Quality Assurance Project Plan
and
Sampling and Analysis Plan

for

Redlands Shooting Range
2125 North Orange Street
Redlands, California 92374

September 11, 2011
Project No. 11059-01

Prepared for:
Environmental Protection Agency
2445 N. Palm Dr. Suite 100
Signal Hill, California 90755
Phone: 562 889 2572;

Prepared by:

GeoMat Testing Laboratories, Inc.
9980 Indiana Avenue, Riverside, California 92503
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SECTION "A" PROJECT MANAGEMENT

A-1 Title and Approval Sheet

Quality Assurance Project Plan
and
Sampling and Analysis Plan

Redlands Shooting Range
2125 North Orange Street
REDLANDS, CALIFORNIA 92374

Project No. 11059-01

Submitted by:
GeoMat Testing Laboratories, Inc.

Signature	Date
Haytham Nabilsi	Project Manager
Name	Title
Signature	Date
Jim Tyner	Owner's Representative
Name	Title
Signature	Date
Robert Wise	EPA Representative
Name	Title

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U.S. Environmental Protection Agency (EPA), 2006. "Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4." Office of Environmental Information. Washington, D.C. Available Online at: http://www.epa.gov/quality/qs-docs/g4-final.pdf>.

U.S. Environmental Protection Agency (EPA), 1998. "Guidance for Quality Assurance Project Plans, EPA QA/G-5." Office of Environmental Information. Washington, D.C. Available Online at: <http://www.epa.gov/quality/qs-docs/g5-final.pdf>.

ITRC, Characterization and Remediation of Soils at Closed Small Arms Firing Ranges, January 2003.

A-3 Distribution List

Task	Name	Address
EPA Representative	Mr. Robert Wise	EPA Long Beach 2445 N. Palm Dr. Suite 100 Signal Hill, CA 90755 562 889 2572;
Owner Representative	Mr. Jim Tyner	GroupRes, Inc 601 E. Daily Dr. Suite 300 Camarillo, Ca 93010 800 498 0016 Ext. 101
Project Manager Q/A Officer	Mr. Haytham Nabilsi, PE	GeoMat Testing Laboratories, Inc. 9980 Indiana Avenue Suite 14 Riverside, California 92503 951-688-5400
Laboratory Project Manager	Lorenzo Rodriguez	E.S. Babcock and Sons, Inc. 6100 Quail Valley Court Riverside, CA 92507
Field Team Leader	Tamer Khalil	GeoMat Testing Laboratories, Inc. 9980 Indiana Avenue Suite 14 Riverside, California 92503 951-688-5400
Data Processor	Omeed Pour	GeoMat Testing Laboratories, Inc. 9980 Indiana Avenue Suite 14 Riverside, California 92503 951-688-5400
Data Reviewer	Mr. Ibrahim Massoud, PE	GeoMat Testing Laboratories, Inc. 9980 Indiana Avenue Suite 14 Riverside, California 92503 951-688-5400

A-4 Project/Task Organization

Haytham Nabilsi is the Project Manager and will manage personnel in this study.

Tamer Khalil will be the field manager and will direct the field team on sample collection and take them to E.S. Babcock and Sons laboratory within holding times. Mr. Khalil is also responsible for developing and maintaining the QA Project Plan in case of discrepancy between plan and field conditions.

Ibrahim Massoud will review sample data for this project.

Lorenzo Rodriguez is the Laboratory Manager for E.S. Babcock and Sons, Inc. Under his authority samples will be analyzed and the results verified.

Stacy Fry is the QA Officer for E.S. Babcock and Sons, Inc.

Field Investigators- will walk the wash and locate sampling sites. As an aid to Mr. Khalil they will also collect samples.

Robert Wise will review and approve the QA Project Plan and any subsequent revisions, in terms of project scope and objectives.

A-5 Project Definition/Background

The Santa Ana River Basin contains valuable ecological, economic, recreational, and cultural resources. The river is also a habitat to many species. At the subject site location two of these species, San Bernardino Kangaroo Rat and the Santa Ana River Wooly Star Plant were identified as endangered species.

At the subject site Redlands Shooting Club, clay targets are typically launched for trap or skeet shooting in a trajectory that causes a significant portion of the lead shot fired at the targets to fall into the Santa Ana River Floodplain and within the rat habitat and the established Santa Ana Wooly Star Preserve.

Over the years, continued target shooting over the area has leads to a significant accumulation of lead shot immediately adjacent to the Shooting club. Because the lead is relatively heavy, the lead shot becomes embedded in and mixed with the sand, silt material within the drop zone.

As time goes on, the amount of lead in the drop zone steadily increases. Currently, a significant concentration of lead shot is found in the drop zone, from the surface to a depth of eight or more inches. Lead concentrations are highest in front of the target area, but downstream water transport of lead shot has occurred during periods of heavy rain when the secondary water channels on site are active.

The area impacted by the lead pellets is subject to a number of land ownership and regulatory jurisdictions, including the US Army corps of Engineers-Corps, the US Fish and Wildlife Service-USFWS, the California Department of Fish and Game-CDFG, the San Bernardino Flood Control District-SBFCD, and the Environmental Protection Agency- EPA.

The EPA's focus on lead shot is through the Hazardous Waste Compliance Program, which implements the Resource Conservation Recovery Act and amendments to that act.

Site investigation by ENVIRA determined that the federally listed as endangered San Bernardino kangaroo rat- SBKR (*Dipodomys merriami parvus*), and the Santa Ana river wooly star (*Eriastrum densifolium sanctorum*) were present on site. Potential habitat also occurs on site for the slender-horned spine lower (*Dodecahema leptocerus*); and water flow from the ephemeral drainage on site are within the watershed that supply water to critical habitat for the endangered Santa Ana river sucker (*Catostomus santaanae*).

Tri-Cities Surface Mining had been retained by the Redlands Shooting Club to recover and recycle lead shot from the drop zone of the Redlands Shooting Park. A final report describing the recovery operation and methods, recovered volume, recycling facility, and dates of activities is not available at this time. We understand that lead shot recovery was conducted from the drop zone within the project area sometime in the past.

Reclamation of the lead shot from the floodplain would reduce potential direct environmental hazard. To further reduce the lead pellets from falling in the river basin the owner is proposing to install a heavy duty pellet curtain stop.

It should be noted that the site is being investigated by EPA pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980 not pursuant to the Hazardous Waste Control Act or the Resource Conservation and Recovery Act as it was indicated in ENVIRA Biological Assessment Report.

A-6 Project/Task Description

The purpose of this project is to identify the horizontal and vertical extent of lead an its constituents in the soil. For this project, the action level for lead and its constituents in soil is listed in the table below.

