Environmental Engineering and Consulting
Remediation and Management Services

INVESTIGATION REPORT

IDENTIFICATION AND CONFIRMATION OF SOILS REQUIRING LONG TERM MANAGEMENT

VALMONT BUTTE PROPERTY
3000 NORTH 63RD STREET
BOULDER, COLORADO

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LIST OF ACRONYMS

bgs	Below ground surface
CDPHE	Colorado Department of Public Health and Environment
CRI	Casey Resources, Inc.
EPA	Environmental Protection Agency
GPS	Global positioning system
mg/Kg	milligram per kilogram
NaI	Sodium iodide
NORM	Naturally occurring radioactive materials
QA/QC	Quality assurance/quality control
URS	URS Operating Systems, Inc.
µR/hr	Micro-roentgens per hour
VCUP	Voluntary Cleanup Plan
XRF	X-ray fluorescence

1.0 INTRODUCTION

This data report, herein, presents the results of environmental investigations conducted at the Valmont Butte property, which is owned by the City of Boulder (the "City"). These environmental investigations were completed to fill data gaps pursuant to the "*Revised Work Plan - Identification and Confirmation of Soils Requiring Long Term Management*", dated May 13, 2009 ("Work Plan"). This Work Plan was prepared to support a plan for additional site cleanup work under the Voluntary Clean-up Program administered by the Colorado Department of Public Health and the Environment ("CDPHE").

As presented in the Work Plan, the environmental investigation at the Valmont Butte Property (the "Property") was conducted to define the areal extent and depth in soil of elevated radiation areas and elevated metal concentration areas at the Property. Surface water and water supply wells near the Property have previously been sampled and offsite water supplies were not impacted (URS Operating Systems, Inc. ["URS"], 2005). Limited surface water occurs within a small drainage located on the northeastern Property boundary. URS (2005) sampled the surface water and sediment from this area and did not identify constituent concentrations greater than drinking water standards or soil cleanup values. Groundwater occurs in the claystone bedrock unit immediately underlying the Property; however, the groundwater occurrence is sporadic, suggesting discontinuous lithologic lenses and limited flow. The bedrock deposits are low permeability and high porosity, which limits groundwater migration.

1.1 PROPERTY DESCRIPTION

The Property is located in Boulder County approximately four miles east of the City's central business district and more specifically 1.5 miles east of the Foothills Parkway and Pearl Street intersection. The Property in bounded on the north by Valmont Road and on the west by North 63rd Street and consists of approximately 101 acres. The main entrance to the Property is listed as 3000 North 63rd Street (Figure 1).

The Property can be divided into three distinct areas based on past land uses. These areas include the Mill Site, the primary and secondary tailings, and the outlying vacant areas. Each of these areas are shown on Figure 2 and discussed below.

- **Mill Site -** In 1936, a mill for processing fluorspar ore was constructed on the western portion of the Property (Ecology & Environment, 1985). The fluorspar mill operated until 1974. The mill was then used until 1985 to process gold ore. The mill structure and associated buildings, referred to hereafter as the "Mill Site", remain on the Property. These buildings include the main mill building, a garage, laboratory building, office building and several miscellaneous buildings. None of these structures are occupied or in use. The Mill Site also includes the filled area to the east of the buildings. The Mill Site area extends from the western Property boundary to approximately 900 feet east of the mill building and encompasses an estimated area of approximately 18 acres. The Mill Site is approximately 30 feet higher in elevation than the primary tailings located to the east.

- **Primary and Secondary Tailings -** The tailings generated from the processing of ores at the mill were deposited in two tailings impoundments located in the central part (primary tailings) and eastern side (secondary tailings) of the Property. URS (2005) estimated that 327,000 cubic yards and 70,000 cubic yards of fluorspar tailings are contained in the primary tailings and secondary tailings, respectively, and that these tailings accumulated from operations conducted by Allied Chemical Corporation from 1941 to approximately 1974. The fluorspar tailings contain naturally occurring radioactive materials ("NORM").

  The gold tailings, generated by Hendricks Mining Company from approximately 1977 to 1985, were deposited on top of the fluorspar tailings in the primary tailings. URS (2005) estimated the total volume of the gold tailings generated by Hendricks Mining Company at 45,000 cubic yards.

URS (2005) estimated the area of the primary tailings at 12.5 acres and the area of the secondary tailings at 4.5 acres.

Use of the primary and secondary tailings is restricted by controls and specifications set forth in the "*Agreement and Declaration of Covenants*" (CDPHE, 1999). The current covenant control boundary includes an area of 14.11 acres (CDPHE, 1999).

- **Outlying Vacant Areas** - The remainder of the Property, approximately 66 acres, is vacant land. This includes the Valmont Butte ridge and land area north to Valmont Road, open land areas east of the primary and secondary tailings extending to the eastern Property boundary, and open land to the south of the primary and secondary tailings. These outlying areas include well established vegetation areas and sensitive cultural (Native American) areas.

1.2 PURPOSE

The City anticipates preparation and submittal of a Voluntary Cleanup Plan ("VCUP") to the CDPHE for remediation of soil impacts associated with the previous use of the Property and to remedy the cap failure within the covenant area. Past environmental investigations identified potential metals and radiation exposure hazards in soils at the Property; however, none of the prior investigations had fully delineated the identified impacted areas (five elevated radiation areas and 18 sampling locations with lead concentration greater than 400 milligrams per kilogram [mg/Kg]) or addressed outlying areas. Potential impacts associated with wind and water erosion and prairie dog infestation on the primary tailings and secondary tailings also had not fully been assessed. The environmental investigation discussed herein was conducted to provide sufficient information to support a VCUP Application. The environmental impacts investigated include metals concentrations (lead and arsenic) in surface soil, plus potential radiation exposure associated with the fluorspar tailings. The results of the investigation will be used to finalize an effective long-term remediation plan for the Property that will be presented in the VCUP Application.

