions based on reported values. In many cases, estimated values are sufficient to characterize certain analytes in a sample. We believe the client is the best judge in interpreting the usability of their data and therefore make no attempt to set guidelines for this parameter.

5.6.9 QA Reports

The QA Coordinator shall prepare a written report to the Laboratory Director and technical staff on a quarterly basis. The report will review recurring QA issues, discuss performance evaluation samples, summarize the findings from any internal audits, and summarize issues regarding state accreditations or arising from site visits. In addition, the report will cover recent modifications in QA policy and general lab practices.

5.6.10 Control Charts

Control charts are maintained for Laboratory Control Samples for selected analytes. A standard X bar control chart is used to plot LCS results. Upper and lower warning limits of $\pm 2s$ (where s equals standard deviation) and upper and lower control limits of $\pm 3s$ are calculated with no less than fifteen measurements. An analytical run is considered out of control when: any one point is outside control limits or when any obvious cyclic pattern is seen in the points.

5.7 Audits

The success of any QA program is driven by its ability to monitor the effectiveness of the quality systems in practice.

5.7.1 Performance Evaluations

5.7.1.1 Internal Performance Evaluations

The Quality Assurance Coordinator conducts internal performance evaluations for commonly analyzed parameters. The PE samples are logged-in as double-blinds. Results will be reported to the Laboratory Director.

5.7.1.2 External Performance Evaluations

SVL participates in two WS and and two WP performance evaluation studies each year. We also participate in Soil, DMR-QA, and Underground Storage Tank PE studies. Copies of recent results are available upon request.

5.7.2 System Audits

The Quality Assurance Coordinator conducts an internal system audit each year. These audits provide a thorough overview of implementation of the Quality Assurance Plan within the laboratory.

The Quality Assurance Coordinator prepares an audit plan, with consideration of information gained during previous audits. The audit plan shall define participating auditors, applicable documents, the audit schedule, and the scope of laboratory activities to be audited. The Quality Assurance Coordinator shall use a written checklist of audit questions. Each question must be answered yes, no, or not applicable, and may be accompanied by appropriate comments.

At the close of the audit, a post-audit meeting shall be held to discuss the audit findings. The auditor can close a finding during this discussion if the laboratory staff can satisfactorily demonstrate that the finding is inappropriate.

The Quality Assurance Coordinator shall prepare an audit report for the Laboratory Director which documents the following: date and location of audit; persons contacted in the laboratory; laboratory operations audited; findings requiring corrective action; and a due date for the corrective action plan. Each finding must then be corrected and closed. The Quality Assurance Coordinator shall verify that corrective action has been successful by direct observation.

During the course of system audits, the Quality Assurance Coordinator shall be cognizant of recurring quality issues and trends which could affect quality. Recurring issues and trends should be addressed in the audit report. Correction for such events may require a review of the adequacy of the QAP. If the inherent problem lies within the QAP, the plan shall be amended through appropriate revision of Quality Assurance documents.

5.7.3 Data Audit

The QA Coordinator shall perform a data audit of at least 10 data packages each year. The purpose of the data audit is to alert the QA Coordinator to chronic problems and trends that may be developing. The QA Coordinator performs a complete review of the data contained in the report, verification of the chain-of-custody holding times, and quality control.

5.8 Corrective Action

When a QC parameter fails acceptance criteria during the course of analysis, the analyst or supervisor resolves the problem before reporting data. The supervisor may arrange for service or repair of instrumentation, if needed. For serious problems, the supervisor may report problems to the Quality Assurance Coordinator as a "Quality Issue". The Quality Assurance Coordinator must then document steps taken to resolve the "Quality Issue".

If there is a non-acceptable result in a performance evaluation sample, the Quality Assurance Coordinator works with the analysts and supervisors to discover the cause, and documents the failure as a "Quality Issue". If required, the Quality Assurance Coordinator prepares a corrective action report for accrediting agencies.