Constituents	Source (Comment)	Action Level
Lead	Primary constituent of most projectiles	20 mg/kg (based on U.S. Fish and Wildlife requested action level)
Antimony	Alloy used as a hardening agent	31 mg/kg (EPA RSL)
Arsenic	Lead shot constituent (used in the production of small shot since it increases the surface tension of dropped lead, thereby improving lead shot roundness)	0.39 mg/kg (EPA RSL
Polycyclic Aromatic Hydrocarbons (PAH)	Clay targets (concentration of PAHs in clay targets varies from one manufacturer to the next but may be as high as 1000 milligrams per kilogram [mg/kg])	TBD based on pending analysis of clay targets
Adapted from ITRC SMART-2, 2005		

Visual Sample Plan software was used as a basis for targeting and establishing sampling locations. The software parameters and output is presented in Appendix A. From this it was determined that 40 sites would be included in this portion of the study and that sites would be sampled daily until all the samples are collected. Surface sediments, interval sampling to maximum depth of 4 feet is proposed.

The following table gives Project activities and their anticipated date of initiation and completion.

Activity	Name/Group	Anticipated date of initiation	Anticipated Date of Completion	Comments
Visual Reconnaissance	Haytham Nabilsi Jim Tyner	7/26/2011	7/26/2011	
QA Project Plan Approval	Robert Wise	10/1/2011	10/21/2011	
Site Determination	Tamer Khalil	11/1/2011	11/7/2011	
Sampling Begins	Tamer Khalil and Field Investigators	11/10/2011	12/10/2011	Daily at 6:00 am to 8:00
Data Review	Ibrahim Massoud	11/11/2011	2/15/2012	
Laboratory Testing	Lorenzo Rodriguez	11/11/2011	1/15/2012	
Report Preparation	Haytham Nabilsi	1/15/2012	2/15/2012	
Data Validation	Lorenzo Rodriguez	Following Data Review and Verification	12/1/2011	

The dates shown in the table above are estimates only. Because of the limited time when the club is not active and possible rain events, delays may occur. Sampling events may be delayed in the cases of serious rain events.

A-7 Quality Objectives and Criteria

DQOs are qualitative and quantitative statements developed by data users to specify the quality and quantity of data needed from a particular data collection activity to support decisions or regulatory actions. DQOs may be established for both quantitative and qualitative tasks.

This plan provides methods for control and review of data collected during field events so that the sample collection, sample analysis, and data analyses are scientifically sound, technically, and legally defensible, and of known, documented quality. The data must be of sufficient quality to make the primary project decisions (described in Table 1).

The DQO development process outlined in "Guidance on Systematic Planning Using the Data Quality Objective Process" (EPA 2006) was followed to develop DQOs for the project.

The seven steps required to achieve appropriate DQOs for the project are:

- Step 1: Statement of the Problem
- Step 2: Identification of Decisions
- Step 3: Identify Inputs to Decisions
- Step 4: Definition of Study Boundaries
- Step 5: Development of Decision Rules
- Step 6: Specification of Limits on Decision Errors
- Step 7: Optimization of Design for Obtaining Data

Details for each of the seven DQO steps are presented in tabular format in Table 1

A-8 Special Training/Certifications

The field team assigned for this project has the following capabilities:

1. HAZWOPER Certified soil samplers
2. Aware of the 'clean hands-dirty hands' technique
3. Red vest and boots are required for this contract.
4. Know shooting range work hours. No work should be conducted within the shooting range property if it is open for business.

Site Safety Considerations:

- All sites must have easy access.
- Follow OSHA standards.
- All equipment brought to a project site must be in safe operating condition. First Aid kit must be part of carried equipment.
- Comply with all environmental health and safety (EHS) contract requirements as well as applicable federal, state, and local regulations.
- Provide all safety and personal protective equipment (PPE) required to complete the contracted scope of work. PPE equipment must meet or exceed the requirements of the appropriate governmental regulatory agency.
- In the event of an incident, ensure that copies of Material Safety Data Sheets are immediately available for all chemicals and products that will be brought onto site.
- Collected sample containers must be closed while onsite, labeled to identify the container contents and in good condition.
- Ensure personal on-site is well trained on EHS activities and regulations in the performance of the work.
- Be familiar with the contents of this guidance document as it applies to the contracted scope of work.
- Report signs that may indicate hazard or sickness and leave area and call 911 and notify the Project Manager immediately.
- Upon hearing of an emergency, the employees should stop all work and evacuate as necessary.
- The crew leader should take a head count to ensure that all contract personnel are accounted for. The personnel should remain within at a safe distance of the area they evacuated until the **"All Clear"** is announced and the crew leader has instructed them that they may return to work.
- If a person is seriously injured, the crew leader should immediately notify the project manager.

A-9 Documentation and Records

Mr. Haytham Nabilsi is responsible for writing, maintaining and distributing the QA Project Plan. The most updated QA Project Plan will be mailed to the persons on the distribution list.

The data report package from the laboratory will include the data in a printed PDF format. Each package submitted will give the lab number and data for one site. Other records will be attached to each sample in accordance with the laboratory QA/QC manual. Record Keeping is also shown in the Laboratory QA/QC Manual.

Sampling records generated by this project are:

1. Field Log
2. Chain of Custody
3. Sample Analysis Laboratory Reports and QA/QC Procedures
4. Corrective Action Report

All records will be copied and transferred to the Redland Shooting Range (Owner).

SECTION "B" MEASUREMENT/DATA ACQUISITION

The samples collected under this plan will follow the procedures detailed in the following sections. Sampling activities will occur as required in this plan.

B-1 Sampling Process

B-1.1 Sampling Location

Soil samples will be collected from 4 feet below ground surface. The sample locations are depicted on Plate 1. All sample locations will be documented in Daily Field Activity Logs. If appropriate, sampling activities will also be documented with representative photographs.

B-1.2 Sample Collection

Soil boreholes will be advanced using a hand auger. Sampling will be conducted in accordance with EPA SOP 2012 "Soil Sampling".

B-2 Sampling Methodology

Each sample will be placed in the appropriate container as shown in Table 2. Samples will be labeled with a unique identifier and processed for shipment to the laboratory.

The sampling methodology for the collected soil samples is as follows:

1. Decontaminate non-disposable sampling equipment or ensure that non-disposable sampling equipment has been decontaminated prior to use.

2. Don a new pair of nitrile, powder-free disposable gloves for each sample.

3. Collect surface sample.

4. Drive auger into ground and collect samples at intervals to a depth not to exceed four feet below ground surface.

5. Extract sample and sieve the sample through No. 10 sieve (2mm). Retained spent lead will be collected in Ziploc bag for visual observation and recording in final report.

6. Collect the soil sample passing No. 10 sieve and place in jar; refer to the method of soil sampling by ITRC-Characterization and Remediation of Soils at Closed Small Arms Firing Ranges.