2.0 FIELD PROGRAM

The field investigation program was presented in the Work Plan (Casey Resources, Inc. [CRI], 2009). The Work Plan identified field screening programs for metals and for radiation exposure for the open land areas as well as the existing buildings. The field programs for metals screening, radiation exposure screening, and the building investigation (both metals and radiation exposure screening) are discussed in Sections 2.1, 2.2, and 2.3, respectively. Any deviations from the Work Plan are noted in the appropriate sections.

2.1 METALS SCREENING

A field portable X-ray fluorescence ("XRF") analyzer was utilized to assist in assessing metals concentrations in shallow soil on the Property. The XRF analyzer selected for this project was the Alpha Series XRF manufactured by Innov-X Systems. During the field screening, nearly 1,000 XRF measurements were taken on surface and subsurface soil samples from locations throughout the Property. A global positioning system ("GPS") instrument was used to record the sampling location as metals screening was performed.

Field screening for lead using the Innov-X Systems Alpha Series unit easily meets the detection limits required for lead screening for this project (screening value of 800 mg/Kg for soils requiring management). The ability of the XRF to detect arsenic concentrations, however, is limited if lead concentration is present in the soil, i.e. the lead concentration interferes with and elevates the arsenic detection level. This phenomenon is not unique to the Innov-X System. Both lead and arsenic typically occur within various minerals that are associated with ore and mineralized rock and as such would also occur in the processed mill tailings, which represent the main source of metals impact at the Property. Since arsenic impact should be colocated with lead impact and lead concentration is easily identified by XRF technology, lead was selected as the primary indicator of metals impact at the Property.

Prior to initiation of the soil sampling program, a correlation study was conducted using XRF and laboratory analysis to determine a correction factor for the response of the XRF to metals in

onsite soils. A discussion of the correlation study is presented in Appendix A. The correlation study resulted in "correction factors" that were used to adjust XRF data to the likely concentration that a laboratory would report. The corrected values are listed in the XRF results tables as "adjusted" values.

Three different soil sampling densities were used for XRF investigation of the Property based on suspected or known levels of impact identified by previous studies (URS, 2005). These soil sampling densities are as follows:

- 200 Foot Grid Screening Area – The 200 foot screening area included those areas of the Property that had not previously been sampled and were not specifically suspected of containing elevated metals impact.

- 100 Foot Grid Screening Area – The 100 foot screening area included the land area between the primary and secondary tailings covenant boundary and the prairie dog control fence. The survey of this area focused on possible impacts from the primary and secondary tailings associated with wind and water erosion or resulting from prairie dog infestation.

- 50 Foot Grid Screening Areas – The 50 foot screening was conducted at 18 specific locations on the Property that had previously been identified by URS (2005) as containing lead concentration greater than 400 mg/Kg.

Where practical, soil samples for metals analysis were collected from the surface to six inches in depth, thoroughly mixed, and measured with the XRF in the field. If the lead concentration in a sample was greater than 800 mg/Kg, additional soil samples were collected at six inch increments until the lead concentration was less than 800 mg/Kg or a maximum depth of 24 inches was reached. XRF field measurements were taken on the composited 0.0 – 6.0 inch samples without any preparation or alteration of the soil sample. This procedure was modified after completion of the 200 foot grid sampling due to the added time requirements for subsurface excavation and sample mixing. The sampling procedure was modified to surface in-situ measurement, with collection of composite (0.0 – 6.0 inch) samples as deemed necessary for the 100 foot and 50 foot grid areas. Surface in-situ measurement is defined as direct XRF

measurement on soil exposed at the ground surface. Procedures and results for the 200 foot grid, 100 foot grid, and 50 foot grid lead screening are discussed in Section 2.1.1.

Confirmation soil samples were collected from each area identified as containing lead concentrations greater than the screening value of 800 mg/Kg. The intent of this sampling was to confirm that the XRF field results were accurate. Confirmation soil sample procedures and results are discussed in Section 2.1.2

Quality assurance/quality control ("QA/QC") samples were collected from every 20th grid sampled and every 20th sample provided to the laboratory. Procedures and results for the QA/QC samples are presented in Section 2.1.3.

2.1.1 Grid Area Soil Sampling

Approximately 1,000 XRF measurements were taken during the grid area soil screening programs. These measurements resulted in confirmation of previously identified areas with elevated (greater than 800 mg/Kg) lead concentration and newly identified additional areas of lead concentration greater than 800 mg/Kg. These lead impacted areas are shown on Figure 3.

<u>200 Foot Screening Area</u>

Square grids were staked out on 200 foot centers throughout the Property as shown in Figure 4. Each grid was then sampled by taking one sample from the approximate center of the grid, and one sample half the distance from the center to each corner of the grid, resulting in five soil samples per grid. In the cases where a full square grid was not available, soil samples were collected across the grid such that the sample density would be at least equal to or greater than five samples per 40,000 square feet. Figure 4 also illustrates the sampling configuration for the approximate 335 sampling points. The initial sample from each location was collected from the ground surface to a depth of six inches and mixed in a plastic storage bag. The XRF was then used to measure metals concentration in the soil contained in the storage bag. If the resulting XRF concentration for lead was greater than 800 mg/Kg, a second sample was collected from a

depth of six inches to 12 inches below ground surface ("bgs"). This process was continued until the XRF measurement for lead was less than 800 mg/Kg or a depth of 24 inches was reached. Note that sampling at the northwest location in grid number 5-E in the Mill Site did not comply with this protocol. Sampling was discontinued at approximately 12 inches bgs although the lead measurement at this location was over 5,000 mg/Kg at the 12 inch depth. Large cobbles and rock were encountered at the one foot depth and the sample excavation could not be deepened. The results of the 200 foot grid sampling are presented in Table 1 and graphically on Figure 5. Sampling locations identified as greater than 800 mg/Kg during the 200 foot grid survey were not further delineated as the majority of sampling locations with elevated lead were adjacent to one another or within or adjacent to areas that were later surveyed on 50 foot grids. The area of impact for each location is estimated to be 100 feet by 100 feet.