If there are findings from an internal audit, the Laboratory Director and supervisors prepare a corrective action plan. The Quality Assurance Coordinator evaluates the corrective action and then verifies that it has been successfully implemented.

5.9 Standard Operating Procedures

It is the policy of SVL to create and maintain standard operating procedures (SOPs) that are useful, accurate, current, and accessible to all employees at SVL. To this end, SVL endeavors to incorporate the input of analysts, staff and/or those most closely involved with the tasks outlined in the SOPs.

To obtain reliable results and ensure reproducibility, SVL generates, distributes and uses accurate and effective SOPs. The appropriate supervisor or director reviews each SOP draft for technical accuracy. The Quality Assurance Coordinator reviews SOPs to ensure that they are in compliance with the appropriate published method, any other applicable regulations, and that they conform to SVL's QA program. In the event that a draft SOP fails to meet any of these requirements, it is denied approval by the QA office, returned to the appropriate personnel for modification.

The numbering system for SOPs is comprised of seven characters: the letters SVL followed by a four digit, unique number in the following categories:
1000 series - Quality Assurance and Safety
2000 series - Sample and Data Management
3000 series - Organic Procedures
4000 series - Inorganic Procedures
6000 series - Mineral Division Procedures

As new procedures are generated, the QA office determines the appropriate category and assigns the next consecutive number for that category.

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6. DATA MANAGEMENT

SVL utilizes state of the art networking software

SVL utilizes state of the art networking software (Novell NetWare® 3.11™ & 4.11™) and hardware to integrate laboratory operations from sample receiving to report generation. Automation and connectivity enables SVL to rapidly process and manage large amounts of data. Network linked PCs are located in analytical laboratories to enable personnel to review data on individual jobs and samples, methods, and SOPs.

Analysts perform specific analyses and enter data onto benchsheets or directly into the computer system depending on the type of report desired by the client. After a set of analyses has been completed, the results are calculated according to the methods specified in the standard operating procedures. The supervisor or director reviews at least 70% of the data and quality control.

Data that will be used to create an USEPA CLP deliverables package is then loaded into a Ward Scientific software program for CLP report generation. After assembly, Contract Compliance Screening software is utilized to screen data packages for completeness and accuracy before delivery to the client. SVL has the capability of providing hardcopy and diskettes. IBM compatible diskettes are available in all EPA CLP formats, as well as popular spreadsheet and database files.

Data that will be assembled into a standard report are loaded into SVL's proprietary Sample Management system. Reports are available in a number of routine and custom hardcopy formats. ASCII, spreadsheet, and database data files are also available. If a client has a specific format, we are usually able to provide data that will merge into their previous records without problems.

All data related to each job are archived for at least 12 months after reports have been issued. This period may be longer or shorter, at the clients discretion.

7. CERTIFICATIONS

SVL maintains current accreditation with several western states

7.1 Drinking Water Accreditations

- Idaho
- Texas
- Montana
- Nevada
- Washington
- California
- Colorado
- Arizona

7.2 Environmental Accreditations

- Nevada
- Washington
- California
- Arizona

Refer to supporting documents section for copies of certificates.

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8. GLOSSARY

Below you will find a list of terms used in this manual and their intended definition

Accuracy The degree of agreement of a measured value with the true or expected value of the quantity of concern.

Aliquot An exact fraction of a solution or suspension.

Bias A systematic error inherent in a method or caused by some artifact or idiosyncrasy of the measurement system. Temperature effects and extraction efficiencies are examples of the first kind. Blanks, contamination, mechanical losses, and calibration errors are examples of the latter kinds. Bias may be both positive and negative, and several kinds can exist concurrently so that net bias is all that can be evaluated, except under special conditions.

Blank An artificial sample designed to monitor the introduction of artifacts into the process. For aqueous samples, reagent water is used as a blank matrix; however, a universal blank matrix does not exist for solid samples, and therefore, no matrix is used.

