APPENDIX B

QUALITY ASSURANCE PROJECT PLAN

1.0   QUALITY ASSURANCE PROJECT PLAN

This Quality Assurance Project Plan (QAPP) specifies project management and organization, identifies the procedures used to assure the accuracy, precision and representativeness of the data collected and assures the procedures provided in the FSP are implemented so that the project Data Quality Objectives (DQOs) are achieved. The QAPP presents an overall description of the methods, responsibilities and procedures associated with the field characterization and construction activities at the Golden Butte Mine and Easy Junior near Ely, Nevada. Accordingly, this QAPP reflects MWH's current corporate standards and procedures for the implementation of these investigations, appropriate regulatory requirements and methods that have developed through experience on similar environmental programs.   It is the responsibility of all project personnel either performing or overseeing sampling and analysis activities to adhere to the requirements of this QAPP and supporting project-specific documents.

1.1   PROGRAM MANAGEMENT

1.1.1 Project Organization

Effective project management is key to implementation of the sampling and analysis program. It provides all parties involved with a clear understanding of their role in the investigation and provides the lines of authority and reporting for the project. Key positions and associated responsibilities are outlined below.

Bureau of Land Management Project Manager – Lynn Bjorkland
- Review and approve work plan and deliverables
- Review project technical and data reports
- Provide project oversight

United States Army Corps of Engineers Project Manager – Kim Mulhern
- Assure delivery of data and project deliverable to BLM
- Issue and oversee contractual issues
- Review project technical and data reports
- Provide project oversight

MWH Technical Manager – John Redmond
- Provide oversight of all technical deliverables
- Implement necessary actions and adjustments to accomplish project objectives

MWH Project Quality Assurance Manager – Jay Pennington
- Work closely with the Technical Manager to assure that data are available on time
- Assure that the appropriate field QA samples are collected per project SOPs
- Receive laboratory deliverables and pertinent field data
- Coordinate and oversee electronic data management system

MWH Field Coordinator – Steve Arington
- Assure sampling events are completed and all necessary data are collected
- Verify QA procedures are followed during sample collection and construction
- Report difficulties/complications in sample collection or construction to Technical Manager
- Assure chain-of-custody forms and field books are filled out properly

Analytical Laboratory(s)
- Responsible for off-site analysis of samples
- Deliver analytical results in a timely manner
- Calibrate and maintain laboratory equipment
- Conduct internal QA/QC procedures
- Notify QA Manager when problems occur
- Assure data and QA information are properly recorded
- Assure all custody records are properly completed and handled

1.1.2 Special Training Requirements/Certification

All personnel who enter an abandoned mine site must recognize and understand the potential hazards to health and safety associated with the site. Employees working on sites exposed to hazardous substances, health hazards, or safety hazards; their supervisors; and management responsible for the site will, at all time of assignment to the field, meet at a minimum the Occupational Safety and Health Administration (OSHA) hazardous waste site workers 40-hour training requirement. Additional training requirements specified in the Health and Safety Plan (Appendix C) will be completed as necessary. In addition, personnel responsible for operating mechanical equipment, including pumps, generators, and mixing equipment, will receive the necessary operating instruction on that equipment. Sampling personnel will be trained in the of use industry-standard practices. A qualified geologist or engineer will provide sampling oversight.

1.1.3 Problem Definition and Background

The Golden Butte and Easy Junior Mines are abandoned mine sites in northeastern Nevada located on public lands administered by the Bureau of Land Management. Planning for reclamation activities at the sites are being conducted as part of the Restoration of Abandoned Mine Sites (RAMS) program. The objective of the Work Plan will be to stabilize potential mine source components (e.g. waste rock and heap materials) and prevent degradation of waters of the State.

1.1.4 Project Description

Field monitoring and sampling will be conducted to support construction activities. The purpose of the field monitoring and sampling will be to ensure the implementation of the Final Closure Plan and to ensure that construction elements of this Work Plan are completed to specifications. Construction elements at Golden Butte are listed below.

- Regrade of Crushed Ore and Run-of-Mine Heap Leach pads
- Place cover on Crushed Ore and Run-of-Mine Heap Leach pads
- Construct draindown collection structure and piping to evaporation basins
- Construct basic and enhanced evaporation basins
- Construct infiltration field
- Demolition of facility foundations and disposal of site debris in Fresh Water Pond (landfill)
- Close Fresh Water Pond
- Install lysimeter in Crushed Ore Heap Leach Pad
- Sample sludges in Run-of-Mine and Crushed Ore ponds
- Sample soils near diesel storage area for TPH
- Revegetate disturbed areas
- Revegetate waste rock as necessary

Construction elements at Easy Junior are listed below.