7. Affix a pre-printed label to side of the jar and place in a labeled Ziploc® bag.

8. Place the bag containing the jar in a cooler of double-bagged ice and preserve at approximately 4°C.

B-3 Sample Handling and Custody

This subsection describes the requirements for sample containers, handling, custody, packaging, and shipping.

B-3.1 Sample Containers

Soil samples will be placed in pre-cleaned containers specified for each analytical method. Table 2 provides additional information on sample container type and volume as well as preservatives and holding times.

B-3.2 Sample Handling

Approved site-specific personal protective equipment, such as gloves, will always be used when collecting a sample to prevent cross-contamination from sample to sample and to assure worker health and safety. A new pair of gloves will be used to collect and handle each sample to prevent sample to sample cross contamination. Samples will be securely placed in a cooler with water ice (not blue or chemical ice) for delivery to the contracted laboratory.

B-3.3 Sample Labeling

Each sample will be assigned a unique Sample Identification Number using the following designations:

- "RSR" – Redlands Shooting Range sample
- "MMDDYY" - Sample Date
- B01 – Boring Number
- "0.0" - Sample Depth

The following Sample Identification Number would indicate a sample collected from the site on September 7, 2011 from boring 1 at a depth of 4 feet:

"RSR-090711-B01-4.0’

The sample collection date and time, requested analyses, client, and sampler will also be identified on the label. In addition to labeling the individual sample containers, the Ziploc® bags containing sample containers will be labeled with the sample date, time, and identification number for easy identification during packing and shipping.

B-3.4 Sample Custody

Each sample will be entered onto a Chain of Custody form and recorded in accordance with the contracted laboratories for this project. Samples will be transported to the laboratory via our vehicle and personnel, transferring custody to the laboratory at that time. If a commercial carrier or courier is used, the laboratory will check the custody tape on each shipping container upon receipt to ensure that the shipping container has not been tampered with. Custody tape will be placed on shipping containers prior to shipment. Laboratory couriers will provide a signed sample receipt with a discrete tracking number when they pick up samples at the site. After ensuring that the shipping container has not been tampered with, the laboratory representative will sign the Chain of Custody noting the time and date of receipt, and thereby assuming custody of the samples.

B-3.5 Sample Documentation

Field personnel will document sampling activities on a Daily Field Activity Log. Each page of the log will be signed and dated by the individual(s) making entries. Field personnel will enter notes and observations on the log and will also take photographs (if needed) to document field activities. A record of the photographs, including the date of the photograph, photographer, frame number, and subject will be maintained on a photograph log.

Samples will be documented daily on a sample tracking log. The tracking log will list the sample number, type, location, specific location, shipment date, the Chain of Custody number, the laboratory location, and the parameter(s) to be analyzed. Any discarded samples will be noted on the sample tracking log.

B-3.6 Temperature

Samples will be stored at 4 °C ± 2 °C prior to shipment to the laboratory. Shipping containers will be packed with ice before shipment to ensure that the samples arrive at the laboratory chilled to 4°C ± 2°C. The ambient temperature of the sample shipping containers, when received at the laboratory, will be measured from a temperature blank only and recorded on the Chain of Custody form. Sample shipping containers received at the laboratory within 4 hours of sample collection and at less than or equal to 10° C will not be subject to normal temperature requirements.

B-3.7 Sample Packaging and Shipping

Samples will be packaged and shipped in accordance with the certified laboratory procedures. The sample container will be placed in a shipping container (typically a cooler) allowing sufficient room between the samples to place ice and/or packing material. The samples will be maintained under proper Chain-of-Custody documentation. The sample container will be tightly sealed and custody tape placed around or over the top. The container will be inspected for integrity and the drain plug sealed with tape.

The contracted laboratory will be notified 24 hours prior to sample collection to arrange for sample pickup at the site or for delivery to the laboratory. The container will be marked and labeled, and custody relinquished to the courier.

B-4 Decontamination of Sampling Equipment

Dedicated sampling equipment will be used where possible to minimize decontamination requirements. EPA SOP 2006 will be the guideline for tools decontamination. Non-dedicated sampling equipment (i.e., core sampler, sleeves, etc.) will be decontaminated between sample locations by the following steps:

1. Physical removal
2. Non-phosphate detergent wash
3. Tap water rinse
4. Distilled/deionized water rinse
5. 10% nitric acid rinse
6. Distilled/deionized water rinse
7. Solvent rinse (pesticide grade)
8. Air dry
9. Distilled/deionized water rinse

B-5 Analytical Methods Summary

Analytical methods for the project are summarized in Table 2. It is anticipated that sample analyses will be completed on a standard turn-around-time schedule, although some samples may require analyses on a rush turn-around schedule. Standard turn-around-time for laboratory results will be a maximum of 14 calendar days while rush turn-around-time is typically within 24 to 48 hours from receipt of the samples at the laboratory. Final data packages will be provided within 14 calendar days. The methods outlined have been selected on the basis of technical merit to achieve the data quality objectives of the project. The certified laboratory analytical methods and QC sample collection are described in the following subsections.

B-5.1 Certified Laboratory Analyses

Augured soil samples will be analyzed for the following:

The laboratory analysis suite will include lead, arsenic and antimony by EPA Method 6020, Toxicity Characteristic Leaching Procedure (TCLP) lead and arsenic by EPA Method 6020A/1311, and PAHs by EPA Method 8270.

B-5.2 Analytical Methods and Reporting Limits

For this project, the action level for lead and its constituents in soil is listed in the table below.

Constituents	Source (Comment)	Action Level
Lead	Primary constituent of most projectiles	20 mg/kg (based on U.S. Fish and Wildlife requested action level)
Antimony	Alloy used as a hardening agent	31 mg/kg (EPA RSL)
Arsenic	Lead shot constituent (used in the production of small shot since it increases the surface tension of dropped lead, thereby improving lead shot roundness)	0.39 mg/kg (EPA RSL
Polycyclic Aromatic Hydrocarbons (PAH)	Clay targets (concentration of PAHs in clay targets varies from one manufacturer to the next but may be as high as 1000 milligrams per kilogram [mg/kg])	TBD based on pending analysis of clay targets
Adapted from ITRC SMART-2, 2005		

B-5.3 Quality Control Samples

Quality control samples will be collected in association with environmental samples. As such, field duplicates will be collected for every 10 augured samples (10 percent). Duplicate samples will be analyzed for the same analyte as original samples (lead).

B-5.4 Holding Times

Samples shall be extracted and analyzed within the holding times presented in Table 2

B-6. Analytical Data Quality Indicators And Goals

Data quality evaluation will be based on several indicators including:

Precision
Accuracy
Representativeness
Completeness
Comparability
Sensitivity

Sources of accuracy that can be traced to the sampling component of environmental data collection are the sampling plan design, sample handling, sample transportation, and use of technical standard operating procedures. The important components to ensuring accuracy are proper calibration and the elimination of sources of potential contamination.