> **Reagent Blank** Aliquot of analyte-free water or solvent analyzed with the analytical batch. Prep Blanks are reagent blanks which are created at the time of sample preparation using all the reagents used in the preparation of the samples (i.e., digestion, distillation or extraction)
>
> **Method Blank** Reagent blank which are put through all the steps of a specific method along with the samples.
>
> **Field Blank** Randomly selected sample container that is filled with distilled water and the appropriate chemical preservative in the field.
>
> **Trip Blank** A specific type of field blank. A trip blanks is not opened in the field. It is a check on sample contamination originating from sample transport, shipping, and site conditions.

Blind Sample A sample submitted for analysis whose composition is known to the submitter but unknown to the analyst. A blind sample is one way to test proficiency of a measurement process.

Calibration Comparison of a measurement standard or instrument with another standard or instrument to report or eliminate by adjustment any variation (deviation) in the accuracy of the item being compared.

Check Standard A blank which has been spiked with the analyte(s) from an independent source in order to monitor the execution of the analytical method.

Contamination There are two general classifications of contamination; random and systematic. Random contamination causes imprecision in analytical results as noted by significant differences between results of duplicate analyses. Systematic contamination generally results in consistent shifts in baseline concentrations as demonstrated by field, trip or equipment blanks.

CLP The Contract Laboratory Program (CLP) created by the United States Environmental Protection Agency to perform analytical work required in support of Superfund.

Control Limits The limits shown on a control chart beyond which it is highly improbable (within a 99.7 % probability) that a point could lie while the system remains in a state of statistical control.

Control Chart A graphical plot of test results with respect to time or sequence of measurement, together with limits within which they are expected to lie when the system is in a state of statistical control.

Detection Limit The smallest concentration/amount of some component of interest that can be measured by a single measurement with a stated level of confidence.

Double Blind A sample known by the submitter but submitted to an analyst in such a way that neither its composition nor its identification as a check sample are known to the latter.

Duplicate Samples Aliquot taken in the laboratory of the same sample, treated exactly the same throughout the analytical method. The relative percent difference (RPD) between the values of the duplicates, as calculated below, is taken as a measure of the precision of the analytical method. The relative percent difference for original sample and duplicate is calculated as follows:

$$\text{RPD} = \left[\frac{|S - D|}{\left[\frac{(S + D)}{2}\right]}\right] \times 100$$

where
RPD=Relative Percent Difference
S=First Sample Value (original)
D=Second Sample Value (duplicate)

Homogeneity The degree to which a property or substance is randomly distributed throughout a material. Homogeneity depends on the size of the sample under consideration. Thus a mixture of two minerals may be nonhomogeneous at the molecular or atomic level but homogeneous at the particulate level.

Instrument Detection Limit (IDL) The smallest concentration detectable on a specific instrument.

Laboratory Control Sample A material of known composition that is analyzed concurrently with test samples to evaluate a measurement process.

Matrix Spike A sample to which a known amount of analyte(s) has been added. Designed to provide information about the effect of the sample matrix on the digestion and measurement methodology. The spike is added prior to sample extraction/digestion and analysis. Individual component sample recoveries are calculated as follows:

$$\%\text{Recovery} = \left[\frac{(SSR - SR)}{SA}\right] \times 100$$

where
SSR = Spiked Sample Result
SR = Sample Result
SA = Spike Added

Mean The sum of all observations divided by the number of observations.

Method An assemblage of measurement techniques and the order in which they are used.

Method Detection Limit (MDL) The smallest concentration detectable by a specific method (the standards used for this determination are carried through all the steps required by the method).

Performance Audit A process to evaluate the proficiency of an analyst or laboratory by evaluation of the results obtained on known test materials.

Precision The degree of mutual agreement characteristic of independent measurements as the results of repeated application of the process under specified conditions.

Procedure A set of systematic instructions for using a method of measurement or sampling or the steps or operations associated with them.

Quality Assurance A system of activities which the purpose is to provide to the producer or user of a service the assurance that it meets defined standards of quality.

Quality Control The overall system of activities whose purpose is to control the quality of a service so that it meets the needs of users.

