APPENDIX A

GLOSSARY

Ambient Concentrations – concentrations in environmental media that include both naturally occurring concentrations of chemicals, and anthropogenic concentrations of chemicals from human-made, non-site sources.

Ambient Data Set – data that represent ambient conditions, and are used to calculate ambient concentrations.

Artesian – pertaining to groundwater under sufficient hydrostatic pressure to rise above the aquifer containing it.

Benicia Screening Levels (BSLs) - concentrations of organic and inorganic chemicals of interest calculated using site-specific information and exposure scenarios, and intended to represent those concentrations in soil that are protective given the exposure scenarios assumed. They are used as screening levels for site investigation data, and for identification of locations at the Benicia Arsenal where chemicals in soil do not present a human health concern given the assumed land use.

Blue Vitriol - A blue, crystalline hydrous solution of copper sulfate, $CuSO4 \cdot 5H2O$, one of the most important industrial copper salts, used in insecticides, germicides, and hair dyes and in the processing of leather and textiles.

Bluing –Bluing is technically called black oxide and is a surface conversion formed when steel is immersed in a caustic soda solution at about 285° F. The black oxide itself has almost no corrosion prevention qualities. It becomes a decent finish when a supplemental oil coating is added to it.

DTSC Approach for Determining Ambient Conditions - a technique for extracting ambient data sets from larger expanded data sets, and determining ambient concentrations from the ambient data.

Ground Penetrating Radar (GPR) - produces an underground cross-sectional image of the soils and subsurface features. The system sends radar pulses into the surface, then it receives and processes the reflected energy.

Conceptual Site Model – links contaminant sources, release mechanisms, exposure pathways and routes and receptors summarizing our understanding of the contamination problem. The CSM should answer:

> Are there are any ecological concerns? Is there potential for land use other than residential/industrial? Are there secondary human exposure pathways (like local fish consumption, raising livestock)? Are there unusual site conditions (large areas of contamination, high dust levels, indoor air contamination)?

Data Quality Objectives - criteria that data collection should satisfy to achieve the project objectives

Expanded Data Set - site characterization data that are typically collected to assess the magnitude and extent of possible contamination.

Homoscedasticity – the uncertainty associated with each measurement is the same.

Incremental – In this report, "incremental" is used for chemicals like arsenic that have a background risk. Total risk = background + incremental. VOCs in indoor air would not have an incremental risk as there is no background risk.

Investigation Derived Waste – waste generated during field activities such as soil cuttings, water, plastic bags, and nitrile gloves.

Method Detection Limit (MDL) – the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. It is determined from analysis of replicate samples of a given matrix containing low levels of the analyte that have been processed through the entire preparation procedure.

Method Quantitation Limit (MQL) – The lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions.

Normal Probability Plot - a plot used to determine how well data fit a normal distribution. Quantiles of sample data are plotted against quantiles of the standardized normal distribution.

Risk Based Screening Level – a risk-based target level for a chemical of concern developed under a Tier 1 evaluation. A Tier 1 evaluation is a risk-based analysis to develop non site-specific values for direct and indirect exposure pathways utilizing conservative exposure factors and fate and transport for potential pathways and various property use categories.

Volatilization – the transfer of a chemical substance from a liquid phase to a gaseous phase.

Outlier - an observation whose value is quite different than other observations in the data set.

Parkerization – Parkerize - "Parkerize" and "Parkerizing" are terms derived from the former Parker Chemical Co., which was the inventor of the process. Parkerizing or Phosphating is a metal finish that really gained in popularity during World War II (WWII) when the US Government was looking to replace the typical blued finish on most small arms with a rust resistant and anti-reflective coating that would be both durable and abrasion resistant and hold up in all weather extremes. The Parkerizing technique is a phosphate etching process that produces a hard matte or dull finish. Today, the most common types used are the original WW2 type, known as grey oxide and the black manganese, still in use by many Military and Civilian manufacturers in many countries on a wide variety of products.

Today, there are commonly two types of parkerizing: 1) using manganese phosphate to turn metal into a dark charcoal, almost black; and 2) using zinc phosphate to turn metal to a lighter gray. These Parkerizing finishes offered much more protection from harsh weather than the older process of bluing, and is very simple to apply and maintain. Parkerizing was much easier to use than the older process of bluing because the parts you want to Parkerize do not have to be polished, they can be acid dipped, sanded, bead blasted or sand blasted. In fact a lot of nicks and scratches that would show up on a blued item would not even be seen after Parkerizing. A green/gray color has also been associated with parkerizing, which meant that something had to be done to contaminate the phosphate. This material was most likely Cosmoline.

Parkerizing is an immersion process requiring the solution to be heated to approximately 190-210 degrees and the dipping time can range from 5-45 minutes or so, depending on the hardness of the metal and the desired thickness of the coating..

Preliminary Remediation Goals - risk based concentrations presented in a EPA Region IX document that are derived from standardized equations combining exposure information assumptions with EPA toxicity data, considered to be protective for humans over a lifetime.

pH - pH is defined as the negative logarithm of the hydrogen ion concentration. The pH scale goes from 0 to 14 with pH 7 as the neutral point. As the amount of hydrogen ions in the soil increases, the soil pH decreases thus becoming more acidic.

Purge Water – water removed from monitoring wells prior to sample collection.

Ranked Data Plot - an X-Y plot of data that are ordered from smallest to largest.

sal ammoniac - NH4Cl, Ammonium Chloride, white or colorless, water-soluble, odorless, cubic crystalline salt with a biting taste. Sal ammoniac is one of the most common and most well known of the ammonium-bearing minerals. Sal ammoniac forms on volcanic rocks near fume releasing vents. Sal ammoniac is very soluble in water. There is no liquid phase as the mineral crystallizes from the gas phase in a process called sublimation. It is prepared commercially by reacting ammonia, NH_3, with hydrogen chloride, HCl, and is used chiefly in the manufacture of electric dry-cell batteries, in soldering fluxes, in textile printing, and in making other compounds. It is also used in certain medical treatments.

Serial Correlation – redundancy of information between observations that are adjacent to each other either spatially or temporally.

Soil Gas - Soil is composed of particles ranging in size from as much as an inch in diameter (gravel) down to less than a thousandth of an inch (clay). Between the particles are "interstitial" spaces (pores) which can contain liquids (normally water) or air. The air in these spaces is called "soil gas".

Specific Conductance (SC) – a numerical expression of the ability of the water to carry an electric current. It can be used to assess the degree of mineralization, salinity, or estimate the total dissolved solids concentration of a water sample.

Spirits of nitre - Spirits of nitre was ethyl nitrite and was supposed to quench thirst and promote secretions including perspiration.

Stoddard solvent - Stoddard solvent (CAS # 8052-41-3) is a colorless, flammable liquid that smells and tastes like kerosene. It will turn into a vapor at temperatures of 150–200 °C. Stoddard solvent is a petroleum mixture that is also known as dry cleaning safety solvent, petroleum solvent, and varnoline; its registered trade names are Texsolve S® and Varsol 1®. It is a chemical mixture that is similar to white spirits. Stoddard solvent is used as a paint thinner; in some types of photocopier toners, printing inks, and adhesives; as a dry cleaning solvent; and as a general cleaner and degreaser.

Tincture of Steel - In medicine, Tincture of steel is an alcoholic solution of the chloride of iron.

Total Dissolved Solids (TDS) – the amount of solids that remain when a water sample is evaporated to dryness.

Total Organic Carbon (TOC) – a measure of the total organic matter present. Organic matter is naturally occurring in animals, plants, and man. Organic matter may also be man made and in products such as pesticides, fuels, solvents, and paints. Too much organic matter could place a significant oxygen demand and impact the soil/water quality. Synthetic organics either do not biodegrade or biodegrade very slowly.

Total Suspended Solids (TSS) – a measure of the undissolved solids that are present. Sources of TSS include sediment from erosion of exposed land and dirt from impervious areas.

AVAILABLE FOR VIEWING
IN THE CITY ATTORNEY'S OFFICE.

APPENDIX B

PLATES

No.	Description
1	Previous Investigations' Results
2	Boring Locations: 50 Series Complex
3	Soil Results: Wet Chemistry
4	Piezometer Location Map with Groundwater Elevations
5	Groundwater Contours: 50 Series Complex
6	Groundwater Results: Wet Chemistry
7	Radial Plots
8	Sample Results Summary
9	Soil Results: VOCs
10	Soil Gas Results: VOCs
11	Groundwater Results: VOCs
12	Soil Results: TPH, PAH, SVOCs
13	Groundwater Results: TPH, PAH, SVOCs
14	Soil Results: Metals
15	Groundwater Results: Metals

APPENDIX C

APRIL 2, 1999 NORCAL GEOPHYSICAL CONSULTANTS SURVEY OF BUILDINGS 53, 73 AND 154

GEOPHYSICAL
CONSULTANTS, INC.

NORCAL

LETTER OF TRANSMITTAL

TO: Brown and Caldwell
9616 Micron Avenue, Suite 600
Sacramento, CA 95827-2627

ATTN: Mr. Dave Zuber

REF: Geophysical Survey
Benicia Arsenal Environmental Restoration Project, Benicia, CA

VIA: MAIL: REG:( )2ND:(X)EXP:( )UPS:(X)AIRBRN:( )FED.X:( )DELIVERED:( )

ENCLOSED PLEASE FIND THE FOLLOWING/COMMENTS:

Two (2) copies of final report for the above referenced work.

BY: Donald J. Kirker

DATE: April 2, 1999

REGIONAL OFFICE
1 NEWHOPE ST., SUITE 101 · FOUNTAIN VALLEY, CA 92708
TELEPHONE (714) 708-7727 · FAX (714) 708-7720

CORPORATE OFFICE
1350 INDUSTRIAL AVENUE, SUITE A · PETALUMA, CA 94952
TELEPHONE (707) 763-1312 · FAX (707) 762-5587

NORCAL GEOPHYSICAL CONSULTANTS, INC.

April 2, 1999

Mr. Dave Zuber
Brown and Caldwell
9616 Micron Avenue, Suite 600
Sacramento, CA 95827-2627

Dear Mr. Zuber:

Geophysical investigations were performed by NORCAL Geophysical Consultants, Inc. at the Benicia Arsenal Environmental Restoration project in Benicia, California. These investigations were conducted under the guidelines presented in Brown and Caldwell's scope of work, Task Order 1, Exhibit A, dated December 31, 1998, and the Revisions to Task Order 1, Exhibit A, dated February 22, 1999. As stated in Revisions to Task Order 1, Exhibit A, the scope of work for this project will be conducted in two phases. Phase 1 consists of geophysical surveys at Buildings 98 (former Bldg. 73), 53, 56A,103, and 154. Phase 2 will consist of geophysical surveys at Buildings 55 through 59, 65, and 66. The Phase 2 work will also include subsurface investigations at seven proposed soil boring locations.

This report presents the findings of the Phase 1 investigation. The field survey for Phase 1 was performed on March 15 and 16, 1999 by NORCAL Geophysicist Donald J. Kirker and Geophysical Technician Lee S. Hurvitz. Logistical support was provided by Brown and Caldwell personnel Wendy Linck, and Paul E. Lopez. All geophysical work performed at the Benicia Arsenal was governed by the Brown and Caldwell Quality Assurance Program Plan (QAPP) dated February 1999.

MODIFICATION TO SCOPE OF WORK

The Brown and Caldwell scope of work for Phase 1 includes geophysical surveys at Buildings 98 (former Bldg. 73), 53, 56A,103, and 154. However, changes were made to this scope by Brown and Caldwell regarding the investigations at Buildings 98 (former Bldg. 73), and 103. At Building 98, the survey area comprises both the exterior and interior portions of the southwest corner of the building. Inside of the building, heavy equipment and machinery are located within the survey area. This equipment precluded access to the interior portion of the site. As specified by Brown and Caldwell, investigations within Building 98 were omitted from the scope. At Building 103, large amounts of surface debris were scattered throughout the survey area. This debris precluded access to the survey area. As specified by Brown and Caldwell, geophysical investigations at Building 103 will be conducted during the Phase 2 investigations. In addition, Brown and Caldwell specified that we conduct surveys at three of the seven proposed boring locations originally included in the Phase 2 investigations.

A summary of the revised Brown and Caldwell scope of work for the Phase 1 investigation is presented below:

- Conduct geophysical investigations outside of and adjacent to the southwest corner of Building 98 (former Bldg. 73).

- Conduct geophysical investigations east and southeast of Building 154.
- Conduct investigations south of Building 56A.
- Investigate the interior of the southeast corner of Building 56A, and the exterior portion extending from Building 56A to Building 53.
- Investigate three proposed boring locations.

PURPOSE

Information, provided by Brown and Caldwell, indicates that underground storage tanks (UST's), cisterns, and dip tanks were used for various industrial purposes at Buildings 98 (former Bldg.73), 53, 56A, and 154. However, records are incomplete regarding the existence or exact location of these below ground features. Therefore, the purpose of the geophysical investigation is to obtain subsurface information that will aid in determining the location and extent of these various subsurface features within each survey area.

For the proposed boring site surveys, the purpose is to locate detectable utilities and subsurface features in the vicinity of each proposed drilling location to minimize the potential for encountering utilities and other possible subsurface obstructions.

SITE DESCRIPTION

The area of investigations for the surveys at Buildings 98 (former Bldg.73), 53, 56A, and 154 are shown on the Site Map, Former Building 73, and the Site Map, Buildings 53, 56A, and 154 Plates 1 and 2, respectively. The locations of the three proposed boring sites are also shown on Plate 2. A brief description of each site is presented below.

Building 98 (former Bldg. 73)

The survey area at Building 98 comprises approximately 1,250 square feet. It is located adjacent to the west and south sides of the building. The northwest portion of the survey area is covered with reinforced concrete. The southern portion is covered by asphalt. East-west trending railroad tracks are located along the south boundary. The survey area is generally free of above ground cultural objects.