- Regrade, cover and seed the heap leach pad
- Close process ponds
- Characterize solids in Settling Pond
- Repair infiltration field
- Demolition and disposal of site facilities
- Construction and closure of on-site landfill
- Reclamation of waste rock pile

1.1.5   Criteria for Measurement Data

Two types of measurement data will be collected as part of construction activities. Onsite measurements as part of compliance monitoring and offsite measurements of field samples performed by an offsite laboratory facility.

MWH will utilize an NDEP-certified laboratory(s) or equivalent to analyze samples collected at the Golden Butte Mine. The laboratory and its staff have the responsibility to process all samples submitted according to the specific protocols for sample custody, holding times, analysis and associated laboratory quality assurance. Designated laboratory personnel will maintain contact with the Project QA Manager to assure that internal laboratory DQOs are achieved. Laboratory DQOs are defined in terms of accuracy and precision. Accuracy and precision will be assessed through the use of field quality assurance samples and consistent laboratory practices.

Onsite measurements include surveying, field measurements and material certification. All survey measurements will be referenced to existing survey control points and will have an horizontal accuracy of +/- 0.5 foot and a vertical accuracy of +/- 0.1 foot. Field measurements of material thickness and structural dimensions will be made using standard engineering measurement tapes and will be measured to the nearest 0.1 foot. Total amount of each amendment and seed mixture shall be recorded for each area revegetated. Certification of material purchased from suppliers shall be provided by the material supplier.

1.1.6   Data Quality Objectives (DQOs)

DQOs are a series of statements that define the type and quality of samples that will be collected during field work, clarify the objectives of the sampling effort and specify acceptable limits of uncertainty. DQOs are quantitative and qualitative statements that specify the quality of the data required to support decisions during the project. The DQOs were developed following the guidance contained in the document *USEPA Guidance for the DQO Process*, USEPA QA/G-4 (USEPA/600R-96/055).

Project objectives have dictated the sampling and analytical methods and QA/QC procedures that will be followed. The DQO approach was developed by the USEPA as a tool to aid planning and decision-making related to the data collection. A primary objective of this QAPP is to ensure that the collected data are of sufficient quality to support remedial decision-making. The seven-step process for developing DQOs and their remedies is presented in Table B.1, *Data Quality Objectives*.

1.2 MEASUREMENT/DATA ACQUISITION

1.2.1 Sample Handling and Custody Requirements

Sample handling and chain-of-custody procedures will be strictly adhered to during sample collection, transportation and laboratory handling to assure the identity of the samples. Improper sample and data handling and inadequate chain-of-custody procedures affect the credibility and acceptability of analytical results, regardless of their accuracy or precision.

All samples will be appropriately labeled with pre-prepared labels. Each label will include the job number and project name, time and date of collection, sample depth, sample identification number, preservative (if applicable), analyses to be performed, and the initials of the sampler.

TABLE B.1 DATA QUALITY OBJECTIVES			
Task	**DQO Step**	**Investigation Statement**	**Work Plan Reference**
Pond Sediment Sampling	State the Problem	Chemical characteristics of sediments in the Barren, Crushed Ore and Run-of-Mine Ponds at Golden Butte are unknown.	Section 4.1
	Identify the Decision	What are the chemical characteristics of the sediments is the process ponds? Are the current plans for containment of the sediments within the ponds consistent with the chemical characteristics?	
	Identify Inputs to the Decision	Analytical results for samples collected from the ponds will be compared to applicable federal and state regulations.	
	Define the Study Boundaries	All sediments are contained within the Barren, Crushed Ore and Run-of-Mine Ponds at the site.	
	Develop a Decision Rule	All sediments will remain within the ponds as currently contained and will be incorporated into the base fill for evaporation systems or closed in place within the pond..	
	Specify the Limits on Decision Error	Limits on analytical error are the internal laboratory DQOs including control limits for MS/MSD and LCS percent recovery, surrogate percent recovery, and detection limits.	
	Optimize the Decision	By collecting one sample from each process pond, sufficient data are expected to be generated to meet the DQOs.	
Borrow Source Analysis	State the Problem	Borrow soils used in cover construction must be substantially similar to soils identified during site characterization.	Section 4.2
	Identify the Decision	Is the borrow soil acceptable as cover material or should other borrow sources be utilized or the cover design modified.	
	Identify Inputs to the Decision	Basic grain size and soil classifications tests will be performed on soils collected from the borrow area prior to cover placement and during cover placement. Data will be compared to results presented in the *Final Closure Plan* (MWH, 2003).	
	Define the Study Boundaries	Potential borrow sources are displayed in the *Final Closure Plan* (MWH, 2003). Additionally, borrow source BS-04 located between the Crushed Ore and Run-of-Mine Heap Leach Pads may be used.	
	Develop a Decision Rule	Acceptability of the borrow source material will be based on the available laboratory data and the professional judgement of the field technician and project engineer.	
	Specify the Limits on Decision Error	Limits on decision errors cannot be assessed for qualitative decisions that rely on the professional judgement of the field technician and project engineer. Limits on analytical error are the internal laboratory DQOs	
	Optimize the Decision	Samples collected before and during cover construction are expected to provide sufficient data to meet the DQOs	