One of the largest components of total accuracy associated with environmental data collection originates from the sampling process. All sampling conducted in support of this project will incorporate review of sample location identifications and other field data prior to execution in order to minimize potential uncertainty.

B-6.1 Precision

Precision will be expressed in terms of a relative percent difference. Precision shall be evaluated through the analysis of laboratory duplicate samples. Laboratory duplicate samples shall be performed for all inorganic and organic analyses at a rate of one in 20 (one duplicate sample for each batch up to a maximum of 20 samples). Laboratory precision goals are presented in Tables 3, 4 and 5.

Laboratory duplicate samples not meeting QC criteria shall be rerun once. Failure of different target compounds to meet QC criteria on successive runs in cases where more than one target compound is detected in concentrations 10 times the reporting limit shall constitute failure.

B-6.2 Accuracy

Accuracy will be assessed through the analysis of laboratory control sample/laboratory control duplicate. The results are expressed as a percent recovery. Laboratory accuracy goals are presented in Tables 3, 4, and 5.

B-6.3 Representativeness

The representativeness criterion is best satisfied by making certain that sampling locations are selected properly and a sufficient number of samples are collected.

B-6.4 Completeness and Comparability

Data comparability will be achieved at the laboratory by using standard analytical methods and standard units of measurement, as specified in the methods.

The completeness goal for this project for all QC parameters, except holding times, will be 90 percent. The project goal for holding times will be 100 percent. Completeness shall be calculated by dividing the number of complete sample results by the total number of sample analyses listed in the sampling plan. Based on the severity of percent incompleteness and the impact of any incomplete data, GeoMat will discuss potential re-sampling or reanalysis to fill the data gap.

B-6.5 Sensitivity

Sensitivity goals are the laboratory reporting limits for the analytical method. Laboratory reporting limits are presented in Tables 3, 4 and 5.

B-7 Data Reporting

Once the analytical data have been reviewed by the laboratory, the following information will be provided in each data package and issued to the GeoMat technical manager in a paginated report for each sample delivery group.

- For each analytical method, the laboratory shall report all analytes as a detected concentration or as less than the reporting limits. All samples with out of control spike recoveries being attributed to matrix interference will be designated as such. Dilution factors, date of digestion, date of analysis, and method detection limits shall be reported for each analyte and method.

- Reports of method blanks shall include all analytes for each analytical method. Analytical results for each sample should be clearly associated with a particular method blank. Any detected concentration found in method blanks shall be reported. Reports of concentrations below the practical quantitation limits are necessary to evaluate low-level determinations of target compounds in samples.

- Results for laboratory duplicates shall be reported with Relative Percent Difference (RPD) limits for duplicate analyses.

- Laboratory control sample/laboratory control duplicate (LCS/LCD) results shall be reported with control limits for laboratory control sample/laboratory control duplicate (LCS/LCD) analyses. Analytical results for each sample should be clearly associated with a particular laboratory control sample/laboratory control duplicate (LCS/LCD).

- Results of initial and continuing calibration for all analyses shall be included in the data package. Calibration verification standard and blank are analyzed at the beginning of the analysis and after every tenth sample. The concentrations of the standards used for analysis and the date and time of analysis must be included. Daily calibration information shall be linked to sample analyses by summary or by daily injection or analysis logs.

The contract laboratory shall prepare a summary of all samples with detected concentrations of target compounds indexed by method and by sample identification.

The comprehensive certificate of analysis shall contain a narrative section identifying samples not meeting QC criteria and any other out of control condition. The narrative shall describe the corrective action taken. If "matrix effects" data qualifiers are described as a cause for out of control recoveries, a subsection of the narrative shall present a detailed justification for this assertion to include a summary of all relevant quality control data.

The data package shall be prepared at the conclusion of the sampling and analytical work. If requested, draft analytical results and preliminary QC data only shall be submitted to GeoMat as soon as they are available. Draft analyses results do not have to satisfy all of the requirements of this section, but should contain basic QC information such as method blank results.

The QC information provided will be used by GeoMat project staff to evaluate the quality of the data. The results of the GeoMat evaluation of the data and data validation will be summarized and included in the appropriate technical report.

SECTION "C" DATA VALIDATION AND USABILITY

Data validation is the systematic process for reviewing a set of data against pre-established criteria to determine the quality of the data. The laboratory will review their data for nonconformance and consistency before submittal to GeoMat. Upon receipt of the analytical data package from E.S. Babcock and Son, Inc., GeoMat project personnel will check the following items:

- Data package includes all requested deliverables
- Samples were analyzed as requested
- Sample holding times were met
- QC sample results were within established control limits
- Appropriate detection limits we
- Preservation met
- Chain-of-Custody maintained
- Sample integrity maintained
- Calibration criteria met
- Blank sample results reported correctly

A systematic effort will be made to identify any outliers and/or errors prior to the reporting of the data to EPA. Outliers (data values that are significantly different from the population) can result from improper sampling or analytical methodology, matrix interference, errors in data transcription, and real but extreme changes in analytical parameters. Outliers that result from errors found during data validation will be identified. Outliers that cannot be attributed to analytical, calculation or transcription errors will be retained in the database for further evaluation. Final data will be reviewed in accordance with the project specific criteria specified in this project plan and the method specific criteria stated in the analytical method. Results from the data review will be included in the appropriate technical report and submitted to EPA.