Elevated lead concentrations identified in grids 3-G, 4-G, 4-F, 5-E, and 6-D (see Figure 5) are contained within or adjacent to areas that were later surveyed on 50 foot grids. The specifics regarding areal extent and depth of impact are presented in the 50 foot grid survey discussion for these locations. These include:

- Elevated lead concentrations identified in grids 3-G, 4-G, and 4-F = 50 foot grid survey Area "C"

- Elevated lead concentrations identified in grid 5-E = 50 foot grid survey Area "F"

- Elevated lead concentrations identified in grid 6-D = 50 foot grid survey Area "G"

Three additional areas were identified as impacted with elevated lead concentrations as discussed below.

- An approximate 60,000 square foot area located north of Valmont Butte Cemetery (referred to as Area "AA" on Figure 3; grids 5-F, 6-F, and 6-E on Figure 5). Elevated concentrations of lead were found up to 18 inches bgs. This area has been backfilled with large cobble and gravel size material. Beginning at approximately six inches bgs

this material contained fluoride crystals and purple coloring, suggesting the backfill includes fluorspar waste rock or possibly discarded ore material.

- An area south of the secondary tailings and east of the primary tailings contains lead concentrations greater than 800 mg/Kg (referred to as Area "BB" on Figure 3; grids 15-E, 16-G, 16-F, 16-E, 17-F, 17-E, 17-D and 18-F on Figure 5). The majority of the elevated concentrations of lead in this area was within the top six inches of soil and is likely windblown contamination from the tailings impoundments prior to soil cap placement. The area of impact is estimated at 160,000 square feet.

- One small area of elevated lead concentration was identified east of the secondary tailings near the overflow dam in grid 19-B shown on Figure 5 (referred to as Area "CC" on Figure 3). Lead concentration greater than 800 mg/Kg was identified at one sampling point to a depth of six inches bgs. The impact is surficial and the area of impact is estimated at 10,000 square feet.

100 Foot Grid Screening Area

The Work Plan called for sampling between the original prairie dog control fence and the covenant controlled area encompassing the primary and secondary tailings. Sampling was to be performed by analyzing five samples within 100 foot by 100 foot grids. However, the prairie dog control fence was placed approximately 30 feet outside the covenant controlled area and 100 foot by 100 foot square grids were not possible. Therefore, the area was divided into separate grids that contained approximately 10,000 square feet per grid area (see Figure 6). A minimum of five soil samples were collected at nearly equal spacing across each grid, meeting the planned sample frequency of one sample per 2,000 square feet. Due to time and cost considerations, the Work Plan XRF soil sampling protocol was modified to XRF surface (in-situ) measurements being taken. In addition, one composite soil sample was collected from each grid using the same collection procedure described for the 200 foot grid sampling and analyzed by XRF to confirm the in-situ surface measurements.

XRF measurements were taken from a total of 77 sampling points in the 100 foot grid sampling area (Table 2). The lead concentration at only one location in grid L100, south of the primary tailings, exceeded the 800 mg/Kg screening value (Figure 6). This result was obtained from an in-situ measurement. A subsequent sample taken at the same location from 0.0 - 6.0 inches bgs resulted in a lead concentration well below the 800 mg/Kg screening value for lead and the area was not included as a lead impacted area. Overall, the vast majority of the composite samples collected from 0.0 - 6.0 inches contained lower lead concentration than the surface in-situ measurements, which may indicate that cap material has been placed in the 100 foot grid investigation area and that the cap placed on the primary and secondary tailings has been effective in limiting airborne dispersion from the tailings areas.

50 Foot Grid Screening Areas

URS (2005) identified 18 sampling locations as exhibiting metals concentrations greater than 400 mg/Kg. The Work Plan called for delineating the areal extent and depth of impact at these locations by dividing each area into 50 foot by 50 foot grids, with five samples collected from each grid for XRF measurement. However, the XRF soil sampling protocol was modified to include only in-situ XRF sampling in the 50 foot grid areas for the reasons stated earlier. In-situ XRF measurements were taken at approximately 15 to 25 foot intervals in the 50 foot grid investigation areas. Detailed discussion of the investigations conducted at each of the 50 foot grid areas is presented in Appendix C. A summary of the results is presented below. The 50 foot grid investigation areas are shown on Figure 7.

- North Hillside Area - A total of 136 XRF measurements were taken and the results are presented in Table 3. Figure 8 shows the sampling locations and the approximate area that exhibited lead measurements of 800 mg/Kg or greater. The total impacted area footprint is approximately 350,000 square feet. In most areas, the lead impact appears to be windblown, as the depth of impact is generally less than six inches bgs and probably occurred prior to the capping the tailings areas.

- Mill Building Area - A total of 57 XRF measurements were taken within this area. Table 4 lists the results from this investigation and Figure 9 shows the locations of these measurements. An area estimated at 2,200 square feet on the east side of the building exhibited lead measurements of 800 mg/Kg or greater. Three individual sample locations (19, 34 and 53 on Figure 9) also exhibited elevated lead concentrations; however, these impact areas are localized and are estimated to be 100 square feet each. Depth of impact varied from 6.0 inches to 24.0 inches bgs.

- Area "A" - A total of 21 XRF measurements were taken in Area "A". XRF measurement locations are shown on Figure 10 and the results are listed on Table 5. Depth of impact appears to be about 6.0 inches bgs and the impacted area footprint (as shown on Figure 10) is approximately 1,500 square feet.

- Area "B" - Table 6 lists the results from 12 XRF measurements taken in this area. The approximate depth of impact is 6.0 inches bgs and the approximate impacted area footprint is 2,500 square feet (Figure 11).