TABLE B.1 DATA QUALITY OBJECTIVES			
Task	**DQO Step**	**Investigation Statement**	**Work Plan Reference**
TPH in Soils Analysis	State the Problem	Soils potentially contaminated with hydrocarbons are expected to exist in the area of the diesel tank pads at both sites. Visibly contaminated soils will be removed prior sampling. Sampling will be conducted to confirm that all contaminated soils have been removed.	Section 4.3
	Identify the Decision	Have all contaminated soils been removed?	
	Identify Inputs to the Decision	Lab analysis for TPH of soil samples collected from removal areas.	
TPH in Soils Analysis (cont.)	Define the Study Boundaries	All samples will be collected from areas in the vicinity of the diesel tank pad where soils were removed due to visible hydrocarbon staining.	
	Develop a Decision Rule	If TPH concentration exceeds 100 mg/kg in any sample. Further material will be removed from the area and another sample will be submitted to the laboratory	
	Specify the Limits on Decision Error	Limits on analytical error are the internal laboratory DQOs.	
	Optimize the Decision	Sampling of potentially contaminated areas following removal of material is expected to provide sufficient data to meet the DQOs	

The chain-of-custody record (COCR) will be initiated by the field sampling personnel upon collection of a sample and will accompany each shipping container. The sampling personnel will retain a copy of the COCR and send the original with the sample shipment.

Samples will be properly packaged in shipping containers to ensure the integrity of the samples. Samples will be transported as soon as possible to the laboratory after sample collection. Shipping containers will be transported via courier or by priority next day delivery to the laboratory. Each shipment will be adequately tracked and documented and will arrive at the laboratory ready for analysis.

Each person who has the samples in his/her possession, including couriers (except Federal Express), will sign the COCR. Upon sample receipt at the laboratory, the cooler temperature will be recorded and the sample container integrity will be checked. Any deficiencies at the time of sample receipt at the laboratory will be documented on the cooler receipt form and the MWH QA Manager will be notified for necessary resolution.

1.2.2   Instrument/Equipment Testing, Inspection, and Maintenance Requirements

Instrument calibration is necessary to ensure that the analytical systems are operating correctly and functioning at the proper sensitivity to meet PQLs. Calibration establishes the dynamic range of an instrument, establishes response factors to be used for quantitation, and demonstrates instrument sensitivity. All laboratory instruments will be calibrated in accordance with each laboratory's SOPs. Criteria for calibration are specific to the instrument and the analytical method. Field instruments will be calibrated daily or immediately before use per manufacturer's instructions.

1.2.3   Inspection Requirements for Supplies and Consumables

All purchased supplies and consumables that support field monitoring and sampling activities or that have a direct relationship to sample quality (e.g. sample containers, decontamination supplies, distilled/de-ionized water) will be inspected upon receipt. At a minimum this inspection will check:

1) Part number/physical description matches requisition
2) Supplies are intact and undamaged
3) All required components/documentation is included

Any non-conforming items will be documented and returned to the supplier for replacement or other action as necessary.