DeLORME

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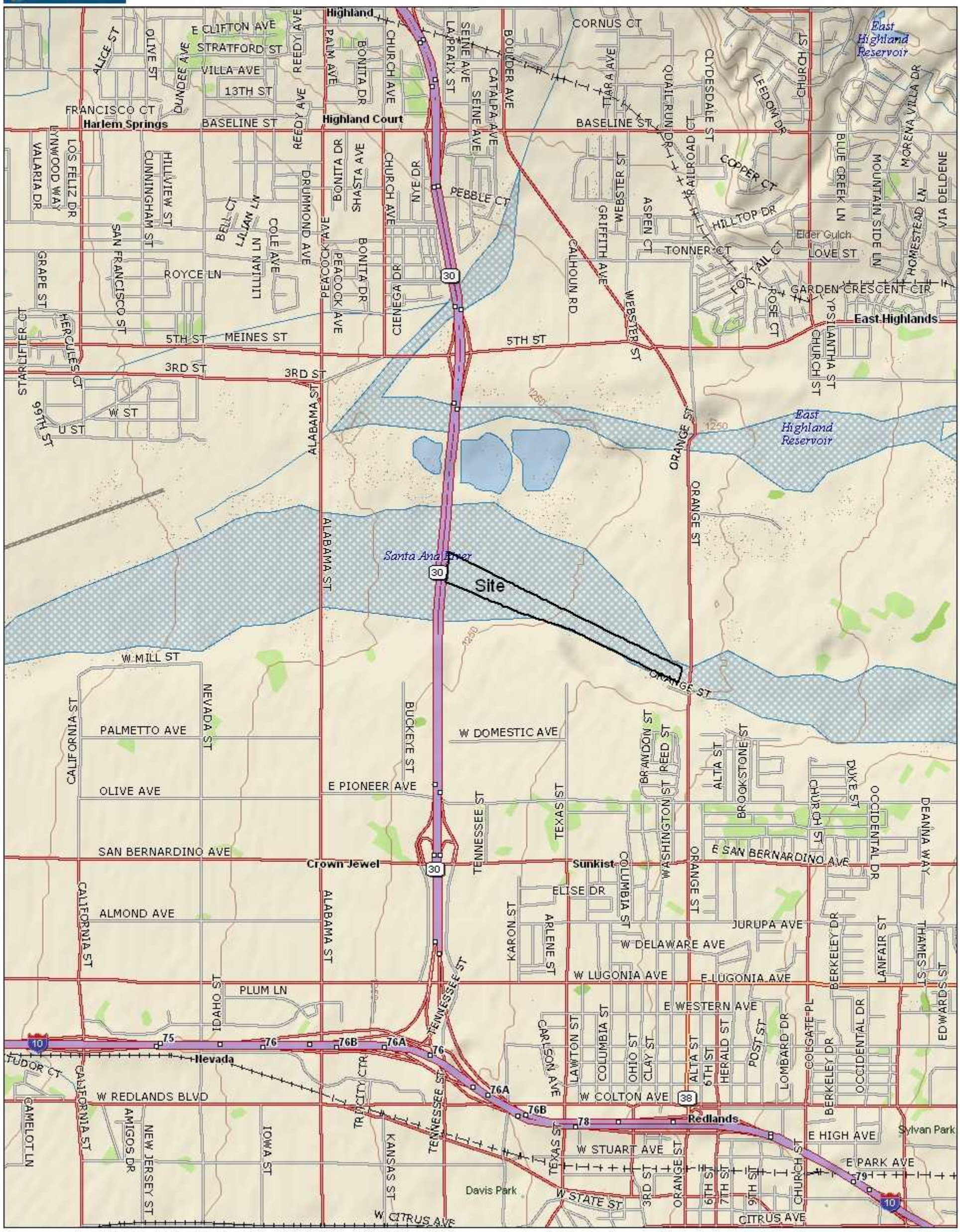

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Data Zoom 12-5

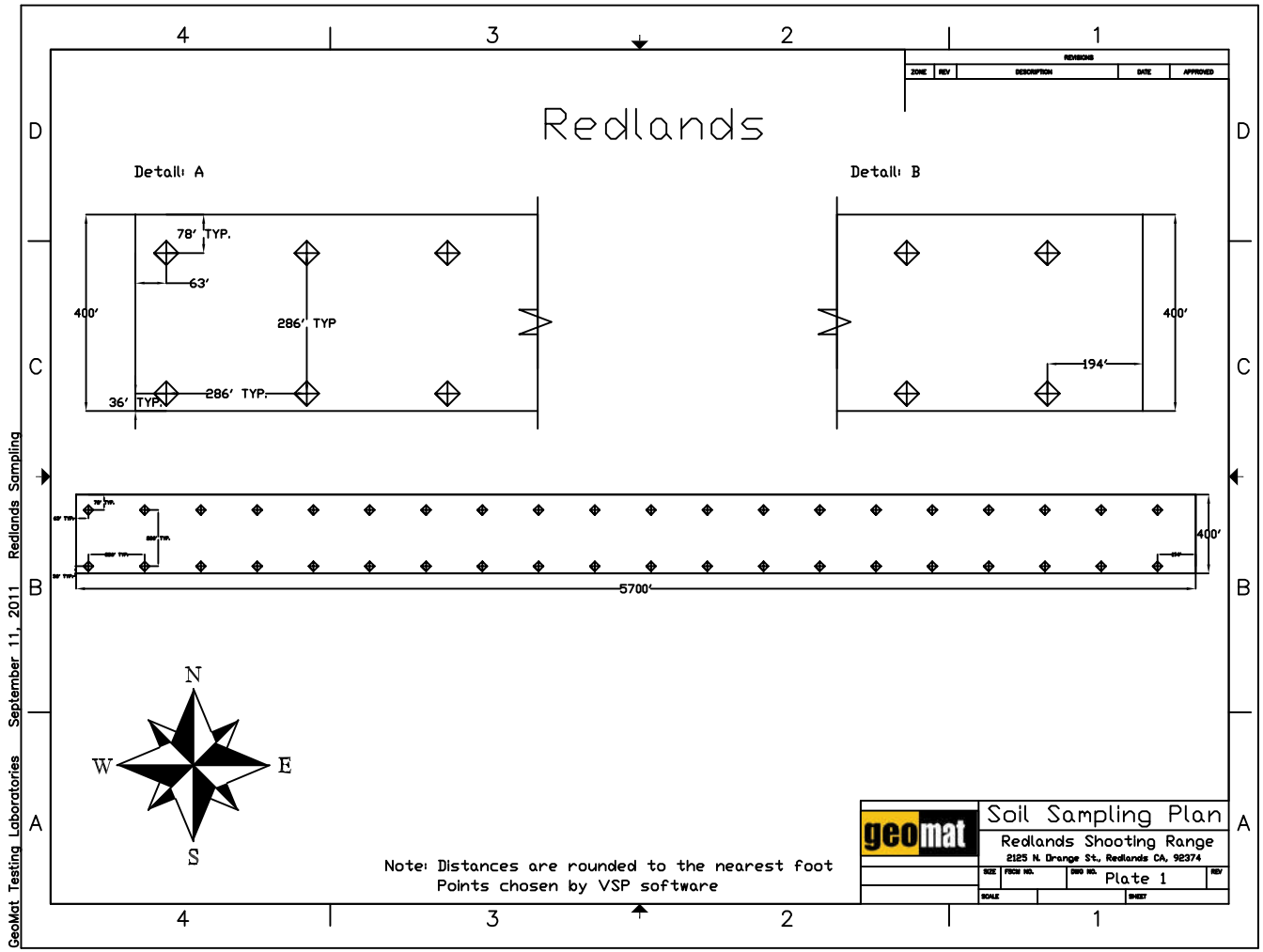

Redlands
Detail A
Detail B
78' TYP.
63'
400'
286' TYP
36' TYP.
286' TYP.
194'
400'
400'
5700'
N
W
E
S
Note: Distances are rounded to the nearest foot
Points chosen by VSP software
geomat
Soil Sampling Plan
Redlands Shooting Range
2125 N. Orange St., Redlands CA, 92374
Plate 1
GeoMat Testing Laboratories September 11, 2011 Redlands Sampling