Relative Standard Deviation The standard deviation divided by the mean and multiplied by 100.

$$RSD = \left[\frac{s}{x}\right] \times 100$$

Sample A representative sample of any material (aqueous, nonaqueous, or multimedia) collected from any source for which determination of composition or contamination is requested or required.

Standard Operating Procedure A procedure adopted for repetitive use when performing a specific measurement or sampling operation. It may be a standard method or one developed by the user.

Subsample A portion taken from a sample. A laboratory sample may be a subsample of a gross sample; similarly, a test portion may be a subsample of a laboratory sample.

Standard Deviation The positive square root of the variance (i.e., σ for populations and s for a sample set of the population). A measure of the average spread around the mean.

Variance The value approached by the average of the sum of the squares of deviations of individual measurements from the mean. Mathematically, it may be expressed as:

$$\frac{\sum (X_i - m)^2}{n} \rightarrow \sigma^2 \text{ as } n \rightarrow \infty$$

Ordinarily, it cannot be known but only its estimate s^2, which is calculated by the expression:

$$s^2 = \frac{\sum (X_i - X)^2}{n - 1}$$

Warning Limits The limits on a control chart within which most of the test results are expected to lie (within a 95% probability) while the system remains in a state of statistical control.

A

APPENDIX

Supporting documents

LYTLE WATER SOLUTIONS, LLC

MEMORANDUM

TO: Larry Fiske
Senior Manager Legacy Sites, Newmont Mining Corporation

FROM: Bruce A. Lytle

SUBJECT: Design and Operation of the Monitoring System Network at the Lined Tailings Facility and Collection Pond

DATE: April 9, 2013

PROJECT NO: 1006-04

Design and Attendant Operation of the Monitoring System Network

A comprehensive ground water monitoring network is in place at the San Luis Mine site to detect potential releases of water from the lined tailings facility (LTF) and collection pond. Other than some shallow colluvial material (and alluvium in the channel bottom), the uppermost stratum beneath these facilities is the Santa Fe Formation.

There are two distinct types of monitoring equipment located downgradient of the LTF and collection pond. First, there are several monitoring (M-series) wells that are completed at various horizons within the Santa Fe Formation to monitor potential fluid movement through the permeable zones within the Santa Fe Formation. These M-series wells have been completed in both the upper portions (which are unsaturated) and the lower strata (which are saturated) of the Santa Fe Formation.

Figure 1 shows the location of the M-series monitoring wells. As this figure shows, monitoring wells M-6, M-7R, M-8, and M-9 are located downgradient of the collection pond (west). The boreholes for these monitoring wells were drilled in 1989 and, at the time of drilling and throughout the subsequent monitoring period, wells M-6, M-7R, and M-8 have not had a measured water table. Well M-6 is 35 feet deep, well M-7R is 45 feet deep, and well M-8 is 135 feet deep. Only well M-9 (which is 213 feet deep) has historically had a measured water table, ranging from approximately 140–145 feet. As these historic water level data over a period of 20 years show, there is no local ground water beneath either the LTF or the collection pond until at least a depth of approximately 140 feet.

Similarly, well M-12 (located south of the collection pond, Figure 1) is 220 feet deep, and water levels in this well have historically been observed to be in the range of 175 to 180 feet in depth over the data collection period. There is a similar situation with well M-13R, which is located east of the collection pond (Figure 1) and is completed to a depth of approximately 175 feet. Historic water levels in M-13R have ranged from approximately 130–135 feet. Well M-14, also located just east of the collection pond (Figure 1), is 180 feet deep, with historic water level depths that have generally ranged from 135–140 feet. Given the relatively thick unsaturated zone beneath the LTF and collection pond, and only minor ranges of water level fluctuations over time, there is no indication that there has been any measurable release from either facility.

Water quality data collected from the M-series monitoring wells since the early 1990s further demonstrate no water quality degradation with time in any of the monitoring wells. These water quality data, coupled with the water level data from the monitoring wells, are further evidence that there has been no excursion of fluids from either facility.