1.3   DATA VALIDATION AND USABILITY

1.3.1   Data Review and Verification Requirements

The contracted laboratories will be responsible for reviewing all analytical data generated under this contract to ensure that it meets the requirements of this QAPP. Each analyst reviews the quality of their work based on established protocols specified in laboratory SOPs, analytical method protocol, project-specific requirements and DQOs. The laboratory will provide analytical results in electronic and paper formats. At a minimum, data verification will include evaluation of sampling documentation, technical holding time, instrument calibration and tuning, field and lab blank sample analyses, method QC sample results, field duplicates and the presence of any elevated detection limits.

1.3.1.1   Laboratory Quality Control

Laboratory overall method performance shall be monitored by the inclusion of various internal QC checks that allow an evaluation of method control (batch QC), and the effect of the sample matrix on the data being generated (matrix-specific QC).   Batch QC is based on the analysis of a LCS to generate accuracy (precision and bias) data and method blank data to assess the potential for cross-contamination.   Matrix-specific QC will be based on the use of an actual environmental sample for precision and bias determinations from the analysis of MS, MSD, matrix duplicates and surrogate spikes.   Laboratory QC will be based on the labs internal QA/QC plan and SOPs. Some QC procedures discussed in this section are not included in the current scope, but are provided to cover future sampling scenarios. The overall quality objectives are to implement procedures for laboratory analysis and reporting of data that are indicative of the degree of quality consistent with their intended use.

Method Blank Samples

Method blanks are analyzed to assess background interference or contamination that exists in the analytical system that might lead to the reporting of elevated concentration levels or false positive data. The method blank is defined as an interference-free blank matrix similar to the sample matrix to which all reagents are added in the same volumes or proportions as used in sample preparation and carried through the complete sample preparation, cleanup, and determinative procedures.   For aqueous analyses, analyte-free reagent water would typically be used. The results of the method blank analysis are evaluated, in conjunction with other QC information, to determine the acceptability of the data generated for that batch of samples. Sample results shall not be corrected for blank contamination.

In general, one method blank sample shall be analyzed for each analytical batch (one every 12 hours for GC/MS analyses). Contamination in method blanks (as well as reagent blanks, instrument blanks, extraction blanks for elutriations, initial calibration blanks, and continuing calibration blanks) above the MDL is not allowed. Data found to be associated with blanks containing target analytes at or above the MDL may be rejected with re-sampling and/or re-extraction and reanalysis at the expense of the laboratory. The USACE will evaluate the data based on the level detected in the associated samples. Chronic systematic method blank contamination will not be accepted.

Laboratory Control Samples

The LCS is analyzed to assess general method performance by the ability of the laboratory to successfully recover the target analytes from a control matrix. The LCS is similar in composition to the method blank. For aqueous analyses use analyte-free reagent water. For soil analyses, a purified solid matrix (e.g., Ottawa sand, sodium sulfate, or other purified solid) would typically be used. However, due to the difficulty in obtaining a solid matrix that is metals-free, analyte-free reagent water is taken through the appropriate digestion procedures for metals analyses. The LCS is spiked with all single-component target analytes (the complete target compound or analyte list) before it is carried through the preparation, cleanup, and determinative procedures.   The laboratory will perform corrective action based on failure of any analyte in the spiking list. When samples are not subjected to a separate preparatory procedure (i.e., purge and trap VOC analyses), the continuing calibration verification (CCV) may be used as the LCS, provided the CCV acceptance limits are used for evaluation. The spiking levels for the LCS would normally be set at the project-specific action limits assuming that the low standard used for the initial calibration was below this limit.   If the low standard used was at this limit or if the site action levels were unknown, then the spiking levels would be set between the low and mid-level standards. The results of the LCS are evaluated, in conjunction with other QC information, to determine the acceptability of the data generated for that batch of samples. The laboratory shall also maintain control charts, or tables for these samples to monitor the precision. The precision may be evaluated by comparing the results of the LCS from batch to batch,

or by duplicate LCSs. Duplicate LCSs within the same batch are not required, but recommended by the USACE.

Matrix Spike

The MS is used to assess the performance of the method as applied to a particular project matrix. A MS is an environmental sample to which known concentrations of certain target analytes have been added before sample manipulation from the preparation, cleanup, and determinative procedures have been implemented. The entire target analyte list will be spiked within the MS. The laboratory will perform corrective action based on failure of any analyte in the spiking list. The spike concentrations of the target analytes would normally be set at the same level as the LCS. From the laboratory perspective, preparation batches require MS frequency at one per preparation batch. The merging of these MS frequencies is often difficult for the laboratory to implement. For instance, batches consisting of samples from multiple sites may require additional MSs to meet project requirements of evaluating the samples within the batch. For a MS from one site cannot be used to evaluate the matrix effects on samples from other sites. The results of the MS are evaluated, in conjunction with other QC information, to determine the effect of the matrix on the bias of the analysis. Sample results shall not be corrected for MS QC excursions.