Building 53

The survey area at Building 53 measures approximately 50 by 125 feet. It is bound by Building 56A to the west, Building 53 to the east, and a planter and steep slope to the north. The survey area is open to the south. An approximate 45 by 50 foot portion of the survey area is located within the southeast corner of Building 56A. Access within this building is limited to areas free of furniture, counters, and equipment. The interior floor is comprised of concrete and is approximately 3.5 feet higher than ground surface. The planter and steep slope to the north comprises the northern most 20 feet of the survey area between Buildings 56A and 53. Access

to this portion of the survey area is limited to areas of the planter located adjacent to the asphalt surface. With exception to a loading ramp along the south boundary of the survey area, the site is generally free from above ground cultural objects. The Brown and Caldwell provided site map indicates that three underground storage tanks (UST's) may exist within this survey area. Two of the suspected tanks have volumes of approximately 1,000 and 10,000 gallons, and may be located beneath Building 56A. The other tank has a reported volume of 4,000 gallons and may be located adjacent to Building 53 in the planter. This map also indicates that the UST associated lines from Building 154 are connected to these tanks and trend to the northeast corner of Building 53.

Building 56A

The survey area at Building 56A measures approximately 30 by 320 feet and is asphalt covered. It is located adjacent to the loading dock along the south side of the building. East-west trending railroad tracks are located within the survey area along its length. With exception to the railroad tracks, the site is generally free of above ground cultural objects and debris. The Brown and Caldwell provided site map indicates that UST associated lines may trend east-west through the survey area from the suspected tanks at Building 154.

Building 154

The survey area at Building 154 is covered with asphalt and measures approximately 60 by 140 feet. It is bound by Building 154 to the west, a steep slope to the north, and Building 56A to the east. The survey area is open to the south. Two large concrete/metal vault lids are located near the west boundary. The site is generally free of above ground cultural objects. A site map, provided by Brown and Caldwell, indicates that three underground storage tanks (UST's) may exist within this survey area. The suspected volumes of these tanks are 1,400, 7,000, and 10,000 gallons.

METHODOLOGY

For this investigation, we used the electromagnetic terrain conductivity (TC), ground penetrating radar (GPR), and electromagnetic line locating (EMLL) methods. The TC method was used to determine conductivity variations that may indicate the presence of UST's, cisterns, and other buried debris and objects. The GPR method was used to aid in further characterizing the source of any detected TC anomalies. Since the GPR method is typically unaffected by above ground metal objects, it was also used to obtain subsurface information inside of buildings, and in close proximity to metal equipment and machinery. The EMLL method was used to aid in further characterizing the source of any detected TC anomalies, as well as to scan each site for near surface metal that may indicate the presence of a UST. This method was also used to locate UST associated utility alignments. In addition, the EMLL and GPR methods were used to investigate the boring locations for detectable utility alignments and drilling obstructions.

Typically, the vertical magnetic gradient (VMG) method is used in conjunction with these techniques to detect buried metal objects. However, magnetic interference caused by the nearby structures and railroad tracks precluded the use of the VMG method in these areas. Descriptions of the TC, GPR, and EMLL methods are provided in Appendix A, of this report.

Use of TC, GPR, and EMLL methods were determined by specific site conditions and access within each survey area. At Building 98, we used the GPR method to obtain the subsurface information. Interference caused by the reinforced concrete slab and the railroad tracks precluded the use of the TC and EMLL methods in this area. For the geophysical survey at Building 53, we used the GPR and EMLL methods. The GPR method was used throughout the survey area, including portions of the interior of Building 56A. The EMLL method could only be used to survey portions of the planter, and the asphalt walkway. Interference caused by the buildings, loading ramp, and railroad tracks precluded the use of the TC method in this area. At Building 56A, we used the GPR and EMLL methods. Interference caused by the railroad tracks precluded the use of the TC method in this area. At Building 154, we used the TC, GPR, and EMLL methods to obtain the subsurface information throughout the survey area.

EQUIPMENT FUNCTIONAL CHECKS

At the beginning and end of each field day, we performed equipment functional checks, as recommended by the instrument manufacturers to ensure proper equipment function. These functional checks included testing the power supply, as well as instrument response. The equipment was operated over a selected test site near Building 56A to verify appropriate gain settings and instrument repeatability. Particular attention was paid to the GPR calibration, with the same gain, filter, and time-depth scales chosen each time to check for repeatable results. This calibration check was documented by printing the calibration plot on the chart recorder. Proper functioning of the equipment was verified by determining that the trends observed in the data were repeatable. The results of these tests indicated that our equipment was functioning properly and accurately throughout the duration of the survey.

DATA ACQUISITION AND ANALYSIS

Descriptions of data acquisition and analysis procedures for the TC, GPR, and EMLL surveys are provided in Appendices B and C, respectively.

SURVEY DOCUMENTATION

We used Daily Field Reports, Borehole Site Survey Log forms, and Draft Field Diagrams to document our field work. The Daily Field Report summarizes each day's activity. The Borehole Site Survey Logs present the pertinent information associated with each proposed borehole location. The Draft Field Diagrams were used to create the computer generated site maps shown

on Plates 1 and 2. Copies of the Daily Field Reports and Borehole Site Survey Log forms are provided in Appendix D.

RESULTS

The results of the geophysical investigation are presented on Plates 1 through 4. Plate 1 is the Geophysical Survey Map for Building 98 (Former Bldg. 73). This plate shows the limits of the survey area, the structures or above ground cultural features that may be in close proximity to the site, the GPR traverses, and the locations of any detectable subsurface features. Plate 2 is the Site Map for Buildings 53, 56A, and 154. This map shows the limits of each survey area, the structures or above ground cultural features that may be in close proximity to the site, and the locations of the GPR traverses. Plate 3 is the Geophysical Survey Map for Buildings 53, 56A, and 154. This plate shows the locations of detected subsurface features and undifferentiated utility alignments. Since a utility search was not the primary objective of this survey, there may be additional utilities that are not shown. Plate 4 is the Terrain Conductivity Contour Map showing the variations in the electromagnetic terrain conductivity within the survey area at Building 154. A description of the results for the geophysical surveys at Buildings 98 (former Bldg.73), 53, 56A, and 154, are presented in the following paragraphs.

Building 98 (former Bldg.73)

The results of the GPR survey at Building 98 are shown on Plate 1. Our interpretation of the GPR data defines reflection patterns characteristic of variable subsurface conditions in the upper 2 to 3 feet. These conditions include shallow fill horizons associated with the asphalt and concrete surfaces, and small discrete reflection patterns associated with the rebar in the concrete. In the south central portion of the survey area, the GPR data defines a zone of broad subtle reflection patterns. We refer to this zone as a GPR anomaly on Plate 1. It has been our experience that broad reflection patterns typically indicate metallic or nonmetallic subsurface features such as utility vaults, cisterns, brick septic tanks, or small UST's. As mentioned above, the railroad tracks precluded the use of the EMLL method in this area. Therefore, we could not determine if the source of the GPR anomaly is a metallic or nonmetallic object. The remainder of the GPR data exhibits continuous reflecting horizons typical of undisturbed subsurface strata.

Building 53

The results of the EMLL and GPR surveys at Building 53 are shown on the Geophysical Survey Map, Plate 3. The EMLL survey defined the location of an anomalous zone of buried metal, as well as undifferentiated and natural gas utility alignments. The zone of buried metal measures approximately 10 by 13 feet and is located adjacent to Building 53 in the planter area. Upon further inspection of this area, we uncovered a UST fill port approximately 6 inches beneath the ground surface at its east end. The approximate dimension of this UST is consistent with the 4,000 gallon UST shown on the Brown and Caldwell provided site drawing. An undifferentiated

utility was detected from this tank to Building 53, then south and west into the adjacent survey area (Building 56A), as shown on Plate 3. Portions of this utility may also trend north, as shown on the Brown and Caldwell provided site map, from the tank along the west and north sides of Building 53. However, the steep terrain in the planter prohibited us from detecting this line any further to the north. We believe that this undifferentiated utility or utilities (side by side) may be associated with the UST's in this area, as shown on the Brown and Caldwell provided site map. We have labeled this utility as 'UST associated lines' on Plate 3.

GPR data were obtained between Buildings 56A and 53, as well as inside of Building 56A at the southeast corner. The GPR data obtained outside of the buildings defined reflection patterns typical of utilities, as well as deeper reflecting horizons characteristic of uniform subsurface conditions. Hyperbolic reflection patterns typical of a UST was not defined in this area. Therefore, the surface trace of the UST, as described above, could not be confirmed with the GPR. The lack of definition may be due to limited GPR depth of investigation caused by the relatively conductive fill materials associated with this area.

The GPR data obtained inside of the building defined reflection patterns typical of shallow fill horizons associated with the floor, and deeper reflecting horizons characteristic of uniform subsurface conditions. The GPR data did not define reflection patterns typical of a UST beneath the floor of the building in this area. It should be noted, however, that the floor of the building is approximately 3.5 feet higher than the ground surface outside of the building. If UST's were in place prior to the construction of this portion of the building, it is highly probable that they are buried deeper than 7 to 8 feet below the surface of the floor. At these depths, UST's are very difficult to detect using the GPR method, especially in conductive soils. Since GPR is not affected by above ground metal objects, it is the only geophysical method that can be used to search for a UST inside of this building. We are not aware of other geophysical methods available that can be used to detect possible UST's beneath this building, given the depth of investigation.

Building 56A

The results of the EMLL and GPR surveys at Building 56A are shown on Plate 3. The EMLL investigation detected the surface trace of an undifferentiated utility and a natural gas line. Both lines trend east-west through the site. Also shown on Plate 3 is a water line. The location of this line was based on the location of valve boxes and asphalt patches. As mentioned above, we believe that the undifferentiated utility represents UST associated lines that trend from the suspected UST's at Building 53 to the Building 154 survey area. The GPR data obtained in this area defined reflection patterns typical of shallow fill horizons associated with the pavement, isolated reflections typical of the railroad tracks and utilities, and deeper reflecting horizons characteristic of uniform subsurface conditions. The GPR data do not indicate hyperbolic reflections within the upper two to four feet large enough to represent a UST or other large subsurface features within the limits of the survey.

Building 154

The results of the EMLL and GPR surveys at Building 154 are shown on the Geophysical Survey Map, Plate 3. The EMLL survey defined the location of two anomalous zones of buried metal, as well as numerous utility alignments. The zones of buried metal are located in the southwest quadrant of the survey area and trend east from the vault lids, as shown on Plate 3. One is relatively small, measuring approximately 10 by 17 feet. The other is significantly larger measuring approximately 10 by 30 feet. The approximate dimensions of these zones are consistent with the 7,000 and 10,000 gallon UST's shown on the Brown and Caldwell provided site drawings. The detected utilities shown on this map include electric, natural gas, storm drain, and several undifferentiated utility alignments. Some of the undifferentiated utilities trend east, from the vaults and suspected UST's, to the adjacent survey area (Building 56A). We believe that these are the same utilities that are associated with the detected UST at Building 53.

The results of the TC Survey are shown on the Terrain Conductivity Contour Map, Plate 4. Also shown are the two EMLL anomalies representing the suspect 7,000 and 10,000 gallon UST's, as described above. The contour map indicates a highly variable TC gradient throughout most of the site. These variations are manifested by numerous circular closures that occur mainly in the central and northern portions of the survey area. The southern portion of the survey area is characterized by widely distributed contours. Closely spaced contours typically indicate effects from above and below ground sources. Whereas, widely distributed contours typically represent background conductivity values that are not influenced by above and below ground sources. Some of the closely spaced contours on this map represent effects from above ground metal objects, such as the nearby buildings. However, most of the TC variations are associated with below ground metal objects, including the two EMLL anomalies (suspected UST's) and the detected utilities.

As shown on Plate 4, the locations of the EMLL defined UST's correspond with two significant TC anomalies. These anomalies are characterized by closely spaced circular closures that exhibit a decrease in TC values. In addition to these anomalies, there is a third TC anomaly that exhibits the same characteristics, indicating that there may be a metallic source buried deeper than the detected utilities in this area. It is located in the center of the survey area northwest of the suspected UST's and is referred to as a TC anomaly on Plate 4. The areal extent of this anomaly is significantly smaller than the others, measuring approximately 5 by 11 feet. These dimensions are consistent with a 1,400 gallon UST and may represent the third tank shown on the Brown and Caldwell provided site drawings. The other TC variations appear to be due to the various utilities that trend through the area.

The GPR data obtained in this area define reflection patterns typical of small isolated objects and utilities, as well as deeper reflecting horizons characteristic of uniform or undisturbed subsurface conditions. The GPR data obtained over the suspected UST's indicated an absence of reflection patterns. Therefore, we could not confirm the surface trace of each UST with the GPR. As

mentioned above, this lack of definition is probably due to limited GPR depth of investigation caused by conductive subsurface materials.

Borehole Site Surveys

The results of the borehole site surveys are shown on the enclosed copies of the Borehole Site Survey Logs (Appendix D). As specified by Brown and Caldwell, these proposed borings are designated as #004, #005, and #006. Proposed boring #004 is located within the Building 154 survey area. Proposed borings #005 and #006 are located within the Building 56A survey area. As described above, EMLL and GPR were systematically used over each location. During the course of this investigation, we identified several undifferentiated utility alignments. The surface trace of these utilities, as well as the proposed boring locations, were marked with spray paint on the ground surface.

STANDARD CARE AND WARRANTY

The scope of NORCAL's services for this project consisted of using geophysical methods to characterize the shallow subsurface. The accuracy of our findings is subject to specific site conditions and limitations inherent to the techniques used. We performed our services in a manner consistent with the level of skill ordinarily exercised by members of the profession currently employing similar methods. No warranty, with respect to the performance of services or products delivered under this agreement, expressed or implied, is made by NORCAL.

We appreciate having the opportunity to provide you with this information.