- Area "C" - XRF measurements were taken at a total of 100 locations in Area "C" and the results are listed in Table 7. Depths of impact varied from surface impact (less than 800 mg/Kg at 6.0 inches bgs) on the southern edge of Area "C" to greater than 24 inches bgs on the southwestern edge where the lead concentration was 1,200 mg/Kg at that depth (Table 7). The total impacted area is approximately 71,000 square feet as shown on Figure 12.

- Area "D" – XRF measurements were taken at 29 locations. Table 8 lists the results of the XRF investigation and the estimated lead impact area is shown on Figure 13. The estimated impact area is approximately 6,700 square feet with depth of impact as much as 18 inches bgs.

- Area "E" – Twenty-eight XRF measurements were taken in this area (Table 9). The total area of impact as shown on Figure 14 is approximately 5,600 square feet and depth of impact was greater than 24 inches bgs.

- Area "F" - Table 10 lists the results of the 14 XRF measurements taken in this area. As depicted on Figure 15, the area of impact is approximately 2,100 square feet. Depth of impact varies from 6.0 inches bgs to greater than 12 inches bgs.

- Area "G" - Seventeen XRF measurements were taken in this area (Table 11). The impacted area, as shown on Figure 16, is approximately 1,300 square feet. Depth of impact is greater than 24 inches bgs.

- Area "H" - Seven XRF measurements were taken in this area with the results ranging from 303 mg/Kg to 584 mg/Kg (Table 12). Because the lead concentrations are less than the screening level of 800 mg/Kg, this area would not be remediated. XRF sampling locations are shown on Figure 17.

- Area "I" – Fifteen locations were analyzed by XRF in Area "I" (Table 13). Several sampling locations indicated lead concentrations greater than 500 mg/Kg; however, only one location (location 13 on Figure 18) was greater than 800 mg/Kg for lead. The lead impact area is estimated to be approximately 1,300 square feet, with depth of impact of 6.0 inches bgs.

- Area "J" - A total of 21 locations were analyzed in this area (Table 14). Figure 19 shows the sampling locations and the estimated lead impact area (approximately 5,100 square feet). Elevated lead concentrations (greater than 800 mg/Kg) were identified to a depth of approximately 12 inches bgs.

- Area “K” - Ten XRF surface measurements were taken in this area and the greatest lead concentration recorded was 216 mg/Kg (Table 15). Because the lead concentrations are less than the screening level of 800 mg/Kg, this area would not be remediated.

2.1.2 Confirmation Samples

Soil samples for laboratory analysis were collected from the sampled impact areas to confirm the field results. Those areas identified as having elevated lead concentrations included: 1) the 50 foot grid areas “A”, “B”, “C”, “D”, “E”, “F”, “G”, “I”, “J”, and the Mill Building Area; and 2) the three areas from the 200 foot grid identified as Areas “AA”, “BB”, and “CC”. A confirmation sample was also collected from grid L100 in the 100 foot grid area.

The XRF and laboratory analyses for these confirmation samples were performed on composite grab soil samples (the soil samples were not prepared per EPA 6200 for XRF analysis). The laboratory results and XRF results measured on the same composite samples are presented in Table 16. Although the laboratory and field results vary (which is expected given the variability of the metals concentration within any given soil sample), the laboratory results show that the XRF screening results are generally conservative (XRF concentrations were generally greater than the laboratory result) and that the XRF equipment had accurately identified lead concentrations greater than the 800 mg/Kg screening value. The laboratory data report for the confirmation soil samples is provided in Appendix B.

2.1.3 Quality Assurance Samples

Per the Work Plan, a quality assurance sample was taken from one of the five grid sampling locations for each 20 grids sampled. Four samples were collected for the 200 foot grid survey and five samples were collected to be representative of the in-situ measurements conducted for the 100 foot and 50 foot grid surveys. These samples were prepared using the same procedure followed for the correlation samples (drying and grinding). Three XRF measurements were taken per sample and the sample vile was sent to the laboratory for analysis. The laboratory results were then compared with the average of the three XRF measurements (adjusted using the

regression analysis formulas) and that data is shown in Table 17. As shown on Table 17, the XRF results are consistently higher than the laboratory results. This confirms that the XRF was providing conservative results in regard to the 800 mg/Kg screening value for lead concentration in the soil. The laboratory data report for the quality assurance samples is provided in Appendix B.

In addition the Work Plan called for duplicate samples and a matrix/matrix spike sample to be submitted to the analytical laboratory. The duplicate sample was submitted for the sample collected from the northwest location of grid 17-F (200 foot grid). The arsenic concentrations reported by the laboratory for the original and duplicate samples were the same at 11 mg/Kg. The lead concentrations reported for the original and duplicate soil sample were 650 mg/Kg and 670 mg/Kg, respectively, which results in an acceptable relative percent difference (RPD) of 3.03%.

The results of the matrix spike sample analysis (MS) and the matrix spike duplicate sample analysis (MSD) were out of the laboratory quality control (QC) range for lead. This may be due to elevated concentration of lead in the sample versus the low lead concentration in the spike or the heterogeneous nature of the soil sample. According to the laboratory, the original sample is not prepared or homogenized before selecting sample aliquots for analysis. Since the sample was not homogenized in any manner before the aliquot was selected, the concentration of lead in each aliquot may have varied enough to cause the MS/MSD comparisons to be out of QC range. However, there is a *possibility* of matrix interference in that particular sample that limits the accuracy of the MS/MSD analysis for that particular matrix. However, the laboratory control spike (LCS) recovery for lead was within QC limits which indicated the laboratory's analysis was in control. Because there is a wide range of soil matrices on the Property and the highly heterogeneous nature of soil, the results from the MS/MSD lead analysis should not impact the representativeness or accuracy of the data collected.