Matrix Spike Duplicate

The MD or MSD is used to assess the performance of the method as applied to a particular matrix and to provide information on the homogeneity of the matrix. A MSD is a duplicate of the MS as previously described. A MD is an environmental sample that is either divided into two separate aliquots by the laboratory, or requires the submittal of an additional sample. When applicable, care should be taken to ensure that the sample is properly divided into homogeneous fractions. Both the MD and MSD are carried through the complete sample preparation, cleanup, and determinative procedures. The normal use of these QC samples would follow the same requirements as described for the MS. The MD is included with each preparation batch of samples processed where target analytes were expected to be present (e.g., inorganic methods). An MSD is included with each preparation batch of samples processed where target analytes were not expected to be present (e.g., organic methods). The results of the MD or MSD are evaluated, in conjunction with other QC information, to determine the effect of the matrix on the precision of the analysis.

Surrogate Standards

Surrogates are analyzed to assess the ability of the method to successfully recover these specific non-target compounds from an actual matrix. Surrogates are organic compounds that are similar to the compounds of interest in chemical behavior, but are not normally found in environmental samples. Surrogates to use are identified within the determinative methods. Other compounds may be chosen and used as surrogates, depending on the analysis requirements, whether they are representative of the compounds being analyzed, and whether they cover the chromatographic range of interest. These compounds should be spiked into all samples and accompanying QC samples requiring GC or GC/MS analysis prior to any sample manipulation. As a result, the surrogates are used in much the same way that MSs are used, but cannot replace the function of the MS. The results of the surrogates are evaluated, in conjunction with other QC information, to determine the effect of the matrix on the bias of the individual sample determinations. Control charts, or tables, shall be maintained for surrogates contained within the LCS or MB to monitor the accuracy of the method for each particular matrix. Sample results shall not be corrected for surrogate excursions.

1.3.1.2   Documentation and Records

MWH will store all important project-related records in a centralized and easily accessible project file. The project manager or designee will maintain the project file. The project file will include the following types of field records:

- Field data measurements
- Sample collection records
- COCRs
- QC sample records
- Field notes, which will include descriptions of any deviations from the QAPP and any difficulties encountered in maintenance or sample collection
- Data results from the analytical laboratories
- Laboratory data deliverables (hard copy and electronic)

All laboratory-related documentation and records will be controlled, distributed, stored and maintained by the contracted laboratories. The information and records to be included in project-specific data reporting packages, and the reporting format, are specified in the following sections.

1.3.1.3   Analytical/Statistical/Control Parameters

Precision

Precision refers to the distribution of a set of reported values about the mean, or the closeness of agreement between individual test results obtained under prescribed conditions. Precision reflects the random error and may be affected by systematic error. Precision also characterized the natural variation of the matrix and how the contamination exists or varies within that matrix. In order to assess matrix heterogeneity or sample handling procedures, field precision is commonly determined from field duplicates samples. In general, field duplicates (QC samples) will be collected at a frequency of one duplicate for each ten samples of a given matrix. The identity of QC samples shall be held blind to the Contract Laboratory until after analyses have been completed.

The relative percent difference for field and laboratory duplicates shall be calculated and used as a measure of precision, however only laboratory duplicates will be included in the quantitative assessment of completeness. Results of field duplicates will be described in qualitative assessment of completeness.

For environmental samples, laboratory precision is commonly determined from laboratory duplicate samples. Laboratory duplicates are defined as two aliquots obtained from the same sample which are extracted and analyzed for the purpose of determining matrix specific precision. In general, laboratory duplicates will be performed for all metals analyses at a rate of one in twenty (one for each batch up to a maximum of twenty). Precision for organic analyses may be determined by the analysis of Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples.

Laboratory duplicate samples not meeting QC criteria shall be re-extracted/reanalyzed once. (For organic analyses failure of different matrix spike compounds to meet QC criteria on successive runs shall constitute failure and satisfy the requirement for reanalysis.) Statistical measures of precision included RPD, standard deviation, or RSD.

Accuracy

Accuracy is the measure of the closeness of an observed value to the "true" value (e.g., theoretical or reference value). Accuracy includes a combination of random error and systematic error (bias) components that result from sampling and analytical operations.