Respectfully,

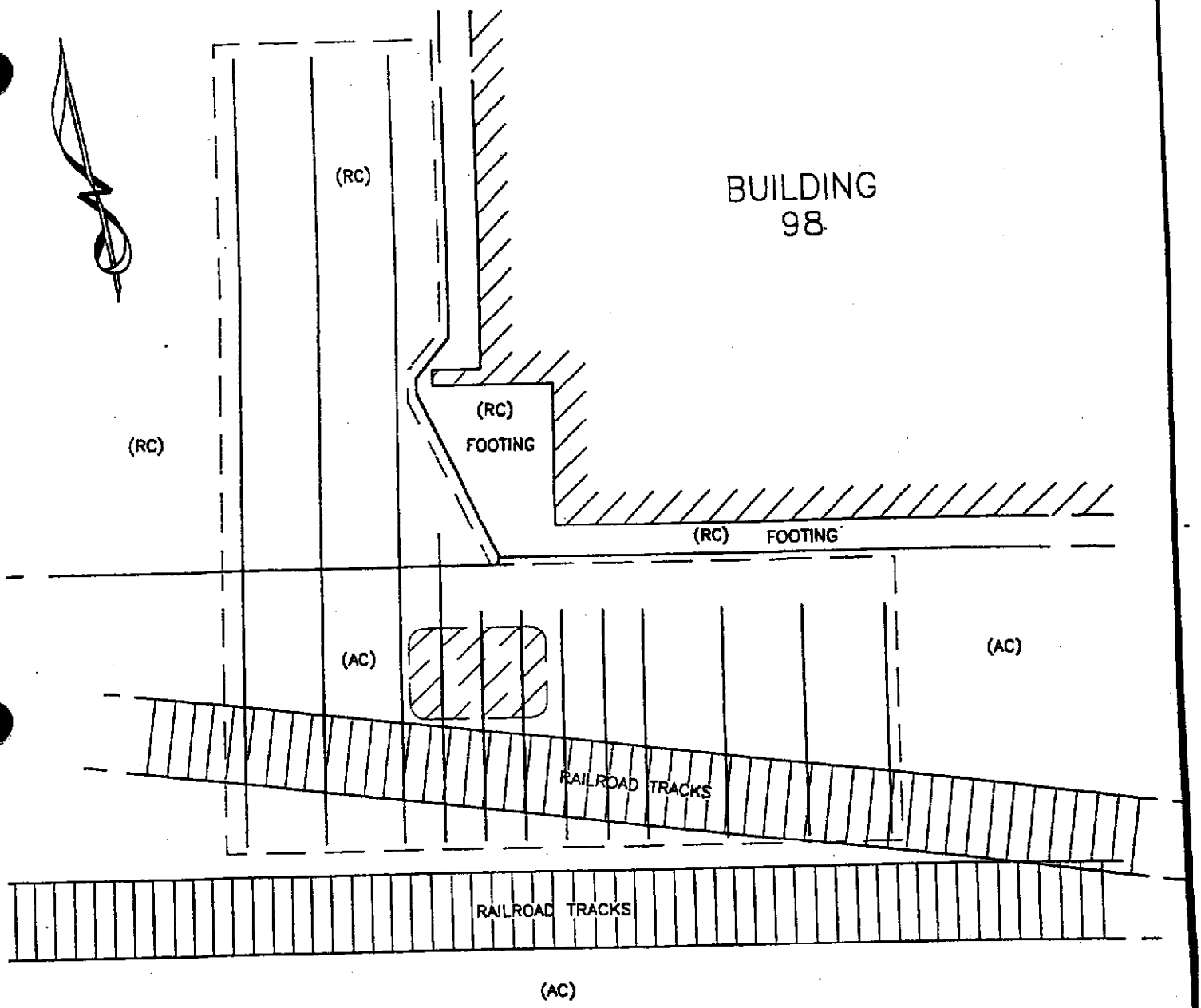
NORCAL Geophysical Consultants, Inc.

Donald J. Kirker

Donald J. Kirker
Geophysicist, GP-997

DJK/jh

Enclosure: Plates 1 through 4
Appendix A, METHODOLOGY
Appendix B, DATA ACQUISITION
Appendix C, DATA ANALYSIS
Appendix D, DAILY FIELD REPORTS AND BOREHOLE SITE SURVEY LOGS



SCALE

0 5 10 20

(1 inch = 10 feet)

LEGEND

——	LIMITS OF SURVEY AREA
——	GPR TRAVERSE
▨	GPR ANOMALY
AC)	ASPHALT
RC)	REINFORCED CONCRETE

NORCAL

GEOPHYSICAL SURVEY MAP
BUILDING 98
(FORMER BUILDING 73)

LOCATION: BENICIA ARSENAL, BENICIA, CALIFORNIA

CLIENT: BROWN & CALDWELL

NORCAL GEOPHYSICAL CONSULTANTS INC.

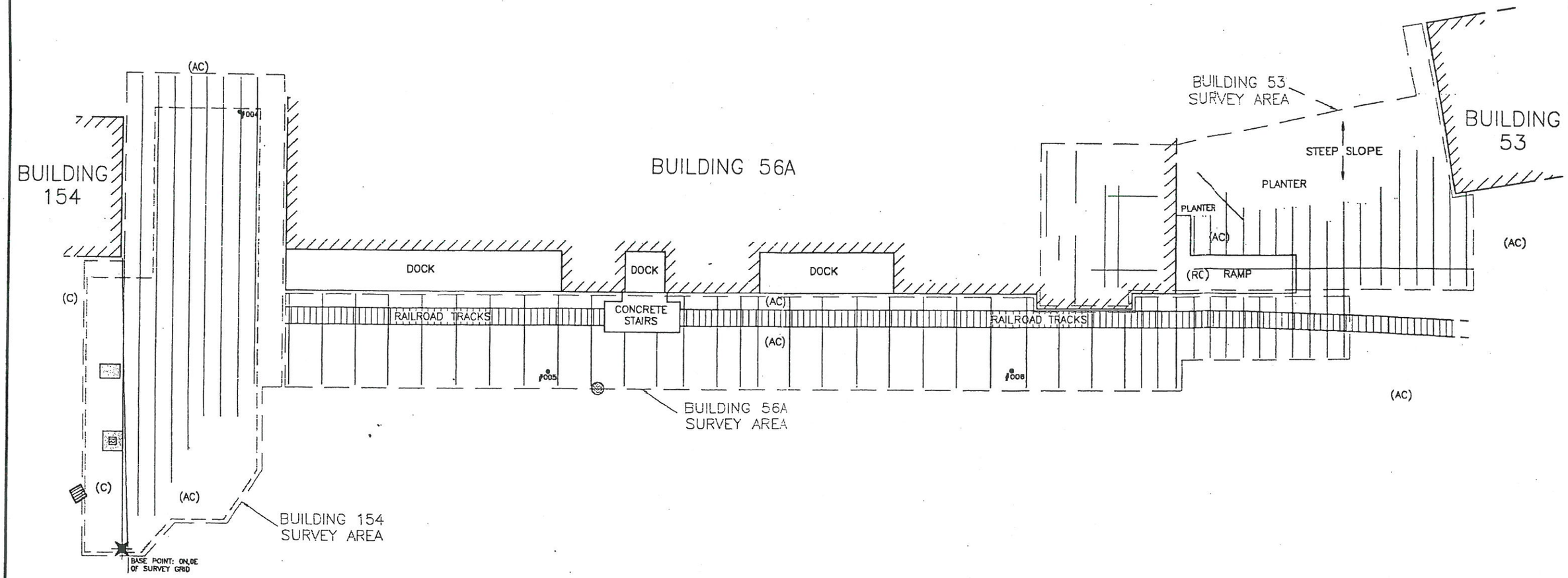
JOB #: 99-141.24

DATE: MAR. 1999

DRAWN BY: .G.RANDALL

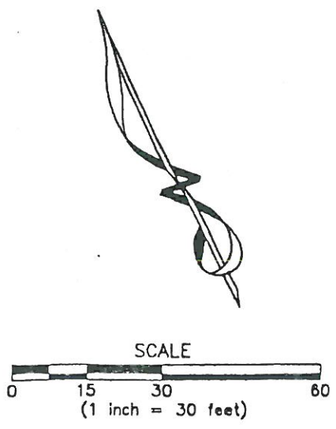
APPROVED BY: DJK

PLATE 1



NOTE: *NOT ALL UTILITIES ARE SHOWN ON THIS MAP*

LEGEND			
— — —	LIMITS OF TERRAIN CONDUCTIVITY SURVEY		MANWAY
— —	LIMITS OF SURVEY AREAS	• #004	PROPOSED BORING SITE
———	GPR TRAVERSE	(AC)	ASPHALT
	CONCRETE/METAL VAULT LID	(C)	CONCRETE (UNREINFORCED)
	STORM DRAIN	(RC)	REINFORCED CONCRETE



NORCAL

SITE MAP
BUILDINGS 53, 56A AND 154

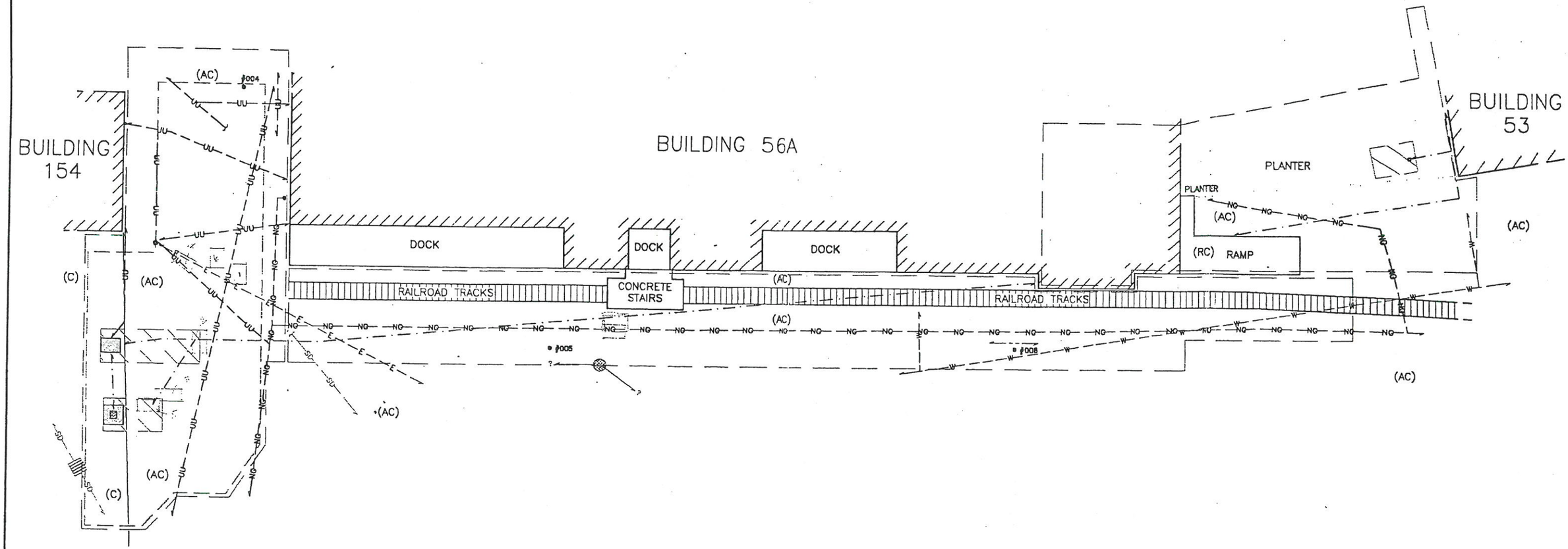
LOCATION: BENICIA ARSENAL, BENICIA, CALIFORNIA

CLIENT: BROWN & CALDWELL

JOB #: 98-141.24 | NORCAL GEOPHYSICAL CONSULTANTS INC.

DATE: MAR. 1999 | DRAWN BY: C.RANDALL | APPROVED BY: DJK

PLATE 2



NOTE: *NOT ALL UTILITIES ARE SHOWN ON THIS MAP*

LEGEND

— — —	LIMITS OF ELECTROMAGNETIC TERRAIN CONDUCTIVITY SURVEY	• #004	PROPOSED BORING SITE
—— ——	LIMITS OF SURVEY AREA	—E—	ELECTRIC LINE
	EMLL ANOMALY REPRESENTING POSSIBLE UST	—NG—	NATURAL GAS LINE
	CONCRETE/METAL VAULT LID	—SD—	STORM DRAIN
	MANWAY	—UU—	UNDIFFERENTIATED UTILITY LINE
	STORM DRAIN	— · — · —	UST ASSOCIATED LINES
(AC)	ASPHALT	——?——?——	POSSIBLE UTILITY ALIGNMENT AS DEFINED BY GPR
(C)	CONCRETE (UNREINFORCED)	—W—	WATER LINE
(RC)	REINFORCED CONCRETE		