2.2 RADIATION EXPOSURE SCREENING

The Work Plan called for a radiation survey to be performed by walking the centerlines of the 50 foot, 100 foot, and 200 foot screening grids established for the metals screening. SHB, Inc. modified the radiation survey procedure to include the use of state-of-the-art portable gamma radiation sodium iodide ("NaI") detection meters with real-time GPS to map positioning equipment. This modification resulted in the most advanced radiation survey conducted at the Property to date. The radiation survey involved traversing the entire Property on approximate 25 foot horizontal spacing with the radiation detectors situated at approximately three feet above the ground surface to simulate human "whole body" exposure conditions (NUREG 5849 and 1575). Over 115,000 data points were collected during the survey. These data were correlated to specific onsite radiation source measurements collected using a High Pressure Ion Chamber. The results of the adjusted individual readings were plotted on an aerial photo of the Property with various colors depicting levels of radiation rates recorded during the survey. This data was also averaged over 25 square foot (five foot by five foot squares) areas and plotted with colors to depict the different levels of projected radiation exposure rates (Appendix D).

Background radiation exposure rates were measured with the same NaI equipment at Legion Park, located approximately one mile south to southeast of the southeast corner of the Property, to determine an approximate baseline for natural radiation on the Property. Legion Park is similar in geologic makeup and close to the Property, but distant enough as to not be impacted by past operations at the Property or adjacent areas. Past investigators identified background radiation rates from 15-18 micro-roentgens per hour ("µR/hr") and 18-22 µR/hr depending on the radiation detector used (EPA, 2004). For the current radiation survey, the background radiation rate was determined to be 20 µR/hr, which is consistent with the results of the previous investigations. The screening value for radiation monitoring established in the Work Plan was 48 µR/hr plus background or 68 µR/hr.

Background soil samples were also collected from Legion Park and analyzed for total uranium, radium 226, radium 228, and gross alpha/beta. Results of the laboratory analyses are presented in Table 18. The laboratory data report is presented in Appendix E.

Results of the radiation exposure survey indicated that there were no areas measured at the Valmont Butte Property that exceeded the specified screening value of 48 µR/hr greater than background. As a result, there were no areas on the Property that required further investigation or collection of soil samples for radiochemical analysis to support a VCUP Application. The full text of the gamma radiation survey report is provided in Appendix D.

2.3 BUILDING INVESTIGATION

The Work Plan required that the mill and associated buildings on the Property would be inspected to assess whether any impacted materials remained within these structures. To complete this task, a radiation exposure rate survey was performed on the interiors of all buildings on the Property by SHB Inc. using a Canberra Instruments model Radiagem 400 exposure rate meter and SG-1R survey probe. Each of the buildings was walked with the instrumentation positioned at approximately three feet above the ground (waist high).

The Laboratory Building was the only building that exhibited exposure rates near the screening level of 68 µR/hr. Figure 21 shows the areas within the Laboratory Building and the area in front of the building where radiation exposure rate readings were between 50 – 60 µR/hr. In the eastern room of the Laboratory Building the survey detected an elongated area of elevated (50 – 60 µR/hr) radiation rates. This elongated area may represent a drain line beneath the building. The interior of the building was relatively free of debris and all floor surfaces are concrete.

The interior of the Main Office Building and Scale House did not exhibit radiation exposure rates significantly above background. The general condition of the building interior was cluttered with debris and trash and the false ceiling panels had fallen and were decomposing on the floor. Floor surfaces are old carpet and tile.

The interior of the Garage Building contained some old mill equipment parts, an old process tank, two overpack drums containing tailings and charcoal material, and two 55-gallon steel drums. All floors are dirt surfaces. No radiation exposure rates were measured significantly above background.

The interiors of the two buildings adjacent to and on the east side of the Mill Building were relatively free of debris and trash. Floor surfaces are concrete and radiation exposure rates measured in these buildings were near background levels.

Radiation measurements taken in the Mill Building were taken around equipment, process tanks, below the silo at the southeast corner of the Building, and in the general work spaces. No areas exhibited exposure readings above background levels. Floor surfaces are concrete, dirt, and metal grating. The interior of the Building contained some debris and general dirty conditions were observed throughout. The floors were covered with mill residue except where grating was present. Some residue samples from the discharge of one ball mill on the second from lowest level and from the base of the silo on the southeast corner of the Building were collected and analyzed for metals. Approximately one half pallet of what appears to be bagged crushed ore samples was observed at one of the upper levels of the Mill Building. This material was also sampled and analyzed for metals. The results of the XRF analysis of these samples are presented in Table 19.

The interiors of the remaining miscellaneous outbuildings were also inspected. They were largely free from trash and debris and no radiation levels were detected that were above background.

No action needs to be taken with any of the building interiors in regard to radiation exposure rates. As discussed above, there are residual ore-related materials within the Mill Building with concentrations of lead greater than the screening value of 800 mg/Kg.

3.0 SUMMARY AND CONCLUSIONS

3.1 SUMMARY

The Property open land area was extensively screened for lead impact in near surface soil and for radiation exposure rates at approximately three feet above the ground surface. In addition, the onsite buildings were screened for metal impact and radiation exposure.

Approximately 1,000 XRF measurements were taken during the metals screening program. Several areas on the Property were identified as being impacted with lead concentrations greater than the screening value of 800 mg/Kg. These areas are shown on Figure 3. Specific details regarding estimated area of surficial impact (estimates in square feet) and estimated depth of impact are presented in Section 2.2. Backfill material from unknown sources was used to fill the land area essentially east of the Mill Building. The backfill material consists of construction debris and in areas exhibits fluoride crystals and purple coloring, suggesting the backfill includes fluorspar waste rock or possibly discarded ore material.