Representativeness

Representativeness refers to the degree to which sample data accurately and precisely describe the characteristics of a population of samples, parameter variations at a sampling point, or environmental condition. Samples that are not properly collected or preserved (e.g., contaminant loss or addition) or are analyzed beyond acceptable holding times should not be considered to provide representative data. An assessment of represenativeness would include an evaluation of precision. The representativeness criterion is best satisfied in the laboratory by making certain that all subsamples taken from a given sample are representative of the sample as a whole. This would include sample pre-mixing/homogenizing prior to and during aliquotting procedures. Samples requiring volatiles analysis should not undergo any premixing or homogenization. Therefore, noting sampling characteristics in a case narrative may assist in the evaluation of data. Representativeness can be assessed by a review of the precision obtained form the field and laboratory duplicate samples. In this way, they provide both precision and representativeness information.

Comparability

Comparability is a qualitative objective of the data, expressing the confidence with which one data set can be compared with another. Sample data should be comparable for similar samples and sample conditions. Comparability is unknown unless precision and bias are provided. When this information is available, the data sets can be compared with confidence.

The laboratory shall make the necessary provisions to ensure the comparability of all data. These procedures include, but are not limited to, the use of standard approved methodologies, the use of standard units and report format, the use of calculations as referenced in the methodology for quantitation, and the use of standard measures of accuracy and precision for QC samples. All provisions to ensure data comparability shall be detailed in the QAPP.

Completeness

Completeness shall be evaluated qualitatively and quantitatively. The qualitative evaluation of completeness shall be determined as a function of all events contributing to the sampling event including items such as correct handling of chain of custody forms, etc. The quantitative description of completeness shall be defined as the percentage of measurements that are judged to be usable (i.e., which meet project-specific requirements) compared to the total number of measurements planned.

Sensitivity

The term sensitivity is used broadly here to describe the contract method detection, quantitation, and reporting limits established to meet the DQOs; and not limited to the definition which describes the capability of a method or instrument to discriminate between measurement responses. Several limits may be established to describe sensitivity requirements (i.e., instrument detection limits [IDL], method detection limits [MDL], sample quantitation limit [SQL], practical quantitation limits [PQL], contract-required detection limits [CRDL], contract-required quantitation limits [CRQL], etc.). Current sensitivity requirements (MDLs) for this project are presented in the FSP.

1.3.2   Quality Control Responsibilities

All of the selected staff for this project have the qualifications and experience required for conducting their specific assignments. If staff changes are necessary during the execution of this work, resumes shall be submitted for new personnel, and a description of their responsibilities, in a technical memorandum to the USACE Project Manager. All MWH project personnel are responsible for identifying, reporting, and documenting any activities that could adversely affect the quality requirements set forth by the contract.

Each laboratory has a designated project manager for this project and shall provide direct interface with MWH personnel. As the Laboratory Project Manager, they are responsible for ensuring that all analytical data generated under this contract are reviewed prior to their release to MWH and the USACE Project Manager. They have sufficient authority to assure that samples submitted from the project site are received and processed in accordance with their MWH accepted quality management system.

1.3.3   Reconciliation with Data Quality Objectives

An assessment of data quality will be performed to determine whether data generated are consistent with the investigation objectives. If data are found to deviate significantly (several orders of magnitude) from previous analyses or surrounding conditions upon which the sampling program was based, the data may be qualified based on the validator's assessment of the usability of the data for the intended end uses.

1.4   CORRECTIVE ACTION

Corrective action is required when potential or existing conditions are identified that may have an adverse impact on data quality. Corrective action applies to both the field and laboratory procedures. In general, any member of the project team who identifies a condition adversely affecting quality can initiate corrective action. Written evidence (e.g. field or laboratory logbook) will document and identify the condition and explain the way it may affect data quality.

A well-defined and effective policy for correcting quality problems is critical to the success of a quality assurance program. While this QA program is designed to minimize problems, it must also identify and correct any problems that do exist. The corrective action system for this project will include:

- Identify the problem
- Identify cause of the problem
- Identify corrective actions to correct the problem
- Implement corrective actions
- Verify effectiveness of corrective actions in correcting the problem
- Document corrective action including:
    - Problem identified and cause
    - Corrective actions implemented
    - Effectiveness of corrective actions
    - Samples impacted by problem

Documentation of corrective actions will be included in the project file.