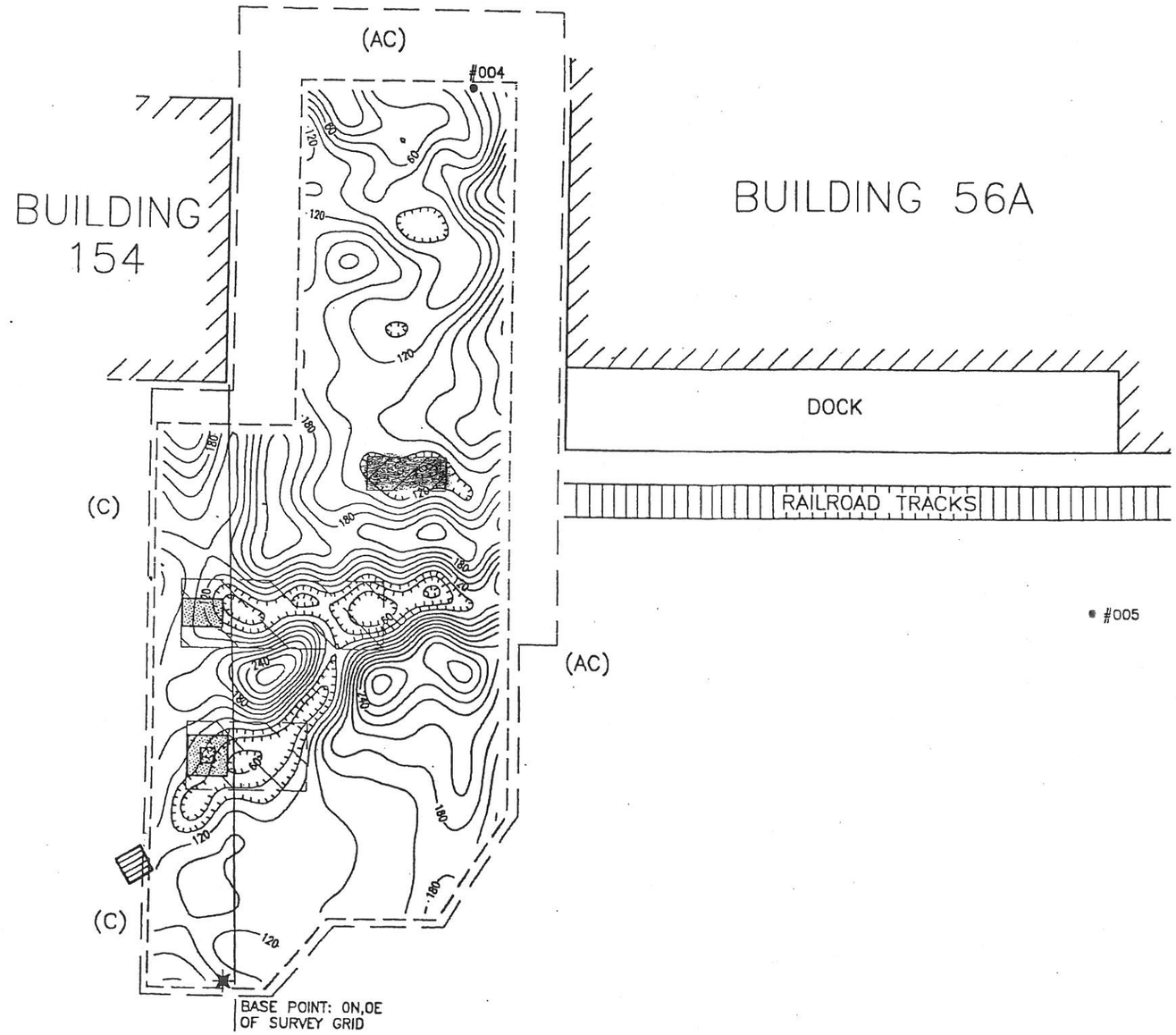
SCALE
0 15 30 60
(1 inch = 30 feet)

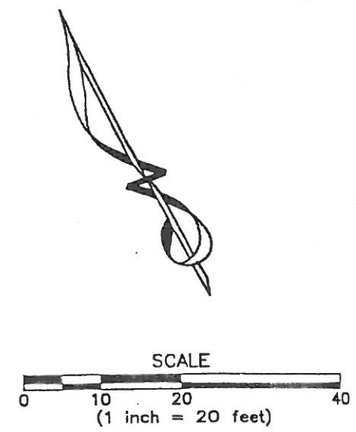
NORCAL

GEOPHYSICAL SURVEY MAP BUILDINGS 53, 56A AND 154

LOCATION: BENICIA ARSENAL, BENICIA, CALIFORNIA
CLIENT: BROWN & CALDWELL
JOB #: 98-141.24
NORCAL GEOPHYSICAL CONSULTANTS INC.
DATE: MAR. 1999
DRAWN BY: C.RANDALL
APPROVED BY: DJH

PLATE 3





LEGEND

	LIMITS OF ELECTROMAGNETIC TERRAIN CONDUCTIVITY SURVEY
	LIMITS OF SURVEY AREA
	TERRAIN CONDUCTIVITY ANOMALY REPRESENTING POSSIBLE UST
	FILL ANOMALY REPRESENTING POSSIBLE UST
	ELECTROMAGNETIC TERRAIN CONDUCTIVITY CONTOUR (CONTOUR INTERVAL = 20 mS/m)
	CONCRETE/METAL VAULT LID
	STORM DRAIN
• #004	PROPOSED BORING SITE
(AC)	ASPHALT
(C)	CONCRETE (UNREINFORCED)

NORCAL

ELECTROMAGNETIC TERRAIN CONDUCTIVITY MAP BUILDINGS 154

LOCATION: BENICIA ARSENAL, BENICIA, CALIFORNIA

CLIENT: BROWN & CALDWELL

PLATE

Appendix A

GEOPHYSICAL METHODS

Electromagnetic Terrain Conductivity (TC)

The electromagnetic method is used to measure variations in subsurface electrical conductivity. The electromagnetic system utilizes two coils separated by a specified distance. One of these coils transmits a time-varying electromagnetic signal (primary magnetic field) which induces current flow in the earth. This in turn creates a secondary magnetic field which is detected by the receiver coil. The secondary signal is complex and has both quadrature and in-phase components. The amplitude of the quadrature component is proportional to the electrical conductivity of the subsurface materials. The in-phase component is proportional to conductivity, but is also affected by electrical properties associated with metal objects. The instrument displays the quadrature component in units of milliSiemens/meter (mS/m). Since this measurement represents the conductivity of the volume of material sampled, rather than individual layers, it is an apparent value and is referred to as terrain conductivity (TC).

We performed the electromagnetic survey using a Geonics EM31-DL ground conductivity meter connected to an Omnidata data recorder. The data recorder automatically stores TC values as well as station locations and annotations regarding cultural features.

Ground Penetrating Radar

Ground penetrating radar is a method that provides a continuous, high resolution cross-section depicting variations in the electrical properties of the shallow subsurface. The method is particularly sensitive to variations in electrical conductivity and electrical permittivity (the ability of a material to hold a charge when an electrical field is applied).

The system operates by continuously radiating an electromagnetic pulse into the ground from a transducer (antenna) as it is moved along a traverse. Since most earth materials are transparent to electromagnetic energy, only a portion of the radar signal is reflected back to the surface from interfaces representing variations in electrical properties. When the signal encounters a metal object, however, all of the incident energy is reflected. The reflected signals are received by the same transducer and are printed in cross-section form on a graphical recorder. Depending upon depth and/or thickness the resulting records can provide information regarding the location of UST's, sumps, buried debris, underground utilities, and variations in the shallow site materials. Generally, electrically conductive materials, such as clay, saturated silt, and rebar can reduce the penetration capability and limit radar performance.

For this investigation, we used a Geophysical Survey Systems, Inc. SIR-2 Subsurface Interface Radar System equipped with a 500 megahertz (MHz) transducer. This transducer is near the center of the available frequency range and is used to provide high resolution at the desired depths.

Electromagnetic Line Location (EMLL)

Electromagnetic line location techniques are used to locate the magnetic field resulting from an electric current flowing on a line. These magnetic fields can arise from currents already on the line (passive) or currents applied to a line with a transmitter (active). The most common passive signals are generated by live electric lines and re-radiated radio signals. Active signals can be introduced by connecting the transmitter to the line at accessible locations or by induction.

The detection of underground utilities is determined by the composition and construction of the line in question. Utilities detectable with standard line location techniques include any continuously connected metal pipes, cables/wires or utilities with tracer wires. Unless carrying a passive current these utilities must be exposed at the surface or in accessible utility vaults. These generally include water, electric, natural gas, telephone, and other conduits related to facility operations. Utilities that are not detectable using standard electromagnetic line location techniques include those made of non-electrically conductive materials such as PVC, fiberglass, vitrified clay, and pipes with insulated connections.

The induction mode is also used to detect buried near surface metal objects such as rebar, manhole covers, and various metallic debris. This is done by holding the transmitter-receiver unit above the ground and continuously scanning the surface. The unit utilizes two orthogonal coils that are separated by a specified distance. One of the coils transmits an electromagnetic signal (primary magnetic field) which in turn produces a secondary magnetic field about the subsurface metal object. Since the receiver coil is orthogonal to the transmitter coil, it is unaffected by the primary field. Therefore, secondary magnetic fields produced by buried metal will generate an audible response from the unit. The peak of this response indicates when the unit is directly over the metal object.

Our instrumentation for this investigation consisted of a Radiodetection RD-400 line locator and a Fisher TW-6 inductive pipe and cable locator.

Appendix B

DATA ACQUISITION

Horizontal Control

Site definition and data acquisition were based on a horizontal control grid. The grid nodes were marked using marking paint on 10 by 10 foot centers at every survey area. Survey points between these markers were paced during data acquisition. The locations of each survey area, as well as the respective TC survey boundary, and the GPR traverses are shown on Plates 1 and 2. The specific locations of the marked grid nodes are not shown on these plates.

Geophysical Survey

At Building 98 (Former Bldg. 73), GPR data were obtained along south-north trending traverses spaced 2.5 to 5 feet apart. The length of these traverses ranged from 15 to 50 feet, as shown on Plate 1.

At Building 53, GPR data were obtained along west-east and south-north trending traverses. From Building 56A to Building 53, these traverses were spaced 5 feet apart. Inside Building 56A, the GPR data were obtained in areas free of furniture and equipment. This resulted in traverses that were spaced 4 to 20 feet apart. The GPR traverses over the entire site ranged in length from 7 to 82 feet, as shown on Plate 2. The EMLL technique was scanned over these same traverses outside of the buildings.

At Building 56A, GPR data were obtained along south-north trending traverses spaced 10 feet apart. The length of these traverses range from 18 to 28 feet. The location of the GPR traverses are shown on Plate 2. The EMLL technique was scanned over these same traverses.

At Building 154, TC data were collected at 5 foot intervals (stations) along south-north trending traverses spaced 5 feet apart. Following data acquisition, we downloaded the data to a portable laptop computer and produced a preliminary contour map in the field. We reviewed the map for locations of TC anomalies that may represent buried metal objects and debris. The GPR and EMLL techniques were then systematically used over the detected TC anomalies. GPR data were obtained along south-north trending traverses that ranged in length from 90 to 130 feet. The EMLL technique was scanned over these same traverses. The location of the TC survey boundary and the GPR traverses are shown on Plate 2.

For the boring site surveys, the investigation at each of the three proposed boring locations included the use of both GPR and EMLL. GPR profiles were obtained along both north-south and east-west trending traverses with the boring positioned at their intersection. Each traverse was approximately 20 feet long. The EMLL system was operated within the same ten foot radius of the boring as the GPR. Detected utilities within these areas were identified and marked with spray paint on the ground surface.

Appendix C

DATA ANALYSIS

Computer Processing

The down loaded TC data were converted into a format for contouring. The contouring program calculated an evenly spaced array of values (gridded) based on the observed field data. Finally, these gridded values were contoured to produce the TC Contour Map.

Contour Map Interpretation

Generally, TC values vary smoothly throughout a given region with uniform conditions. Areas where variations are strong are defined by closely spaced contours and are typically considered anomalous when there are no possible above ground sources. If the source of a particular anomaly is an isolated object or a group of closely spaced objects, the contours may form circular or elliptical closures. A large accumulation of buried objects may appear as a group of closely spaced anomalies or one large anomaly.

Actual anomaly magnitude and shape are dependent on the relative position and size of the buried objects with respect to the location of the data points. In general, anomaly magnitude will decrease and anomaly width will increase as distance (depth) to the source increases. Anomalies may or may not have paired high and low values creating what are known as magnetic dipoles.

GPR Analysis

We examined the GPR records for reflection patterns characteristic of UST's, cisterns, vaults, and buried debris. We also reviewed the records for changes in reflection character that could indicate variations in fill material associated with an excavation. For this survey, we estimate the depth of detection to average approximately three feet, with a maximum penetration of up to five feet in localized areas.

NORCAL GEOPHYSICAL CONSULTANTS INC.

NORCAL

DAILY FIELD REPORT

te: 3-15-99 Client/Location: BROWN & CALDWELL / BENICIA ARSENAL

rsonnel: DJK / LH Equipment: GPR, EMLL

oject Description: LOCATE BURIED FEATURES, INCLUDING UST's, JST ASSOCIATED UTILITIES, CISTERNS, AND UTILITY LINES.

ME	NOTES
30:	ARRIVE PETALUMA OFFICE, MOB FOR BENICIA ARSENAL
00:	ARRIVE BLDG 154
	-MEET WENDY LINCK OF B&C FOR HEALTH & SAFETY MEETING
10:	CALIBRATE EQUIPMENT AT NORCAL ESTABLISHED TEST SITE
	- START UST SEARCH AT BLDG 154, OBTAIN EMLL & GPR ON 5X5 GRID
5:	MOVE TO SURVEY AREA FOR BUILDING 53
	-OBTAIN GPR DATA INSIDE SOUTHEAST CORNER OF BLDG 56A
	(ACCESS WAS LIMITED TO AREAS FREE OF FURNITURE & EQUIPMENT)
00:	MOVE TO SURVEY AREA, FORMER BLDG 73
	-OBTAIN EMLL & GPR ON 5X5' GRID OUTSIDE OF BUILDING
	(AREA INSIDE OF BLDG WAS NOT SURVEYED, AT BROWN &
	CALDWELL REQUEST, BECAUSE OF VERY LIMITED ACCESS)
00:	MOVE BACK TO BLDG 53
	-OBTAIN GPR DATA INSIDE SOUTHEAST CORNER OF BLDG 56A,
	WEST PORTION (ACCESS WAS LIMITED TO AREAS FREE
	OF FURNITURE AND EQUIPMENT)
00:	INVESTIGATE AREA SOUTH OF BLDG 56A, BETWEEN 154 & 53
15:	RECALIBRATE EQUIPMENT AT NORCAL ESTABLISHED
	TEST SITE
30:	LEAVE SITE

LD DAY SUMMARY MOBILIZATION 2.5 HOURS, FIELD 7.5 HOURS

Donald J. Kirke Signature
NORCAL Representative

Signature
CLIENT Representative

NORCAL GEOPHYSICAL CONSULTANTS INC.