The radiation survey conducted at the Property by SHB, Inc. represents the most sophisticated radiation screening conducted at the Property to date and included over 115,000 data points collected over the entire Property. These data were correlated to specific onsite radiation source measurements collected using a High Pressure Ion Chamber. The results confirmed that there are no areas measured at a height of three feet above the ground (human "whole body" exposure) at the Property that exceeded the specified screening value of 68 µR/hr (48 µR/hr greater than the established background of 20 µR/hr). As such, no soil sampling was necessary for radiochemistry analysis.

A radiation exposure rate survey was performed on the interiors of all buildings on the Property. All buildings surveyed exhibited radiation exposure rates near or slightly greater than the background of 20 µR/hr, with the exception of the Laboratory Building. Radiation exposure rates at this location and in front of the building exhibited exposure rates between 50 µR/hr and 60 µR/hr, which are below the radiation screening value of 68 µR/hr. The Mill Building was the only structure that contained materials requiring metals assessment. These materials included residue from the ball mill on the second from lowest level, from the base of the silo on the southeast corner of the building, and bagged crushed ore located in the upper level of the Mill Building. All three samples contained lead concentrations greater than the screening value of 800 mg/Kg.

3.2 CONCLUSIONS

The conclusions resulting from the field screening assessment are presented in the following sections.

3.2.1 Lead Screening

During the site screening investigation, approximately 679,600 square feet (15.6 acres) of the Property were identified as containing lead concentrations in surficial soils that exceeded the screening value of 800 mg/Kg for lead (Figure 3). The identified lead impact areas (greater than 800 mg/Kg) included 16 out of the 18 sampling locations identified by URS (2005) as containing lead concentrations greater than 400 mg/Kg and three previously unidentified areas.

The land area between the covenant controlled tailings area and the prairie dog control fence was previously identified as potentially containing tailings material eroded from the primary and secondary tailings or from tailings exposed by prairie dog activity. The results of the 100 foot grid lead survey indicate that lead concentrations are less than 800 mg/Kg at the ground surface. These results suggest limited to no impact in the 100 foot grid survey area from erosion or prairie dog infestation within the covenant controlled area.

The depth of lead impact varies from a thin veneer (surficial) to greater than two feet in depth. The surficial lead impact was likely generated by dust particulates associated with the crushing and milling operations and by wind and water erosion of the exposed tailings prior to capping. The deeper lead impact is associated with former ore storage areas and where ore and/or waste rock was used as fill material.

3.2.2 Radiation Exposure Screening

URS (2005) identified five areas that exhibited elevated radiation at the ground surface. The current investigation measured radiation exposure rates at three feet above the ground surface to provide data relevant to human “whole body” radiation exposure. The current investigation did

not identify radiation exposure rates greater than the screening level of 68 µR/hr; however, the survey confirmed that higher radiation rates were recorded in the same locations as identified by URS. As shown on Figure 22, the five areas of elevated radiation identified by URS are colocated with areas identified as containing lead concentrations greater than 800 mg/Kg. As such, the elevated radiation areas identified by URS would be addressed along with the lead impact during remediation activities.

3.2.3 Remediation Planning

The remedial action selected for the impacted areas on the Property will be dependent on topography (construction accessibility), physical condition of the area (established vegetation, cultural important features, or avoidance area), and the overall quantity/volume of impacted soil to manage. As remediation work is performed in the lead impacted areas (Figures 3 and 22), additional monitoring for metals and radiation exposure rates will be performed to ensure that all impacted areas are remediated appropriately. Nonetheless, sufficient data has been collected to develop a final removal plan consistent with the covenant restrictions for the site under the auspices of the State of Colorado's Voluntary Cleanup Program.

Any construction project or soil disturbing activity on the Property will require a soil management plan to properly screen the soils for potential elevated radiation values and metals concentrations. Contractors and monitoring personnel will be appropriately trained to handle these materials and the work will be conducted under the supervision of a certified health physicist.

4.0 REFERENCES

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URS Operating Services, Inc., 2005: *Analytical Results Report for Site Reassessment, Valmont Butte/Allied Piles, Boulder, Colorado.* Prepared for the U.S. Environmental Protection Agency. January 1, 2005.

TABLES

FIGURES

CASEY RESOURCES, INC.