Table 1 Data Quality Objectives

Step 1 Statement of the Problem	Step 2 Identification of Decisions	Step 3 Identify Inputs to Decisions	Step 4 Definition of Study Boundaries	Step 5 Decisions Rules	Step 6 Limits on Decision Errors	Step 7 Sampling Design
The site contains soil containing lead of unknown levels	The primary decision associated with the project is to collect data to confirm the extent of the contamination. The following decision must be made: • The horizontal and vertical extent of contaminated soil containing lead	The following input will be used to make the decisions in Step 2: • Analytical results from sampling and analysis. • Standard analytical methods published by the EPA, State regulatory authorities, etc. are available for lead testing to make remedial action decisions. • Analytical services of certified laboratory will be used to perform the sample analysis.	Lead pellet drop zone is northerly of the earthen berm (currently used as target range). The estimated distance is 400 feet toward the north. This is based on 600 feet range of fired shots. The length in the downstream direction of the study area was discussed with Mr. Robert Wise of the EPA and decided on including the study up to Highway 30 overpass bridge. This distance was measured at approximately 5700 lineal feet. Hence the total area of this investigation is 400 feet wide and 5700 feet in length.	The following "if….then" statement will serve as the decision rule for the project: "If analytical results indicate that soil samples contain concentrations of lead exceeding the limit then area would require remediation and future action will be discussed with EPA."	The following limits on decision error will be implemented: Laboratory quality control limits consistent with project objectives will be implemented as listed in Section B5	Biased judgmental soil sampling will be used to document concentrations of the analysis from excavations. Samples will be taken from locations within the site per attached plan. The samples will be collected from surface sediment and at intervals to a maximum of 4 feet below ground surface. Refer to Plate 1, Sample Location Map.

Source: Fictitious data, for illustration purposes only

Table 2 Summary of Soil Sample Collection and Analysis

Analyte	Analytical EPA Method	No. of Samples	Sample Container	Preservative	Holding Time	Sample Volume
Lead/Arsenic/Antimony TCLP (Lead and Arsenic) PAH	6020 6020A/1311 8270	100	Glass Jar	4° C	6 months	200ml

The laboratory analysis suite will include lead, arsenic and antimony by EPA Method 6020, Toxicity Characteristic Leaching Procedure (TCLP) lead and arsenic by EPA Method 6020A/1311, and PAHs by EPA Method 8270.

E.S. Babcock & Sons, Inc.

8/10/2011

Analytical Method Information

Analyte	MDL	Reporting Limit	Surrogate %R	Duplicate RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
EPA 6020 -- Metals and Metalloids; EPA SW846 Series inSolid								
Preservation: NA								
Container: 8 oz. jar			**Amount Required:** 1g/50g			**Hold Time:** 180 days		
Lead	0.29	10 mg/kg		20	71.5 - 125	20	72.6 - 123	

Table 3

E.S. Babcock & Sons, Inc.

8/10/2011

Analytical Method Information

Analyte	MDL	Reporting Limit	Surrogate %R	Duplicate RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
EPA 6020A -- California Waste Extraction Test (Title 22 sec. 66261 Apx II); Inorganics inSolid								
Preservation: Store cool at 4°C; Add HNO3 to pH<2 after extraction								
Container: 8 oz. jar				**Amount Required:** 50g/200 g			**Hold Time:** 180 days	
Lead	0.0039	0.50 mg/L			72.9 - 123	20	77 - 117	

Table 4

E.S. Babcock & Sons, Inc.

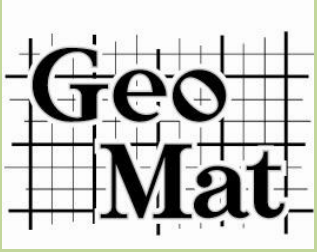
8/10/2011

Analytical Method Information

Analyte	MDL	Reporting Limit	Surrogate %R	Duplicate RPD	Matrix Spike %R	Matrix Spike RPD	Blank Spike / LCS %R	Blank Spike / LCS RPD
EPA 6020A -- Toxicity Characteristic Leaching Procedure (EPA Method 1311); Metals inSolid								
Preservation: Store cool at 4°C; Add HNO3 to pH<2 after extraction								
Container: 8 oz. jar				**Amount Required:** 100 g/500g			**Hold Time:** 180 days	
Lead	0.00097	0.50 mg/L			79 - 121	20	78.8 - 121	

Table 5

Appendix A



Systematic sampling locations for comparing a mean with a fixed threshold (parametric)

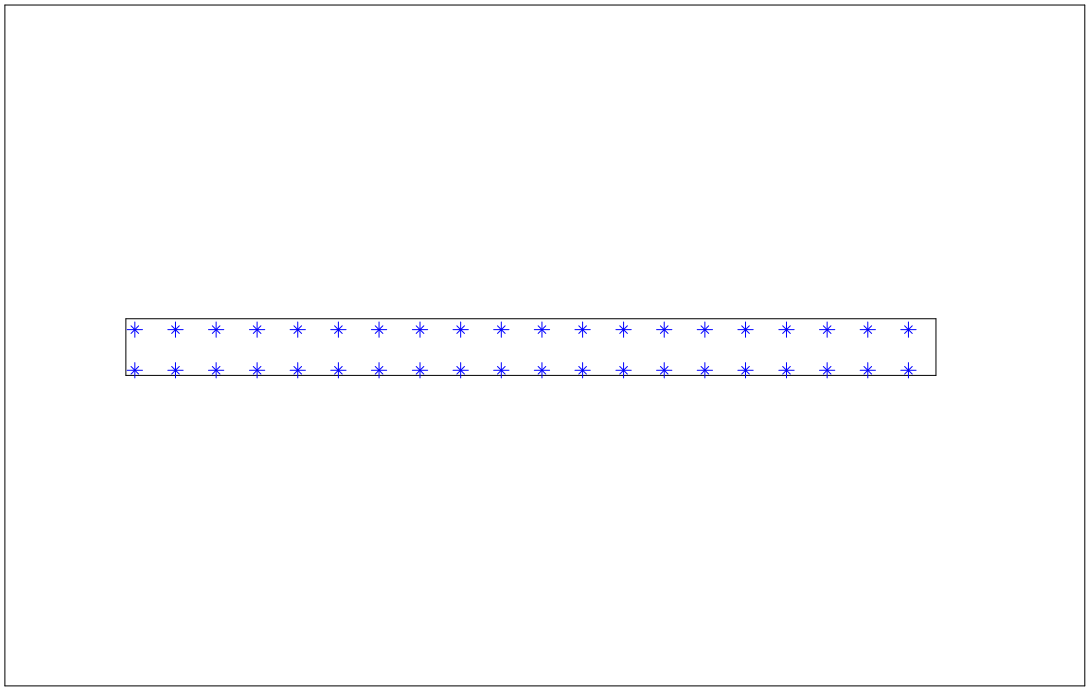
Summary

This report summarizes the sampling design, associated statistical assumptions, as well as general guidelines for conducting post-sampling data analysis. Sampling plan components presented here include how many sampling locations to choose and where within the sampling area to collect those samples. The type of medium to sample (i.e., soil, groundwater, etc.) and how to analyze the samples (in-situ, fixed laboratory, etc.) are addressed in other sections of the sampling plan.