NORCAL

DAILY FIELD REPORT

Date: 3-16-99 Client/Location: BROWN & CALDWELL / BENICIA ARSENAL

Personnel: DJK / LH Equipment: EM31 EMLL GPR

Project Description: LOCATE BURIED FEATURES, INCLUDING UST's, UST ASSOCIATED UTILITIES, CISTERNS, AND UTILITIES

TIME	NOTES
6:15:	ARRIVE PETALUMA OFFICE, MOB VEHICLE
7:45:	ARRIVE BENICIA ARSENAL
7:55:	CALIBRATE EQUIPMENT AT NORCAL ESTABLISHED TEST SITE
	- CONTINUE GPR SURVEY SOUTHEAST CORNER OF BUILDING 56A
	- OBTAIN GPR DATA IN ACCESSIBLE AREAS AT BUILDING 53
	- OBTAIN EM31 DATA AT BUILDING 154
	- SURVEY BUILDING 53 WITH EMLL TECHNIQUE, MARK OUT POSSIBLE 4000 GALLON UST
12:15:	- DRAW SITE MAP
	- INVESTIGATE THREE PROPOSED BORING LOCATIONS (#004) (#005) (#006)
1:33:	RECALIBRATE EQUIPMENT AT NORCAL ESTABLISHED TEST SITE
	- DOWN LOAD EM31 DATA TO LAPTOP COMPUTER
	- PRODUCE CONTOUR MAPS
2:45:	LEAVE SITE
	(A SITE WALK WAS CONDUCTED NORTH & NORTHWEST OF BLDG 53. HOWEVER, A GEOPHYSICAL SURVEY COULD NOT BE CONDUCTED IN TH AREA BECAUSE OF LIMITED ACCESS BEHIND THE BUILDING & ON THE EMBANKMENT)

FIELD DAY SUMMARY MOBILIZATION 2.0 HOURS, FIELD 7.0 HOURS

Donald J. Kirker Signature
NORCAL Representative

Signature
CLIENT Representative

1350 INDUSTRIAL AVENUE SUITE A • PETALUMA, CA 94952
TELEPHONE (707) 763-1312 • FAX (707) 762-5587

CHANNEL: CSH/DJK

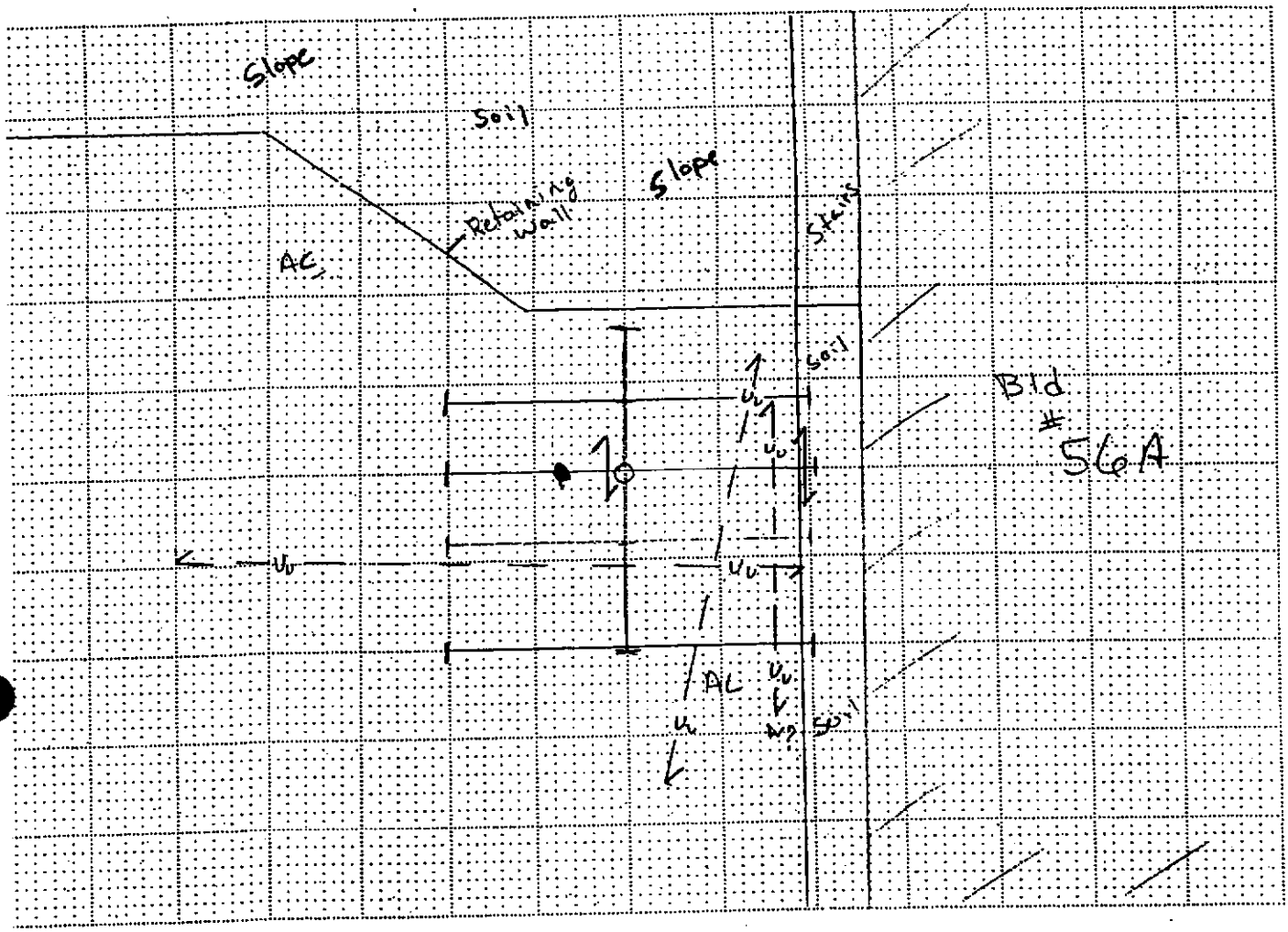
DATE: 03/16/99

NORCAL GEOPHYSICAL CONSULTANTS INC.

CLIENT: Brown + Caldwell

LOCATION: Benecia Arsenal

BORING: 004



Scale: 1" = 10'

EXPLANATION

- Original Boring Location
- Final Boring Location
- GPR Traverse
- Localized GPR Anomaly
- Utility Alignment

Utilities

- T (Telephone, Comm.)
- E (Electric)
- NG (Natural Gas)
- CA (Compressed Air)
- STM (Steam)
- SS (Sanitary Sewer)
- SD (Storm Drain)
- W (Water)
- FS (Fire Supression)
- ✓ UU (Undifferentiated Utility)

Surface

- RC (Reinforced Concrete)
- AC (Asphalt)
- C (Concrete)
- ✓ Soil
- Gravel
- other

NOTES

Equipment:
- ✓ GPR (Radar)
- BD 400
- ✓ M Scope
- other

Procedure:
- ✓ EMC (Conduction)
- EMI (Induction)
- ✓ Ambient
- ✓ GPR

Surface Conditions:
- Wet
- ✓ Dry
- other

REMARKS

Can't detect fire line in this area as shown on Brown and Caldwells supplied map.

N

PERSONNEL: LSH / DJK

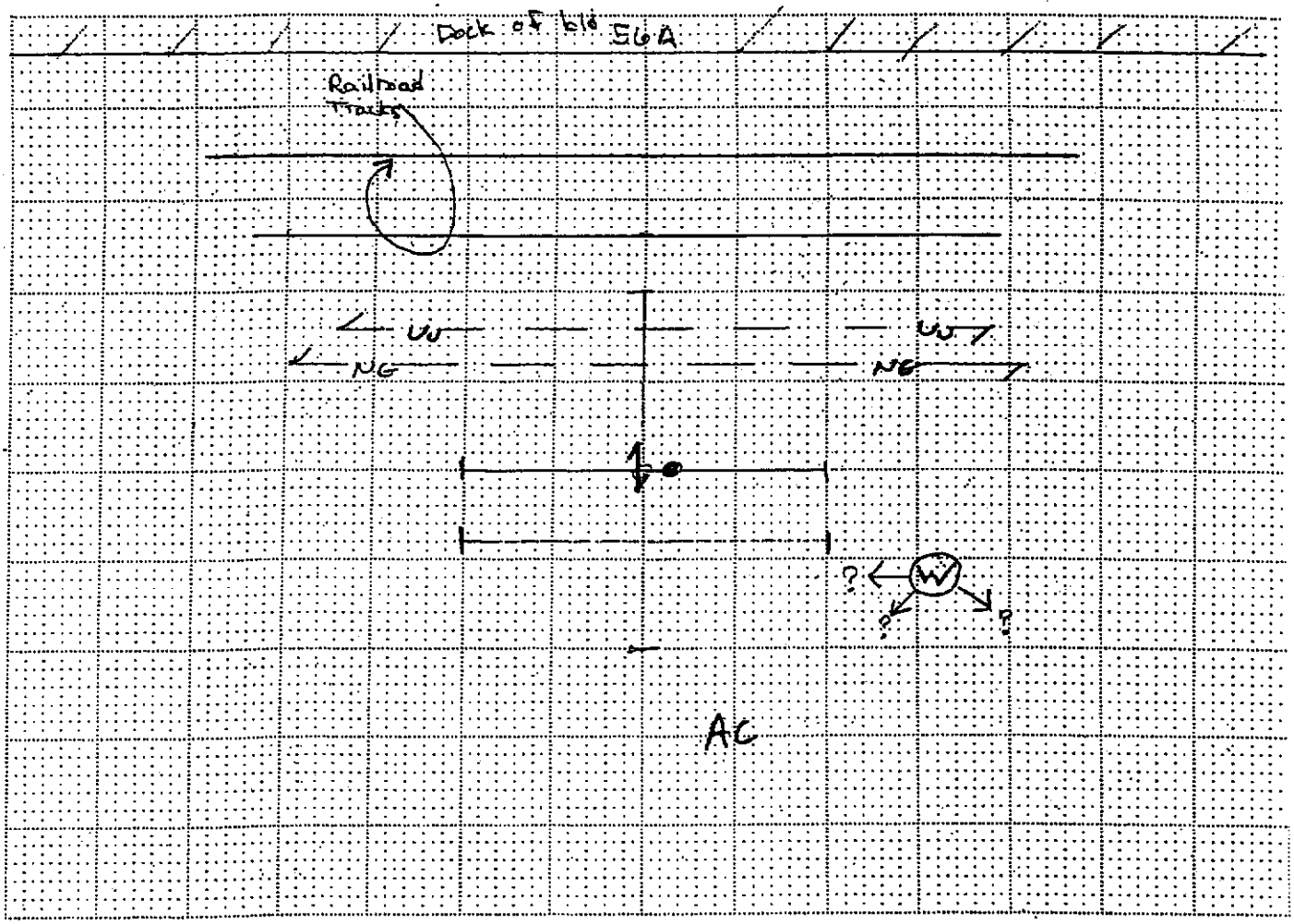
JOB: | DATE: 03/16/99

NORCAL GEOPHYSICAL CONSULTANTS INC.

CLIENT: Brown + Caldwell

LOCATION: Benecia Arsenal

BORING: 005



Scale: 1" = 10'

EXPLANATION

- ○ Original Boring Location
- ● Final Boring Location
- ⊢——⊣ GPR Traverse
- ▭ OR —— Localized GPR Anomaly
- — — — Utility Alignment

Utilities

- _ T (Telephone, Comm.)
- _ E (Electric)
- ✓ NG (Natural Gas)
- _ CA (Compressed Air)
- _ STM (Steam)
- _ SS (Sanitary Sewer)
- _ SD (Storm Drain)
- _ W (Water)
- _ FS (Fire Supression)
- ✓ UU (Undifferentiated Utility)

Surface

- _ RC (Reinforced Concrete)
- ✓ AC (Asphalt)
- _ C (Concrete)
- _ Soil
- _ Gravel
- _ other

NOTES

Equipment:	Procedure:	Surface Conditions:
✓ GPR (Radar)	✓ EMC (Conduction)	_ Wet
✓ RD 400	_ EMI (Induction)	✓ Dry
✓ M Scope	✓ Ambient	_ other
_ other	✓ GPR	

REMARKS

N ↑ Water line not detected our projections are based on Brown + Caldwells supplied maps

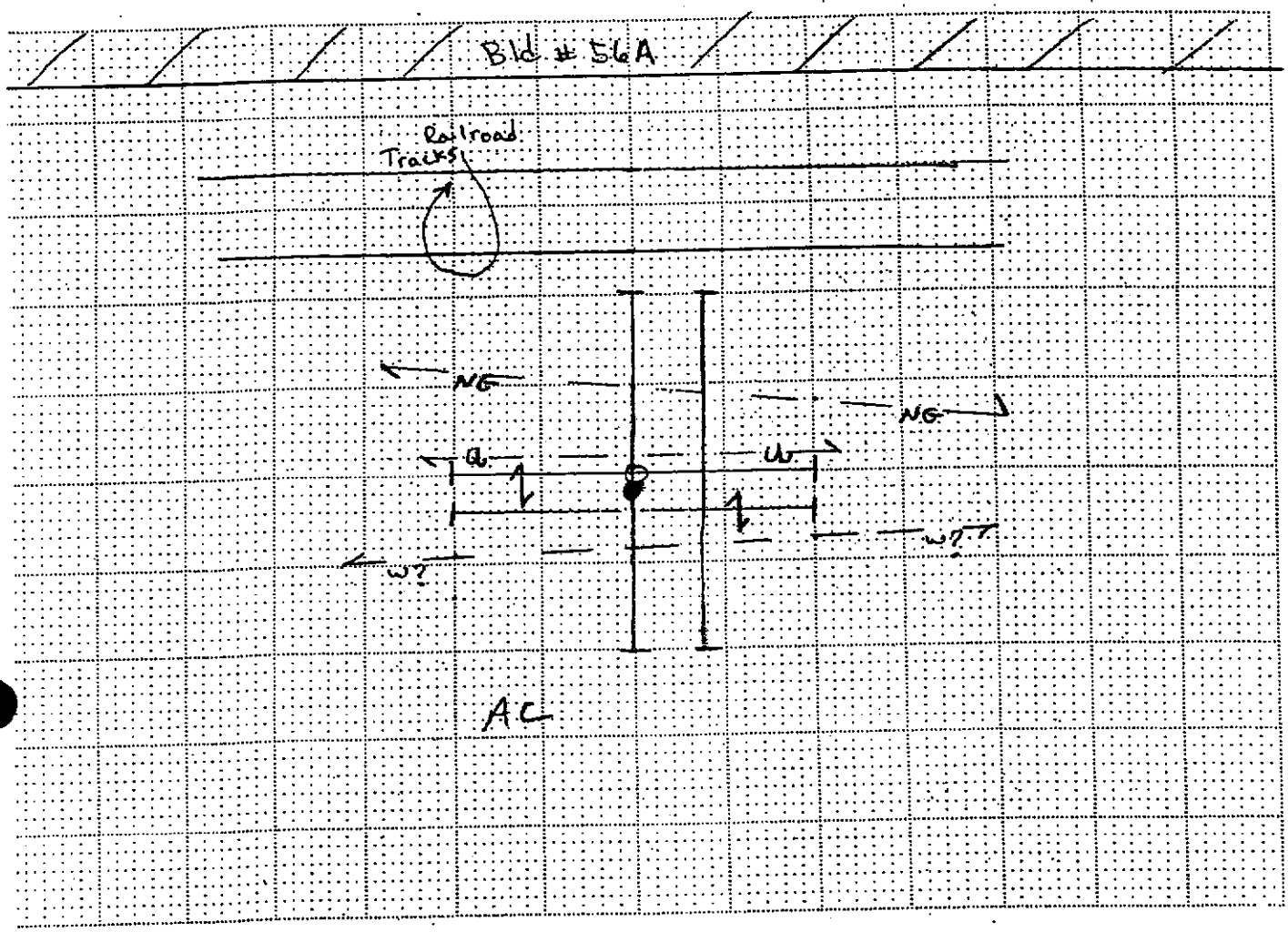
DATE: 03/16/99

CLIENT: Brown + Caldwell

LOCATION: Benecia Arsenal

NORCAL GEOPHYSICAL CONSULTANTS INC.