The second type of monitoring equipment is the porous-cup lysimeters that are completed in the vicinity of the collection pond (L-series). These lysimeters are designed to extract water quality samples from the unsaturated zone if there is sufficient water above specific retention, but below specific yield, which can be drawn into the porous-cup lysimeters by creating a pressure differential in the near-vicinity soils to the porous cup. These lysimeters vary from the unsaturated zone monitoring wells, in that the lysimeters can actively attempt to collect samples from the unsaturated zone, while monitoring wells completed in the unsaturated zone will only collect samples if those strata subsequently become saturated.

The lysimeters were installed to monitor potential flow horizons in the shallow unsaturated zone in the Santa Fe Formation. As such, when the lysimeters were installed in 1991, boreholes were initially drilled to log the geologic strata. When significant clay layers were encountered, a lysimeter was installed above this low-permeability barrier so that unsaturated flow in these zones could potentially be sampled by the lysimeters. Three pairs of lysimeters were installed pursuant to the terms and conditions in BMRI's decree in Case No. 89CW32. At each lysimeter location, a shallow and deep lysimeter were installed. At location L-1, the shallow lysimeter was completed to a depth of 27 feet and the deep lysimeter was completed to a depth of 50 feet. At location L-2, the shallow lysimeter was completed to a depth of 24 feet and the deep lysimeter was completed to a depth of 50 feet. At location L-3, the shallow lysimeter was completed to a depth of 22 feet and the deep lysimeter was completed to a depth of 36 feet. While the procedures for sampling these lysimeters have been followed since the time of their installation, no water has been present in any of the lysimeters since the time of their installation, demonstrating that there is no unsaturated flow movement in the vicinity of the lysimeters. This further shows that there has been no measurable release of water from either the LTF or the collection pond.

The wells and lysimeters collectively monitor multiple strata in the Santa Fe Formation, from 22 to 213 feet, so any measurable excursions within this stratigraphic section would have been detected by some of the monitoring system, yet no excursions have been detected to date. This is indicative of no past, or current, ground water quality issues associated with the LTF and collection pond.

Monitoring as an Early Warning System

The locations of the M-series monitoring wells and the L-series porous-cup lysimeters are shown in Figure 1 relative to their proximity to the LTF and collection pond. It should be noted that the general topography and expected ground water flow gradient is generally from east to west; therefore, all of these monitoring locations are situated downgradient of the BMRI facilities in this sub-drainage basin, and are located in the appropriate places to provide an early warning detection system for identifying potential future ground water impacts.

There are a number of factors which demonstrate why the current monitoring network provides an effective early warning system that would allow ample time for implementing an appropriate response, should an issue ever arise. These include:

(1) There is a thick unsaturated zone beneath the LTF and collection pond;
(2) If there were to be an excursion of fluids from either facility, there would have to be a major release to create saturated flow conditions, since the soils are likely currently at or below specific retention;
(3) Even if saturated flow conditions were established, the hydraulic conductivity of the Santa Fe Formation is such that there would be very slow ground water seepage velocities;
(4) The monitoring system would then be able to detect this potential flow long before it reached the mine site boundary due to its slow movement; and
(5) If necessary, a site-specific remediation plan could be designed and implemented without the loss of fluids beyond the BMRI property boundary.

To demonstrate the thick unsaturated zone beneath the LTF and collection pond, we have constructed a geologic cross-section from the logs obtained from the monitoring wells completed in the vicinity of these facilities. Figure 1 shows the location of cross-section A-A', while the actual cross-section is presented in Figure 2. The Santa Fe Formation is characterized by generally low-permeability strata that are significantly layered, which will tend to impede the downward flow of ground water. As such, any ground water that would be found in the higher-permeability strata would likely move more laterally than vertically. As cross-section A-A' shows, these various strata are being monitored by the downgradient well and lysimeter monitoring system. Based on the data we have available to us, the unsaturated zone beneath the BMRI facilities is approximately 95 to 180 feet thick, providing a large buffer to the actual saturated aquifer that is part of the Santa Fe Formation.