The following table summarizes the sampling design. A figure that shows sampling locations in the field and a table that lists sampling location coordinates are also provided below.

SUMMARY OF SAMPLING DESIGN	
Primary Objective of Design	Compare a site mean to a fixed threshold
Type of Sampling Design	Parametric
Sample Placement (Location) in the Field	Systematic with a random start location
Working (Null) Hypothesis	The mean value at the site exceeds the threshold
Formula for calculating number of sampling locations	Student's t-test
Calculated total number of samples	40
Number of samples on map [a]	40
Number of selected sample areas [b]	1
Specified sampling area [c]	2280000.00 ft^2
Size of grid / Area of grid cell [d]	286.496 feet / 82080 ft^2
Grid pattern	Square
Total cost of sampling [e]	$0.00

[a] This number may differ from the calculated number because of 1) grid edge effects, 2) adding judgment samples, or 3) selecting or unselecting sample areas.
[b] The number of selected sample areas is the number of colored areas on the map of the site. These sample areas contain the locations where samples are collected.
[c] The sampling area is the total surface area of the selected colored sample areas on the map of the site.
[d] Size of grid / Area of grid cell gives the linear and square dimensions of the grid used to systematically place samples.
[e] Including measurement analyses and fixed overhead costs. See the Cost of Sampling section for an explanation of the costs presented here.



Area: Area 1					
X Coord	**Y Coord**	**Label**	**Value**	**Type**	**Historical**
-1005.0003	55.0933			Systematic	
-718.5042	55.0933			Systematic	
-432.0082	55.0933			Systematic	
-145.5121	55.0933			Systematic	
140.9840	55.0933			Systematic	
427.4801	55.0933			Systematic	
713.9761	55.0933			Systematic	
1000.4722	55.0933			Systematic	
1286.9683	55.0933			Systematic	
1573.4643	55.0933			Systematic	
1859.9604	55.0933			Systematic	
2146.4565	55.0933			Systematic	
2432.9526	55.0933			Systematic	
2719.4486	55.0933			Systematic	
3005.9447	55.0933			Systematic	
3292.4408	55.0933			Systematic	
3578.9369	55.0933			Systematic	
3865.4329	55.0933			Systematic	
4151.9290	55.0933			Systematic	
4438.4251	55.0933			Systematic	
-1005.0003	341.5894			Systematic	
-718.5042	341.5894			Systematic	

-432.0082	341.5894			Systematic	
-145.5121	341.5894			Systematic	
140.9840	341.5894			Systematic	
427.4801	341.5894			Systematic	
713.9761	341.5894			Systematic	
1000.4722	341.5894			Systematic	
1286.9683	341.5894			Systematic	
1573.4643	341.5894			Systematic	
1859.9604	341.5894			Systematic	
2146.4565	341.5894			Systematic	
2432.9526	341.5894			Systematic	
2719.4486	341.5894			Systematic	
3005.9447	341.5894			Systematic	
3292.4408	341.5894			Systematic	
3578.9369	341.5894			Systematic	
3865.4329	341.5894			Systematic	
4151.9290	341.5894			Systematic	
4438.4251	341.5894			Systematic	

Primary Sampling Objective
The primary purpose of sampling at this site is to compare a mean value of a site with a fixed threshold. The working hypothesis (or 'null' hypothesis) is that the mean value at the site is equal to or exceeds the threshold. The alternative hypothesis is that the mean value is less than the threshold. VSP calculates the number of samples required to reject the null hypothesis in favor of the alternative hypothesis, given a selected sampling approach and inputs to the associated equation.

Selected Sampling Approach
A parametric systematic sampling approach with a random start was used to determine the number of samples and to specify sampling locations. A parametric formula was chosen because the conceptual model and historical information (e.g., historical data from this site or a very similar site) indicate that parametric assumptions are reasonable. These assumptions will be examined in post-sampling data analysis.

Both parametric and non-parametric approaches rely on assumptions about the population. However, non-parametric approaches typically require fewer assumptions and allow for more uncertainty about the statistical distribution of values at the site. The trade-off is that if the parametric assumptions are valid, the required number of samples is usually less than the number of samples required by non-parametric approaches.

Locating the sample points over a systematic grid with a random start ensures spatial coverage of the site. Statistical analyses of systematically collected data are valid if a random start to the grid is used. One disadvantage of systematically collected samples is that spatial variability or patterns may not be discovered if the grid spacing is large relative to the spatial patterns.

Number of Total Samples: Calculation Equation and Inputs
The equation used to calculate the number of samples is based on a Student's t-test. For this site, the null hypothesis is rejected in favor of the alternative hypothesis if the sample mean is sufficiently smaller than the threshold. The number of samples to collect is calculated so that 1) there will be a high probability ($1-\beta$) of rejecting the null hypothesis if the alternative hypothesis is true and 2) a low probability (α) of rejecting the null hypothesis if the null hypothesis is true.

The formula used to calculate the number of samples is:

$$n = \frac{S^2}{\Delta^2}\left(Z_{1-\alpha} + Z_{1-\beta}\right)^2 + 0.5Z_{1-\alpha}^2$$

where

n	is the number of samples,
S	is the estimated standard deviation of the measured values including analytical error,
Δ	is the width of the gray region,
α	is the acceptable probability of incorrectly concluding the site mean is less than the threshold,
β	is the acceptable probability of incorrectly concluding the site mean exceeds the threshold,
$Z_{1-\alpha}$	is the value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\alpha}$ is 1-α,
$Z_{1-\beta}$	is the value of the standard normal distribution such that the proportion of the distribution less than $Z_{1-\beta}$ is 1-β.