BORING: 006



Scale: 1" = 10'

EXPLANATION

- ○ Original Boring Location
- ● Final Boring Location
- ——— GPR Traverse
- □ OR ◠ Localized GPR Anomaly
- — — — Utility Alignment

Utilities

- _ T (Telephone, Comm.)
- _ E (Electric)
- ✓ NG (Natural Gas)
- _ CA (Compressed Air)
- _ STM (Steam)
- _ SS (Sanitary Sewer)
- _ SD (Storm Drain)
- _ W (Water)
- _ FS (Fire Supression)
- ✓ UU (Undifferentiated Utility)

Surface

- _ RC (Reinforced Concrete)
- ✓ AC (Asphalt)
- _ C (Concrete)
- _ Soil
- _ Gravel
- _ other

NOTES

Equipment:
- ✓ GPR (Radar)
- _ RD 400
- ✓ M Scope
- _ other

Procedure:
- ✓ EMC (Conduction)
- _ EMI (Induction)
- ✓ Ambient
- ✓ GPR

Surface Conditions:
- _ Wet
- ✓ Dry
- _ other

REMARKS

N ↑ Water line not detected our projection is based on the Brown + Caldwells Supplied Map.

APPENDIX D

JUNE 7, 1999 NORCAL GEOPHYSICAL CONSULTANTS SURVEY OF 50 SERIES COMPLEX

NORCAL GEOPHYSICAL CONSULTANTS, INC.

LETTER OF TRANSMITTAL

TO: Brown and Caldwell
9616 Micron Avenue, Suite 600
Sacramento, CA 95827-2627

ATTN: Mr. Dave Zuber

REF: Geophysical Survey
Benicia Arsenal Environmental Restoration Project, Benicia, CA

VIA: MAIL:( ) 2ND:(X) EXP:( ) UPS: RED.( ) 2ND:( ) GRD:( ) FED.X:( )

ENCLOSED PLEASE FIND THE FOLLOWING/COMMENTS:

Two (2) copies of final report for the above referenced work.

BY: Donald J. Kirker

DATE: June 7, 1999

REGIONAL OFFICE
NEWHOPE ST., SUITE 101 • FOUNTAIN VALLEY, CA 92708
TELEPHONE (714) 708-7727 • FAX (714) 708-7720

CORPORATE OFFICE
1350 INDUSTRIAL AVENUE, SUITE A • PETALUMA, CA 94952
TELEPHONE (707) 763-1312 • FAX (707) 762-5587

NORCAL GEOPHYSICAL CONSULTANTS, INC.

June 7, 1999

Mr. Dave Zuber
Brown and Caldwell
9616 Micron Avenue, Suite 600
Sacramento, CA 95827-2627

Dear Mr. Zuber:

Geophysical investigations were performed by NORCAL Geophysical Consultants, Inc. at the Benicia Arsenal Environmental Restoration project in Benicia, California. These investigations were conducted in two phases under the guidelines presented in Brown and Caldwell's scope of work, Task Order 1, Exhibit A, dated December 31, 1998, and the Revisions to Task Order 1, Exhibit A, dated February 22, 1999. We performed the Phase 1 investigations on March 15 and 16, and May 6, 1999 and presented the findings in our reports dated April 2 and May 21, 1999, respectively. This report presents the findings of the Phase 2 investigations.

The field survey for Phase 2 was performed on May 24 through 27, 1999 by NORCAL Geophysicist Donald J. Kirker and Geophysical Technician Lee S. Hurvitz. Logistical support was provided by Brown and Caldwell personnel Wendy Linck. All geophysical work performed at the Benicia Arsenal was governed by the Brown and Caldwell Quality Assurance Program Plan (QAPP) dated February 1999.

SCOPE OF WORK

The Brown and Caldwell scope of work for Phase 2 includes geophysical surveys at the Building 50 Series Complex, and Building 120. The Building 50 Series Complex is comprised of several buildings located adjacent to one another. The geophysical surveys were conducted along the exterior perimeters of these buildings, as well as over portions of the interiors of three of the buildings. The geophysical investigation at Building 120 was conducted over both exterior and interior portions of the northwest corner of the building. The Brown and Caldwell scope of work for Phase 2 also includes conducting geophysical surveys over 23 proposed boring locations.

PURPOSE

Information, provided by Brown and Caldwell, indicates that underground storage tanks (UST's), cisterns, and dip tanks were used for various industrial purposes at these buildings. However, records are incomplete regarding the existence or exact location of these below ground features. Therefore, the purpose of the geophysical investigation is to obtain subsurface information that will aid in determining the location and extent of these various subsurface features within the designated survey areas. For the proposed boring site surveys, the purpose is to locate detectable utilities and subsurface features in the vicinity of each proposed drilling location to minimize the potential for encountering utilities and other possible subsurface obstructions.

SITE DESCRIPTION

The area of investigations, as designated by Brown and Caldwell, for the surveys at the Building 50 Series Complex (exterior), Building 50 Series Complex (interior), and Building 120 are shown on Plates 1, 2, and 3, respectively. A brief description of each site is presented below.

Building 50 Series Complex (exterior)

The survey area at the Building 50 Series Complex (exterior) site comprises approximately 22,000 square feet. It is located adjacent to Buildings 55, 55A, 56, 56A, 56B, 56C, 57, 57A, 57C, and 65B, as shown on Plate 1. The survey area is primarily covered with asphalt. Several reinforced concrete pads and ramps, as well as various fencing, utility vaults, and an electrical transformer, are located throughout the survey area. A septic tank and oil/water separator are located adjacent to Buildings 56 and 57C, respectively. With exception to the above mentioned features, the survey area is generally free of above ground cultural objects and debris.

Building 50 Complex Series (interior)

The survey area at the Building 50 Series Complex (interior) site comprises portions of Building 57A, 65B, and the hallway to Building 56A, as shown on Plate 2. The survey area within Building 57A measures approximately 50 by 75 feet. However, the eastern most 15 feet could not be accessed because of stored equipment and vehicles. Therefore, as specified by Brown and Caldwell, only the western most 35 feet were surveyed. The interior floor is comprised of reinforced concrete. Two large dip tanks, filled with gravel, are evident in the center of the survey area. A large diameter vertical pipe protrudes from the southwest corner of the east tank. It is not known if this pipe is associated with the dip tanks or if it was placed in the tank when they were being filled with gravel. Two small pickup truck beds are located in the northwest corner. With exception to the stored equipment to the east and in the northwest corner, the site is generally free from above ground objects.

The survey area within Building 65B measures approximately 36 by 30 feet. The interior floor is comprised of reinforced concrete and is approximately 3.5 feet higher than ground surface. The site is generally free from above ground objects and debris. The Brown and Caldwell provided site map indicates that one or more underground storage tanks (UST's) may exist within this survey area. However, their volumes and dimensions are unknown.

The survey area within Building 56A consists of the hallway that leads from the east entrance of the building to the south entrance. It comprises approximately 1,960 square feet and is covered with reinforced concrete. The floor of this building is approximately 3.5 feet higher than ground surface. The site is generally free from above ground objects and debris.

Building 120

The survey area at Building 120 comprises both exterior and interior portions of the northwest corner of the building. The exterior portion measures approximately 20 by 100 feet, as shown on Plate 3. It is covered with asphalt and is free from above ground objects. The interior portion measures approximately 20 by 60 feet. However, stored equipment and boxes precluded access to most of the survey area. The interior floor is comprised of reinforced concrete and is approximately 3.5 feet higher than ground surface. The Brown and Caldwell provided site map indicates that one or more underground storage tanks (UST's) may exist within this survey area. However, their volumes and dimensions are unknown.

METHODOLOGY

For this investigation, we used the ground penetrating radar (GPR), and electromagnetic line locating (EMLL) methods. The GPR method was used to obtain subsurface information that may indicate the presence of UST's, cisterns, and other buried debris and objects. Since the GPR method is typically unaffected by above ground metal objects, it can be used inside of buildings, and in close proximity to metal equipment and machinery. The EMLL method was used to aid in further characterizing the source of any detected GPR anomalies, as well as to scan each site for near surface metal that may indicate the presence of a UST. It should be noted, however, that magnetic interference caused by the metal rebar in the concrete floor of the building interiors precluded the use of the EMLL method in these areas. In addition, the EMLL and GPR methods were used to investigate the boring locations for detectable utility alignments and drilling obstructions.

Typically, the vertical magnetic gradient (VMG) and electromagnetic terrain conductivity (TC) methods are used in conjunction with these techniques to detect buried metal objects. However, interference caused by the nearby structures precluded the use of the VMG and TC methods at this site. Descriptions of the GPR and EMLL methods were provided in our report dated April 2,1999.

EQUIPMENT FUNCTIONAL CHECKS

At the beginning and end of each field day, we performed equipment functional checks, as recommended by the instrument manufacturers to ensure proper equipment function. These functional checks included testing the power supply, as well as instrument response. The equipment was operated over a selected test site near Building 56A to verify appropriate gain settings and instrument repeatability. Particular attention was paid to the GPR calibration, with the same gain, filter, and time-depth scales chosen each time to check for repeatable results. This calibration check was documented by printing the calibration plot on the chart recorder. Proper functioning of the equipment was verified by determining that the trends observed in the data were

repeatable. The results of these tests indicated that our equipment was functioning properly and accurately throughout the duration of the survey.

DATA ACQUISITION AND ANALYSIS

Data Acquisition

For the exterior surveys, we obtained GPR data along both south-north and/or west-east trending traverses spaced 5 feet apart. The GPR traverses ranged in length from 10 to 160 feet. The EMLL technique was then systematically scanned over these same traverses. For the interior surveys, we obtained GPR data along both south-north and/or west-east trending traverses that ranged in length from 12 to over 190 feet. These traverses were spaced from 3 to 20 feet apart, depending on site conditions and access. As mentioned above, the EMLL technique could not be used within the buildings. The limits of the respective survey areas and the location of the GPR traverses are shown on Plate 1 through 3.

GPR and EMLL Analysis

We examined the GPR records for hyperbolic reflection patterns characteristic of UST's, cisterns, and underground utilities. We also reviewed the records for changes in reflection character that could indicate the presence of fill material associated with an excavation.

The EMLL instrumentation indicates the presence of buried metal by emitting an audible tone. There are no recorded data to analyze. The locations of buried objects detected with the EMLL method were marked on the ground surface with white marking paint.

SURVEY DOCUMENTATION

We used Daily Field Reports, Borehole Site Survey Log forms, and Draft Field Diagrams to document our field work. The Daily Field Report summarizes each day's activity. The Borehole Site Survey Logs present the pertinent information associated with each proposed borehole location. The Draft Field Diagrams were used to create the computer generated site maps shown on Plates 1 through 5. Copies of the Daily Field Reports and Borehole Site Survey Log forms are provided in Appendix A.

RESULTS

The results of the geophysical investigation are presented on Plates 3 through 6. These plates are the respective Geophysical Survey Maps for Building 120, the Building 50 Series Complex (exterior) site, and the Building 50 Series Complex (interior) site. Each plate shows the limits of the survey area, the structures or above ground cultural features that may be in close proximity to the site, and the locations of detected subsurface features and undifferentiated utility

alignments. Since a utility search was not the primary objective of this survey, there may be additional utilities that are not shown. A description of the results for the respective geophysical surveys are presented in the following paragraphs.

Building 120

The results of the EMLL and GPR surveys at Building 120 are shown on the Geophysical Survey Map, Plate 3. The EMLL survey defined the location of a large utility vault, as well as several utility alignments. The utility vault measures approximately 8 by 17 feet and is located in the northwest corner of the survey area. The detected utilities shown on this map include storm drain, sanitary sewer, and two undifferentiated utility alignments. The EMLL technique did not detect any additional zones of buried metal that may indicate a UST or cistern within the limits of the survey area.

GPR data were obtained outside of Building 120, as well as over a small area inside of the building. The GPR data obtained outside defined reflection patterns typical of shallow fill horizons associated with the pavement and deeper reflecting horizons characteristic of uniform subsurface conditions. The GPR data do not indicate hyperbolic reflections within the upper two to three feet large enough to represent a UST or other large subsurface features within the limits of the survey.