Even if there were some excursion of fluids from either of the BMRI facilities, the Division of Minerals and Geology (now Division of Reclamation, Mining, and Safety) concluded in an April 14, 1992 memorandum that, given the design of the LTF, the water moisture content below specific retention, hydraulic properties of the Santa Fe Formation, and assumed EPA leakage criteria through a synthetic liner, "the San Luis Project tailings impoundment seepage rate is low enough that it will not induce unsaturated flow in the underlying material, hence any pollutants that seep through the liner would not reach the water table." We believe that this conclusion is even more valid today, as there is less free water in the LTF than there was at the time of mining, the tailings deposition has resulted in a thicker layer of lower-permeability material over the liner, and there is less hydraulic head on the liner than there was when the calculations were made in the April 14 memorandum.

The estimated ground water seepage velocity in the Santa Fe Formation beneath the LTF was calculated as part of Technical Revision 15. Data were provided that the average hydraulic conductivity was 4.4×10^{-4} centimeters per second, with a formation porosity of 20 percent and a ground water hydraulic gradient of 0.052 foot per foot. Given these data, the ground water seepage velocity would be approximately 0.32 foot per day, or 118 feet per year. This is a relatively slow ground water velocity and would allow changes in ground water flow to be detected during the routine sampling of the monitoring well network downgradient of the LTF and collection pond.

As Figure 2 shows, the monitoring well network that has been in place, and has been monitored since the early 1990s, provides detection capabilities in both the unsaturated and saturated zones of the Santa Fe Formation downgradient of the LTF and collection pond. As summarized in Technical Revision 32, each of the M-series wells below the LTF and collection pond are sampled on a quarterly basis, and the L-series lysimeters are sampled on a quarterly basis.

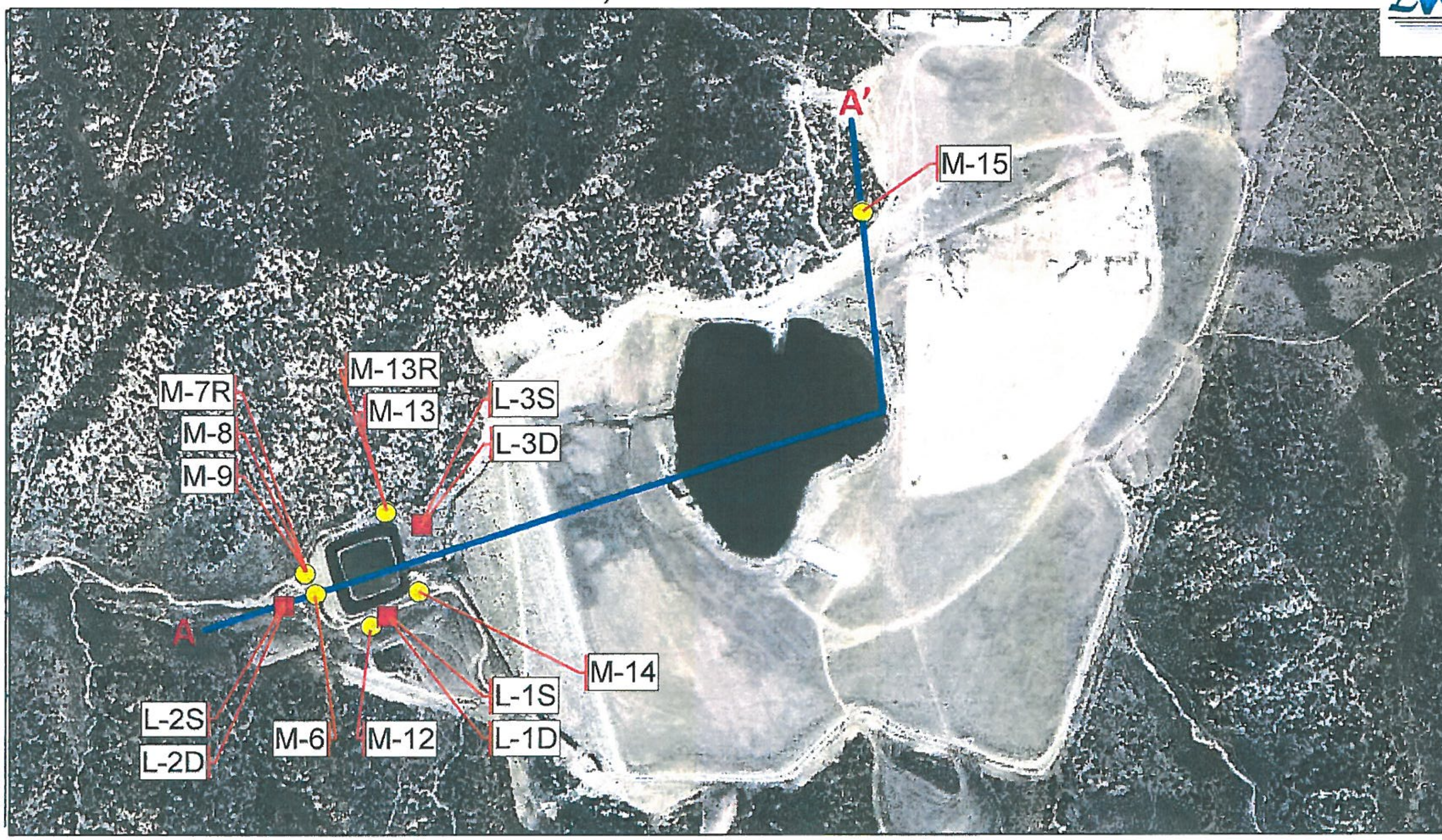
Because the ground water is moving at less than 1 foot per day and just a little more than 100 feet per year, there would be adequate time to react to any potential excursion long before any potential downgradient impacts.