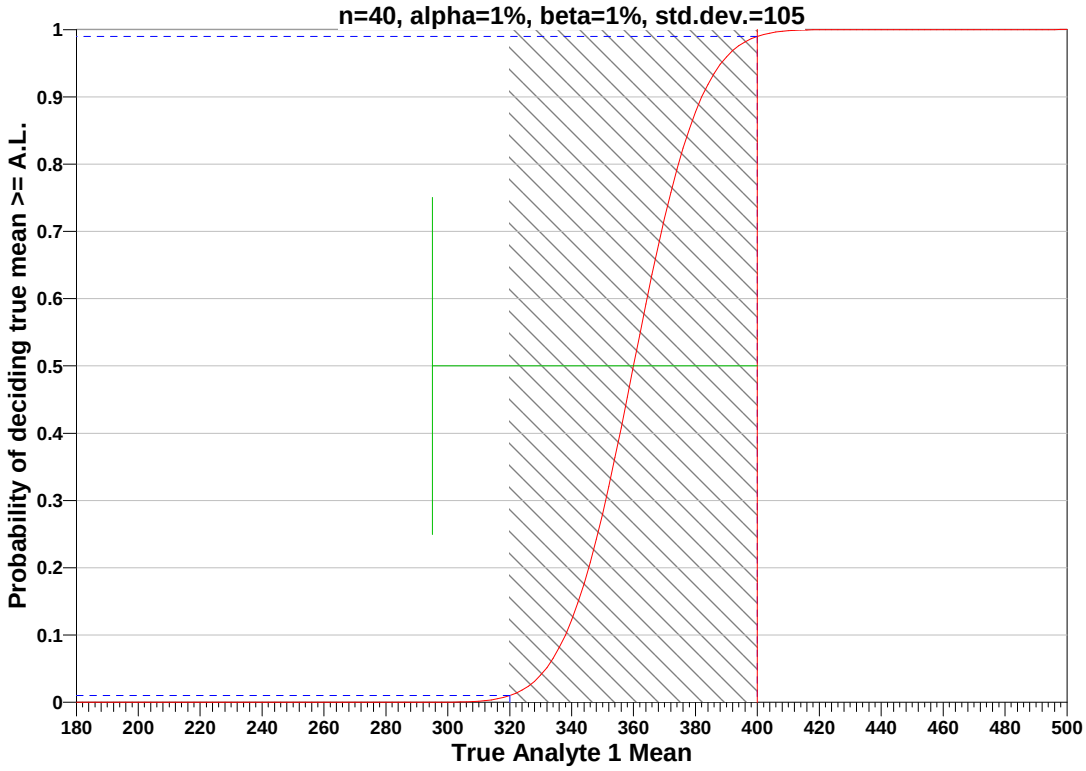
The values of these inputs that result in the calculated number of sampling locations are:

Analyte	**n**	**Parameter**					
		S	**Δ**	**α**	**β**	$Z_{1-\alpha}$ [a]	$Z_{1-\beta}$ [b]
Analyte 1	40	105	80	0.01	0.01	2.32635	2.32635

[a] This value is automatically calculated by VSP based upon the user defined value of α.
[b] This value is automatically calculated by VSP based upon the user defined value of β.

The following figure is a performance goal diagram, described in EPA's QA/G-4 guidance (EPA, 2000). It shows the probability of concluding the sample area is dirty on the vertical axis versus a range of possible true mean values for the site on the horizontal axis. This graph contains all of the inputs to the number of samples equation and pictorially represents the calculation.

The red vertical line is shown at the threshold (action limit) on the horizontal axis. The width of the gray shaded area is equal to Δ; the upper horizontal dashed blue line is positioned at 1-α on the vertical axis; the lower horizontal dashed blue line is positioned at β on the vertical axis. The vertical green line is positioned at one standard deviation below the threshold. The shape of the red curve corresponds to the estimates of variability. The calculated number of samples results in the curve that passes through the lower bound of Δ at β and the upper bound of Δ at 1-α. If any of the inputs change, the number of samples that result in the correct curve changes.



Statistical Assumptions

The assumptions associated with the formulas for computing the number of samples are:

1. the sample mean is normally distributed (this happens if the data are roughly symmetric or the sample size is more than 30; for extremely skewed data sets, additional samples may be required for the sample mean to be normally distributed),
2. the variance estimate, S^2, is reasonable and representative of the population being sampled,
3. the population values are not spatially or temporally correlated, and
4. the sampling locations will be selected probabilistically.

The first three assumptions will be assessed in a post data collection analysis. The last assumption is valid because the gridded sample locations were selected based on a random start.

Sensitivity Analysis

The sensitivity of the calculation of number of samples was explored by varying the standard deviation, lower bound of gray region (% of action level), beta (%), probability of mistakenly concluding that μ > action level and alpha (%), probability of mistakenly concluding that μ < action level. The following table shows the results of this analysis.

Number of Samples							
AL=400		α=5		α=10		α=15	
		s=210	s=105	s=210	s=105	s=210	s=105
LBGR=90	β=5	300	76	237	60	199	51
	β=10	238	61	182	47	149	38
	β=15	200	51	149	38	119	31
LBGR=80	β=5	76	20	60	16	51	13
	β=10	61	17	47	13	38	10
	β=15	51	14	38	11	31	8
LBGR=70	β=5	35	10	28	8	23	7

β=10	28	8	21	6	17	5
β=15	24	7	18	5	14	4

s = Standard Deviation
LBGR = Lower Bound of Gray Region (% of Action Level)
β = Beta (%), Probability of mistakenly concluding that μ > action level
α = Alpha (%), Probability of mistakenly concluding that μ < action level
AL = Action Level (Threshold)

Cost of Sampling
The total cost of the completed sampling program depends on several cost inputs, some of which are fixed, and others that are based on the number of samples collected and measured. Based on the numbers of samples determined above, the estimated total cost of sampling and analysis at this site is $0.00, which averages out to a per sample cost of $0.00. The following table summarizes the inputs and resulting cost estimates.

COST INFORMATION			
Cost Details	**Per Analysis**	**Per Sample**	**40 Samples**
Field collection costs		$0.00	$0.00
Analytical costs	$0.00	$0.00	$0.00
Sum of Field & Analytical costs		**$0.00**	**$0.00**
Fixed planning and validation costs			$0.00
Total cost			**$0.00**

Further Recommended Data Analysis Activities
Post data collection activities generally follow those outlined in EPA's Guidance for Data Quality Assessment (EPA, 2000). The data analysts will become familiar with the context of the problem and goals for data collection and assessment. The data will be verified and validated before being subjected to statistical or other analyses. Graphical and analytical tools will be used to verify to the extent possible the assumptions of any statistical analyses that are performed as well as to achieve a general understanding of the data. The data will be assessed to determine whether they are adequate in both quality and quantity to support the primary objective of sampling.

Because the primary objective for sampling for this site is to compare the site mean value with a threshold value, the data will be assessed in this context. Assuming the data are adequate, at least one statistical test will be done to perform a comparison between the data and the threshold of interest. Results of the exploratory and quantitative assessments of the data will be reported, along with conclusions that may be supported by them.