The GPR data obtained inside of the building defined reflection patterns typical of shallow fill horizons associated with the floor, and deeper reflecting horizons characteristic of uniform subsurface conditions. The GPR data did not define reflection patterns typical of a UST beneath the floor of the building in this area. It should be noted, however, that the floor of the building is approximately 3.5 feet higher than the ground surface outside of the building. If UST's were in place prior to the construction of this portion of the building, it is highly probable that they are buried deeper than 7 to 8 feet below the surface of the floor. At these depths, UST's are very difficult to detect using the GPR method, especially in conductive soils. Since GPR is not affected by above ground metal objects, it is the only geophysical method that can be used to search for a UST inside of this building. We are not aware of other geophysical methods available that can be used to detect possible UST's beneath this building, given the possible depth of investigation.

Building 50 Series Complex (exterior)

The results of the EMLL and GPR surveys at the Building 50 Series Complex (exterior) are shown on the Geophysical Survey Map, Plate 4. The EMLL survey defined the location of three anomalous zones of buried metal, as well as numerous utility alignments. The zones of buried metal are located north of Building 57C and 56, and south of Building 55. They are labeled A through C on Plate 4, and are referred to as EMLL anomalies. These anomalous zones of buried metal are consistent with reinforced concrete slabs, utility vaults, and/or small UST's. The detected utilities shown on this map include electric, natural gas, storm drain, sanitary sewer, and several undifferentiated utility alignments.

GPR data were obtained over the EMLL anomalies, as well as throughout the survey area. Over EMLL Anomaly A, the GPR defined a large zone of reflection patterns typical of an additional subsurface slab, as well as isolated buried debris or utilities. The slab extends approximately 20 feet north of the reinforced concrete ramp, as shown on Plate 4. The isolated debris corresponds with the location of the EMLL anomalies and may represent vault lids, abandoned utilities, or rebar in the subsurface slab. GPR data obtained over EMLL Anomaly B defines reflection patterns typical of a reinforced concrete slab buried beneath the asphalt surface. This slab extends approximately 10 feet north of the building. Over EMLL Anomaly C, the GPR data defined patterns typical of a reinforced concrete slab, and two vault lids. The reinforced concrete (RC) slab extends approximately 10 feet south of the Building 55 ramp. The apparent utility vaults are located east of the RC slab and may be associated with the undifferentiated utilities in this area. The GPR data did not define reflection patterns typical of a UST at these locations.

The GPR data, obtained throughout the remaining survey area, defined three anomalous areas that may indicate possible buried subsurface features. They are labeled GPR Anomalies D through F on Plate 4. GPR Anomaly D is defined by broad near surface reflections that are typical of an additional slab or a possible cistern below the gravel. GPR Anomaly E is defined by hyperbolic reflections that are typical of a large utility or a small UST oriented south-north. Anomaly F is characteristic of a change in fill material that may represent the location of the former incinerator shown on the Brown and Caldwell provided site map. The remainder of the GPR data exhibits hyperbolic patterns typical of the detected utility alignments shown on Plate 4, and continuous reflecting horizons typical of undisturbed subsurface strata.

Building 50 Series Complex (interior)

The results of the EMLL and GPR surveys at the Building 50 Series Complex (interior) are shown on the Geophysical Survey Map, Plate 5. Geophysical surveys were performed inside of Buildings 57A, 65B, and portions of 56A. In Building 57A, we used the EMLL to investigate the vertical pipe in the east dip tank. The results of this survey did not indicate any detectable laterals extending from this pipe. Therefore, we believe that this pipe was placed in the tank when it was filled with gravel. Measurements inside of the pipe indicate that the tank is approximately 7 to 8 feet deep. This is based on the assumption that the pipe extends to the bottom of the tank. We obtained GPR data throughout the survey area.

The GPR data defined reflection patterns typical of shallow fill horizons associated with the building floor, and deeper reflecting horizons characteristic of uniform subsurface conditions. The GPR data did not define reflection patterns typical of a UST or additional dip tanks beneath the floor of the building within the limits of the survey.

In Building 65B, the GPR data defined large subtle hyperbolic reflections typical of two UST's. The apparent tanks are oriented east-west, as shown on Plate 5, and positioned side by side. Each

tank exhibits dimensions that are consistent with 15,000 to 25,000 gallon UST's. The remainder of the GPR data exhibits continuous reflecting horizons typical of undisturbed subsurface strata.

In Building 56A, The GPR data defined reflection patterns typical of shallow fill horizons associated with the concrete floor, and deeper reflecting horizons characteristic of uniform subsurface conditions. The GPR data did not define reflection patterns within the upper 2 to 4 feet typical of a UST or cistern within the limits of the survey.

Borehole Site Surveys

The results of the borehole site surveys are shown on the enclosed copies of the Borehole Site Survey Logs (Appendix A). As specified by Brown and Caldwell, these proposed borings are designated as IBO120SB001&2, IBO53SB001&2, IBO55SB001&2, IBO56SB001-4, IBO56AHA002&3, IBO56BSB001-3, IBO57AHP001-3,7&8, IBO57ASB001, IBO65BHA001, and IBO66ASB001. As described above, EMLL and GPR were systematically used over each location. During the course of this investigation, we identified several undifferentiated utility alignments. The surface trace of these utilities, as well as the proposed boring locations, were marked with spray paint on the ground surface.

STANDARD CARE AND WARRANTY

The scope of NORCAL's services for this project consisted of using geophysical methods to characterize the shallow subsurface. The accuracy of our findings is subject to specific site conditions and limitations inherent to the techniques used. We performed our services in a manner consistent with the level of skill ordinarily exercised by members of the profession currently employing similar methods. No warranty, with respect to the performance of services or products delivered under this agreement, expressed or implied, is made by NORCAL.

We appreciate having the opportunity to provide you with this information.

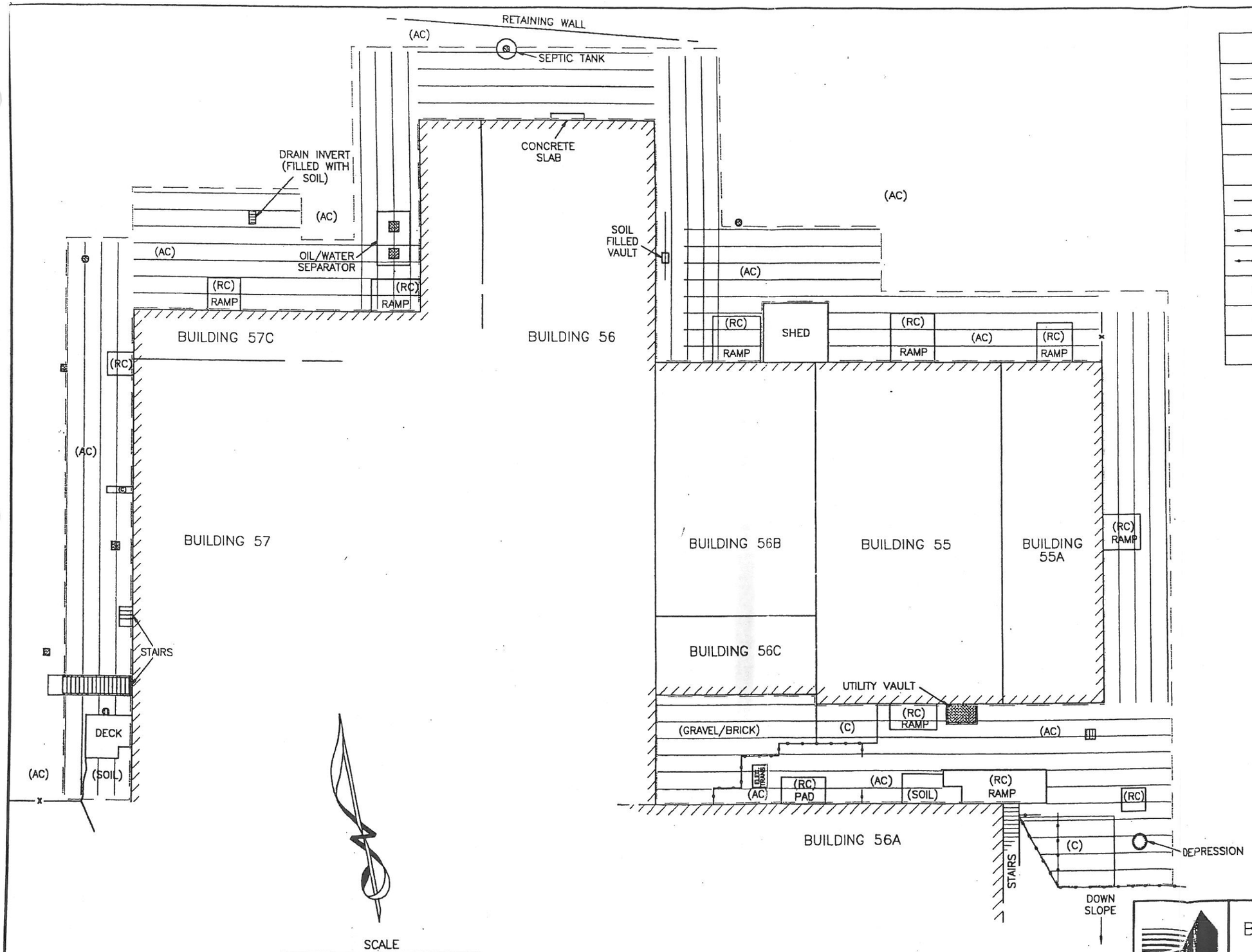
Respectfully,
NORCAL Geophysical Consultants, Inc.

Donald J. Kirker

Donald J. Kirker
Geophysicist, GP-997

DJK/jh

Enclosure: Plates 1 through 5
Appendix A, DAILY FIELD REPORTS AND BOREHOLE SITE SURVEY LOGS



LEGEND

— —	LIMITS OF SURVEY AREA
———	GPR TRAVERSE
⊗	MANWAY
▤	STORM DRAIN
—x—	CHAIN LINK FENCE
—•—•—	GUARD RAIL
—•—•—	WOODEN FENCE
(AC)	ASPHALT
(C)	CONCRETE (UNREINFORCED)
(RC)	REINFORCED CONCRETE

SITE MAP
BUILDING 50 SERIES COMPLEX (EXTERIOR)

LOCATION: BENICIA ARSENAL, BENICIA, CALIFORNIA

CLIENT: BROWN & CALDWELL

NORCAL GEOPHYSICAL CONSULTANTS INC.

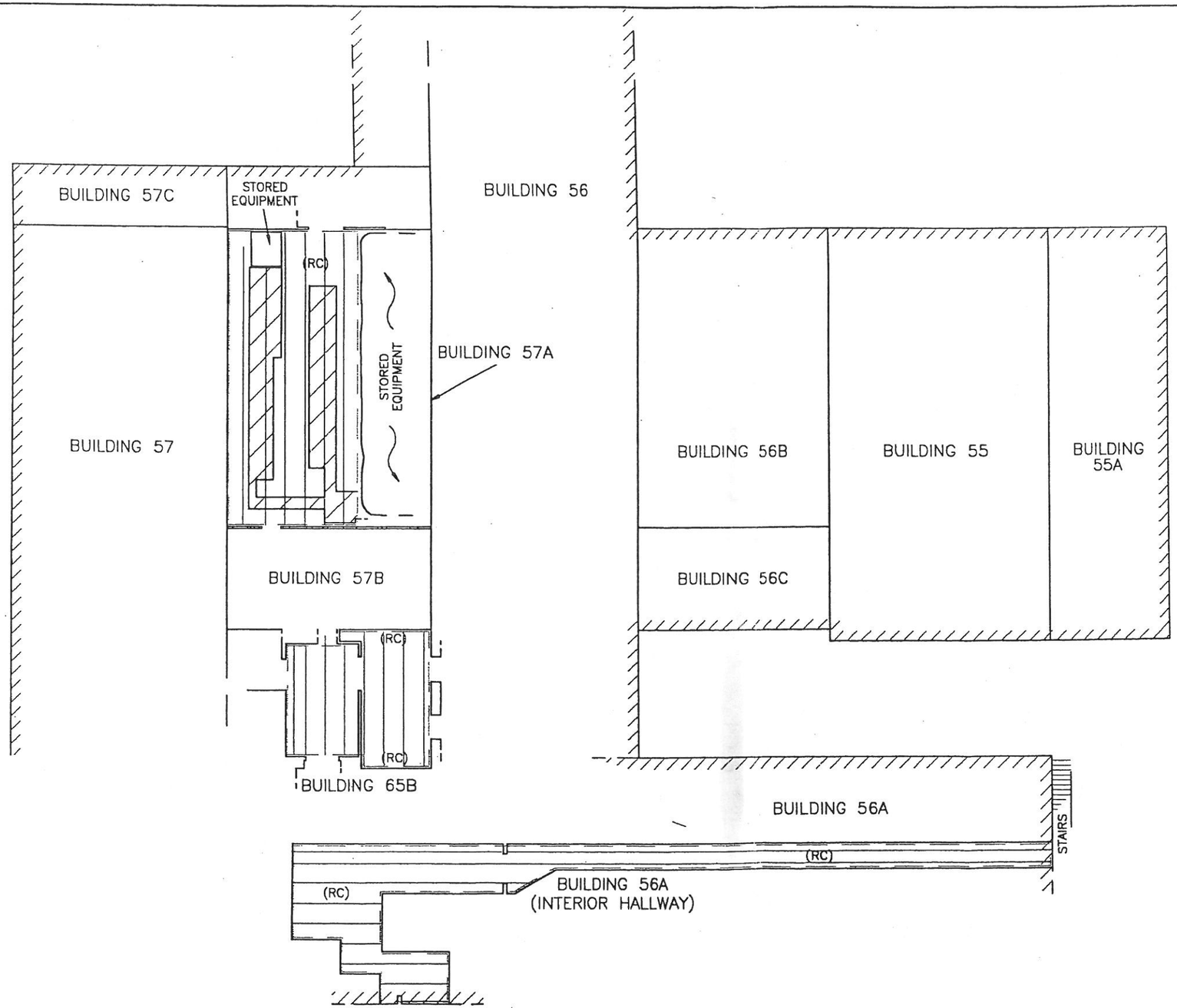
JOB #: 98-141.24

DATE: MAY 1999

DRAWN BY: G.RANDALL

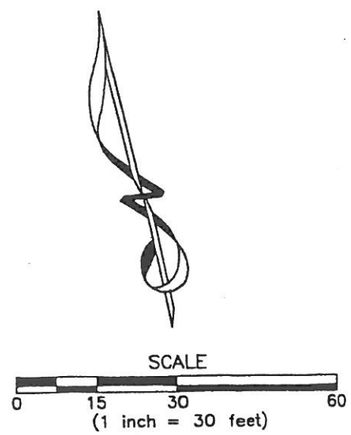
APPROVED BY: DJK

PLATE 1



LEGEND	
— —	LIMITS OF SURVEY AREA
———	GPR TRAVERSE
▨	GRAVEL FILLED DIP TANKS
(RC)	REINFORCED CONCRETE

NOTE: LOCATIONS OF INTERIOR SURVEY AREAS ARE BASED ON SITE MAP PROVIDED BY BROWN & CALDWELL



NORCAL

SITE MAP
BUILDING 50 SERIES COMPLEX (INTERIOR)