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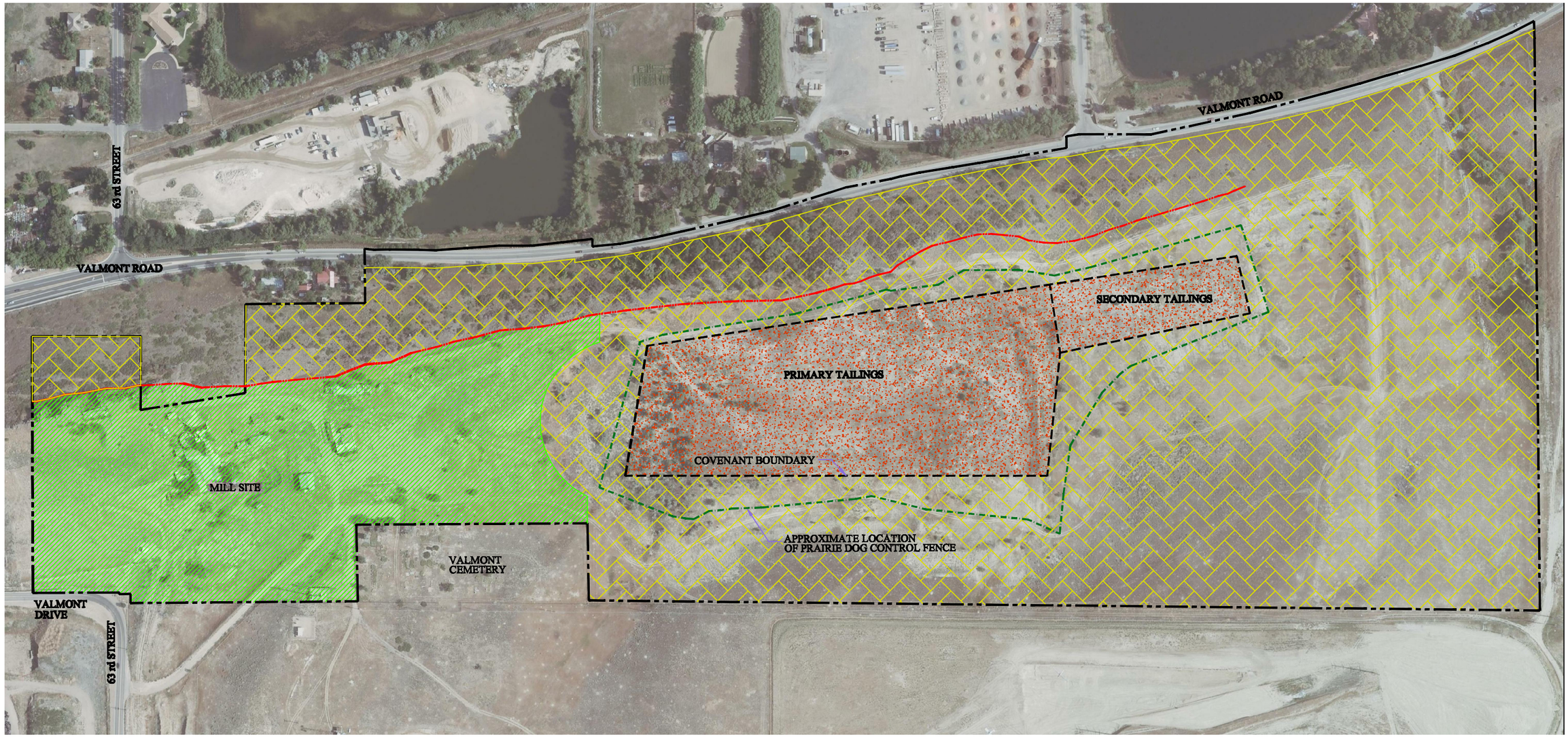
FIGURE 1

VICINITY MAP
VALMONT BUTTE PROPERTY
3000 NORTH 63RD STREET
BOULDER, COLORADO



EXPLANATION

- Property Boundary
- Valmont Butte Ridge
- Outlying Vacant Area
- Mill Site Area
- Primary and Secondary Tailings (Covenant Controlled Area)

N

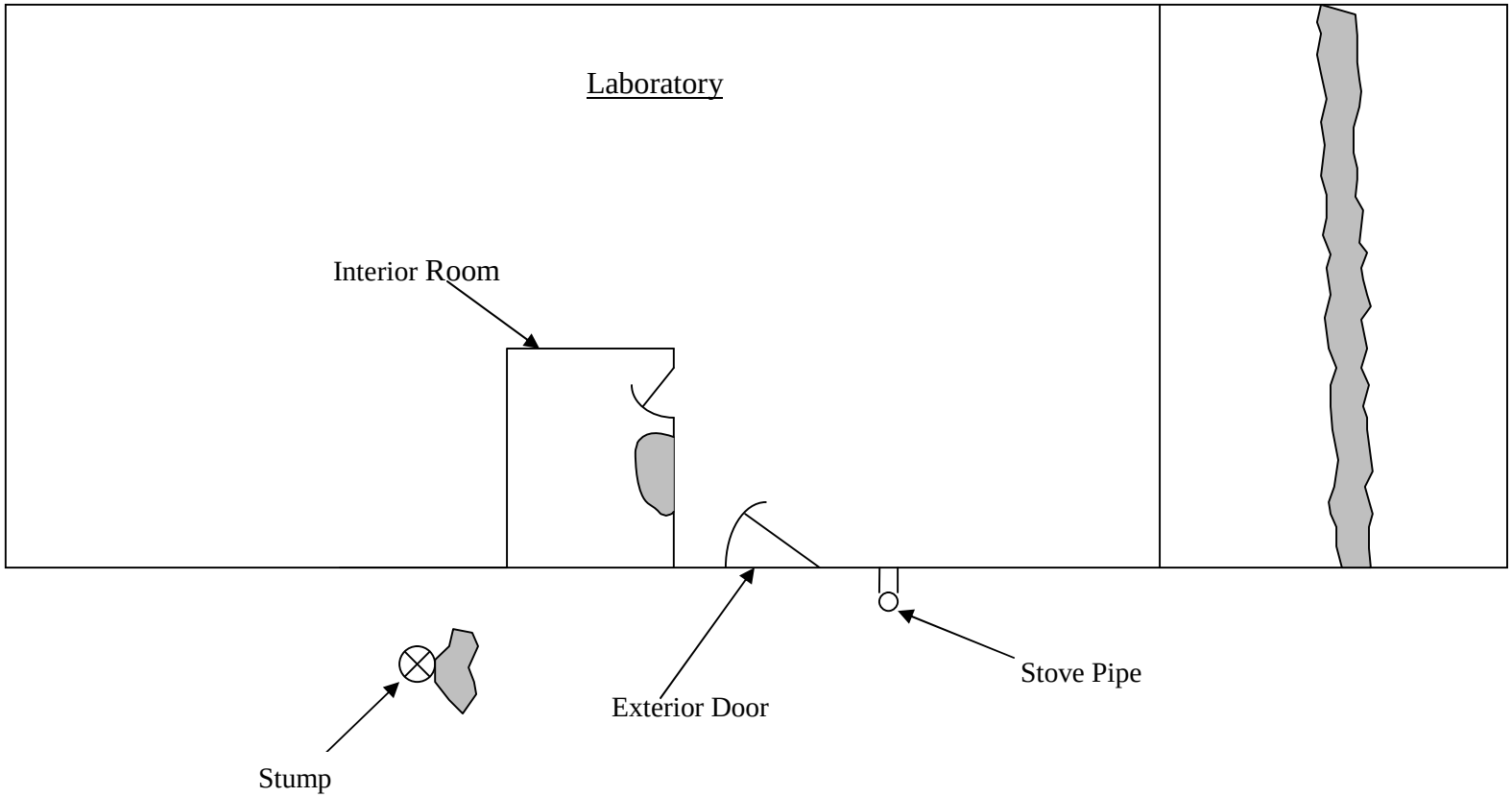
Scale: 1.0 Inch = 300'
Aerial Photograph from Google Earth

Valmont Butte Property Boundary based on
April 14, 2000 Land Survey Plat

CRI
CASEY RESOURCES, INC.