SUMMARY

The LTF and collection pond facilities were designed to contain both the mine tailings and water discharged to the LTF. These facilities were permitted through the Colorado Mined Land Reclamation Board and have consistently operated as designed. Contrary to Costilla County allegations that these facilities were never designed to contain water, they were, in fact, designed to contain large volumes of water, including the runoff from the probable maximum precipitation event.

While the design of the facilities minimizes the potential for excursion of fluids from the facilities, there is also an extensive monitoring well network which serves as an early detection system should there be any escape of fluids from the facilities. Given the very thick unsaturated zone underlying these facilities, the fact that none of these unsaturated strata have developed a water table over more than 20 years of operation, and that the water quality data do not indicate any significant shifts or trends in water quality that would indicate a new source of water, there is no evidence of any loss of fluids affecting the natural environmental downgradient of the BMRI facilities.

LYTLE WATER SOLUTIONS, LLC



LEGEND

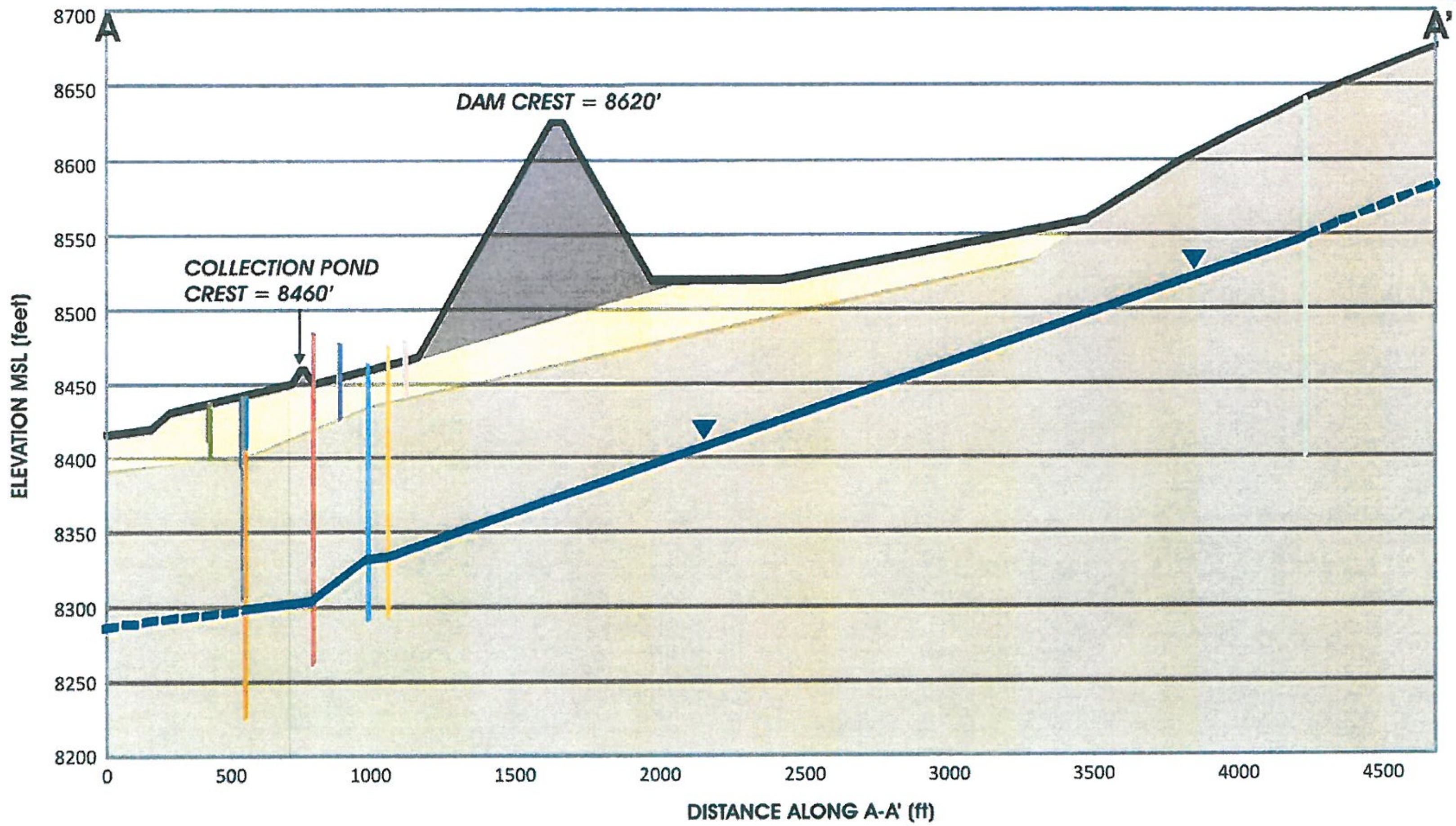
- MONITORING WELLS
- LYSIMETERS
- CROSS-SECTION A-A"

N

0 610 ft

BATTLE MOUNTAIN RESOURCES, INC.		
MONITORING WELLS AND LYSIMETERS NEAR LINED TAILINGS FACILITY		
File Name: Wells&Lysimeters.cdr		Date: 04/06/2013
Project No.: 1006-04	Drawn By: VAL	Fig. No.: 1

LYTLE WATER SOLUTIONS, LLC



LEGEND

L-1S, L-1D, L-2S, L-2D, L-3S, L-3D, M-6, M-7R, M-8, M-9, M-12, M-13, M-14, M-15

GROUND SURFACE PROFILE

STATIC WATER LEVEL

MANMADE FILL

ALLUVIUM

SANTA FE FORMATION

BATTLE MOUNTAIN RESOURCES, INC.		
CROSS-SECTION A-A' THROUGH TMF AND COLLECTION POND		
File Name: X-Sect_A-A'-TMF.cdr		Date: 04/06/2013
Project No.: 1006-04	Drawn By: VAL	Fig. No.: 2