FIGURE 2

FACILITY MAP
VALMONT BUTTE PROPERTY
3000 NORTH 63rd STREET
BOULDER, COLORADO



EXPLANATION

Areas with 50 – 60 µR/Hr Radiation Readings

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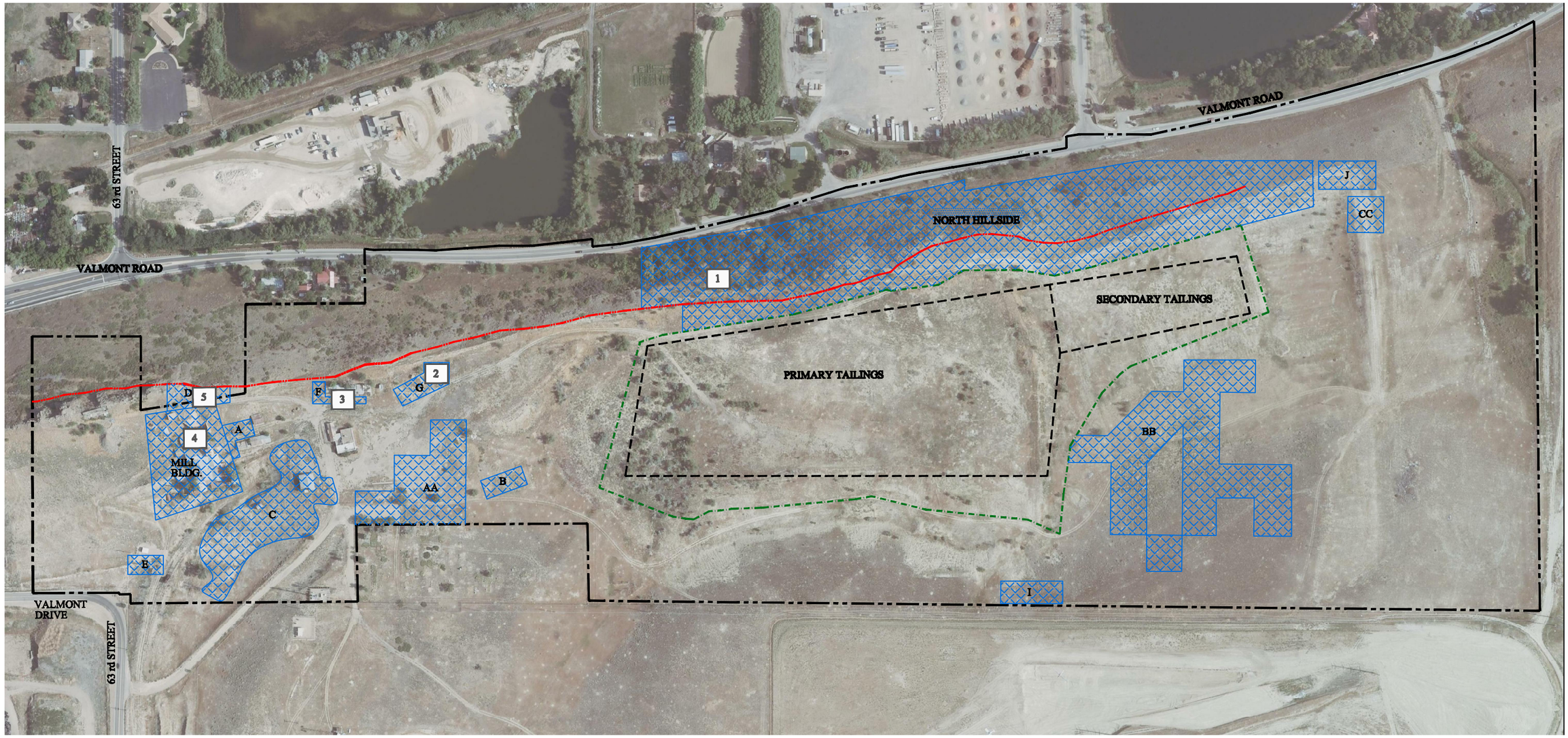
FIGURE 21

RADIATION SURVEY RESULTS
LABORATORY BUILDING
VALMONT BUTTE PROPERTY
3000 NORTH 63RD STREET
BOULDER, COLORADO



EXPLANATION

- Property Boundary
- Covenant Boundary
- Prairie Dog Control Fence
- Valmont Butte Ridge
- A — Lead Concentration > 800 mg/Kg
- 1 — Location Of Elevated Radiation Readings (URS, 2005)

Scale: 1.0 Inch = 300'
Aerial Photograph from Google Earth

Valmont Butte Property Boundary based on April 14, 2000 Land Survey Plat

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FIGURE 22

PROJECTED VCUP SOIL MANAGEMENT AREAS
VALMONT BUTTE PROPERTY
3000 NORTH 63rd STREET
BOULDER, COLORADO

APPENDIX A

XRF CORRELATION STUDY

APPENDIX B

LABORATORY ANALYTICAL REPORTS

FOR METALS IN SOIL SAMPLES

APPENDIX C

DISCUSSION OF 50 FOOT GRID SURVEY

APPENDIX D

GAMMA RADIATION SURVEY REPORT

APPENDIX E

LABORATORY ANALYTICAL REPORTS

FOR RADIATION BACKGROUND SOIL SAMPLES