LOCATION: BENICIA ARSENAL, BENICIA, CALIFORNIA

CLIENT: BROWN & CALDWELL

JOB #: 99-141.24

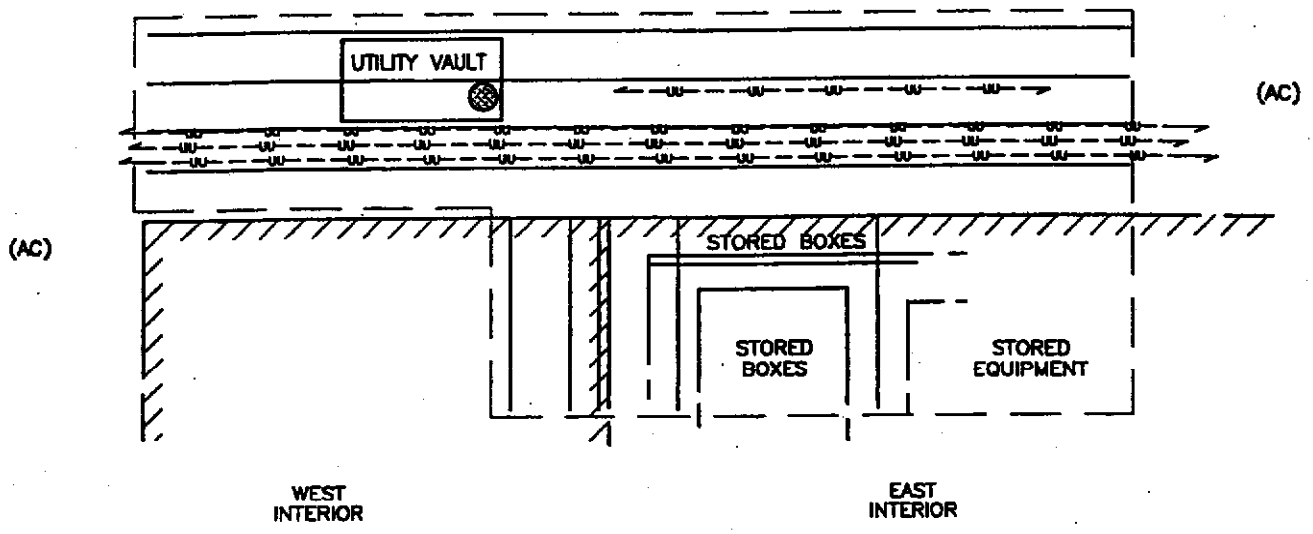
NORCAL GEOPHYSICAL CONSULTANTS INC.

DATE: MAY 1999

DRAWN BY: G.RANDALL

APPROVED BY: DJK

PLATE 2



BUILDING 120

TE: *NOT ALL UTILITIES ARE SHOWN ON THIS MAP*

LEGEND	
— ——	LIMITS OF SURVEY AREA
———	GPR TRAVERSE
—UU— —	UNDIFFERENTIATED UTILITY LINE
⊗	MANWAY
(AC)	ASPHALT

SCALE

0 10 20 40

(1 inch = 20 feet)

NORCAL

GEOPHYSICAL SURVEY MAP BUILDING 120

LOCATION: BENICIA ARSENAL, BENICIA, CALIFORNIA

CLIENT: BROWN & CALDWELL

NORCAL GEOPHYSICAL CONSULTANTS INC.

JOB #: 99-141.24

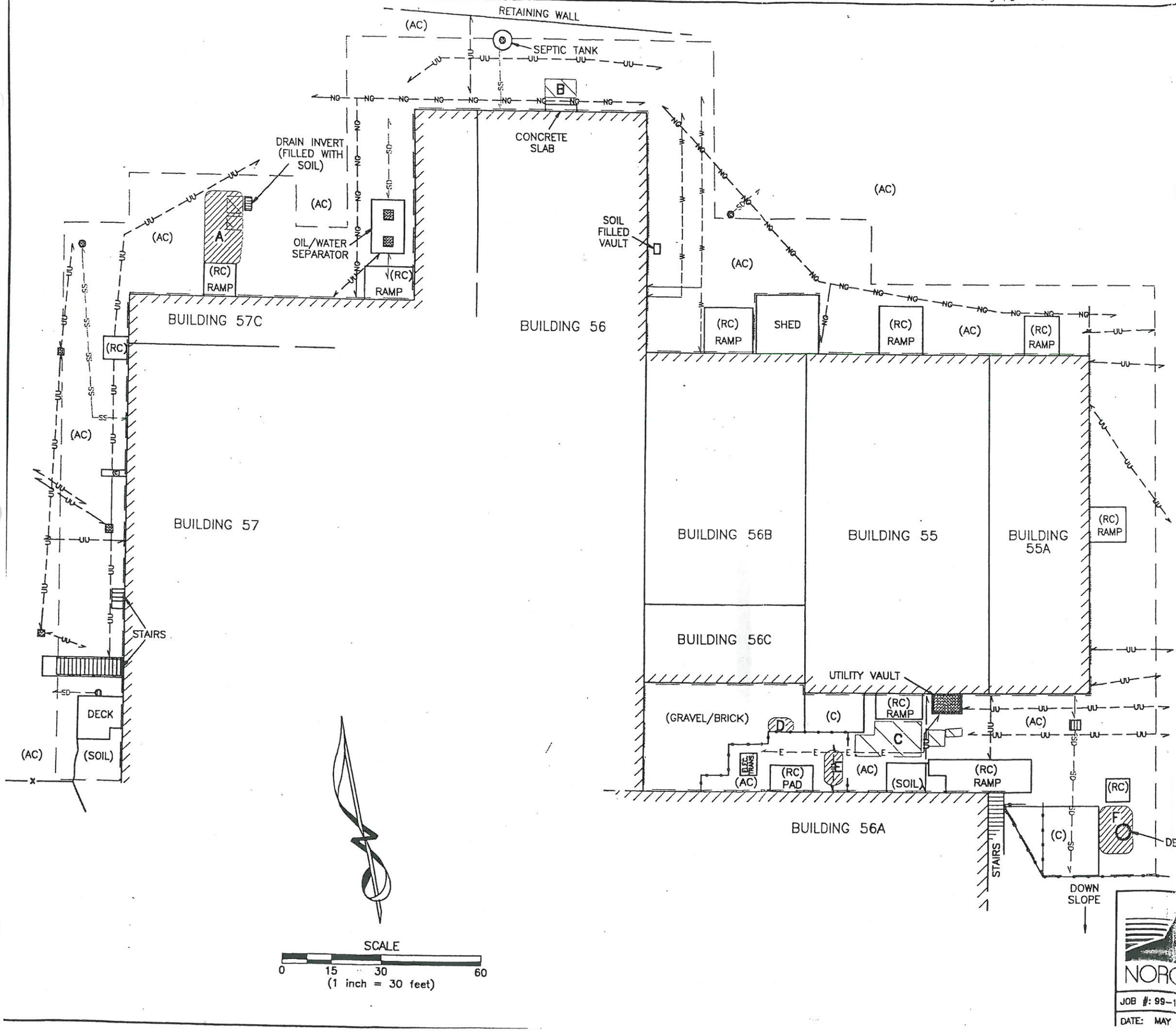
DATE: MAY 1999

DRAWN BY: G.RANDALL

APPROVED BY: DJK

PLATE 3

345213



LEGEND

— —	LIMITS OF SURVEY AREA
	EMLL ANOMALY REPRESENTING NEAR SURFACE METAL
	GPR ANOMALY
—E—	ELECTRIC LINE
—NG—	NATURAL GAS LINE
—SD—	STORM DRAIN
—SS—	SANITARY SEWER
—UU—	UNDIFFERENTIATED UTILITY LINE
—W—	WATER LINE
	MANWAY
	STORM DRAIN
—x—	CHAIN LINK FENCE
	GUARD RAIL
	WOODEN FENCE
(AC)	ASPHALT
(C)	CONCRETE (UNREINFORCED)
(RC)	REINFORCED CONCRETE

NOTE: *NOT ALL UTILITIES ARE SHOWN ON THIS MAP*

GEOPHYSICAL SURVEY MAP BUILDING 50 SERIES COMPLEX (EXTERIOR)

NORCAL

LOCATION: BENICIA ARSENAL, BENICIA, CALIFORNIA

CLIENT: BROWN & CALDWELL

JOB #: 99-141.24

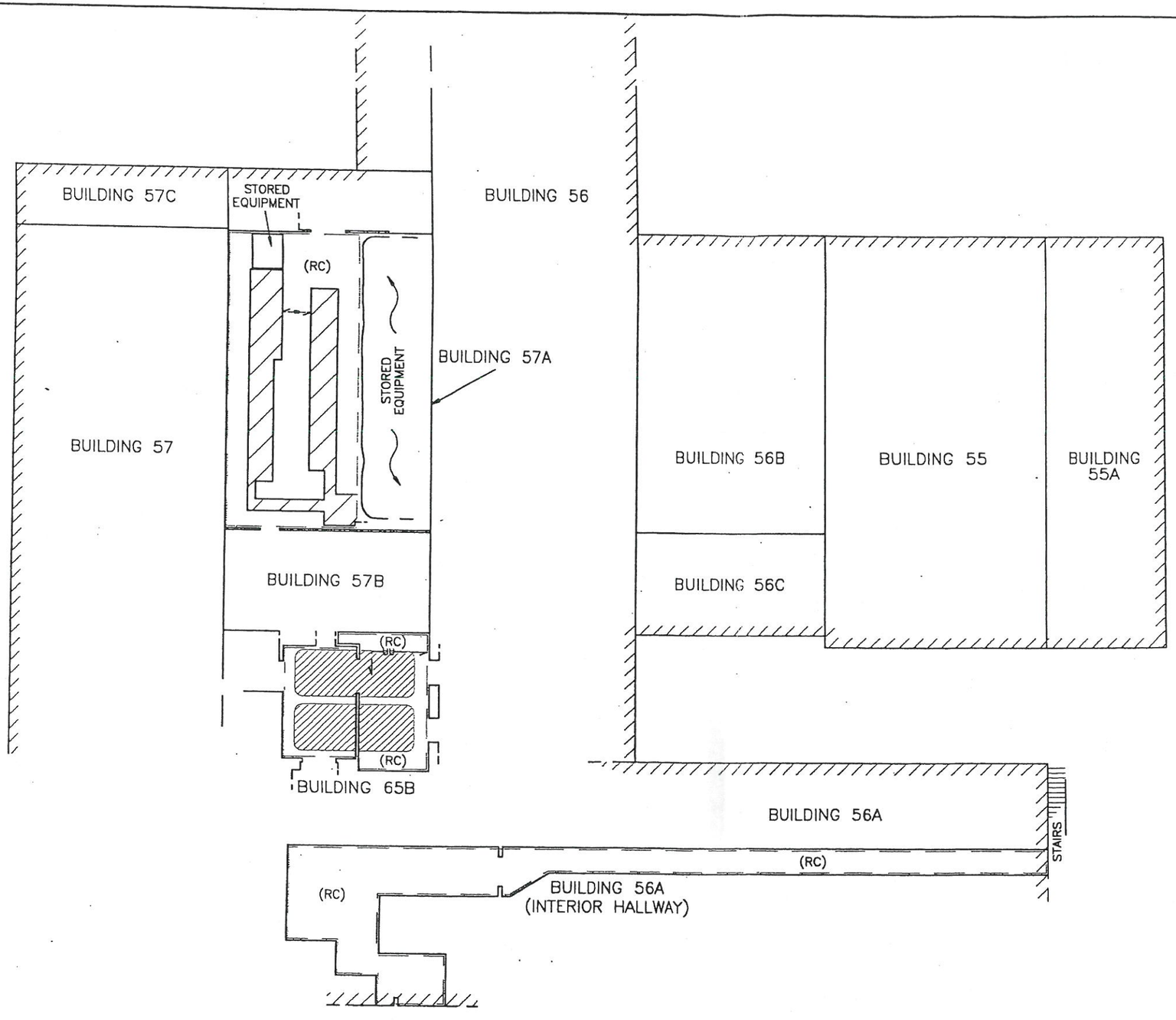
NORCAL GEOPHYSICAL CONSULTANTS INC.

DATE: MAY 1999

DRAWN BY: G.RANDALL

APPROVED BY: DJK

PLATE 4



LEGEND

— —	LIMITS OF SURVEY AREA
▨	GPR ANOMALY REPRESENTING POSSIBLE UST
▨	GRAVEL FILLED DIP TANKS
— —UU— —	UNDIFFERENTIATED UTILITY LINE
(RC)	REINFORCED CONCRETE

NOTES: LOCATIONS OF INTERIOR SURVEY AREAS ARE BASED ON SITE MAP PROVIDED BY BROWN & CALDWELL

NOT ALL UTILITIES ARE SHOWN ON THIS MAP

SCALE
0 15 30 60
(1 inch = 30 feet)

NORCAL

GEOPHYSICAL SURVEY MAP BUILDING 50 SERIES COMPLEX (INTERIOR)

LOCATION: BENICIA ARSENAL, BENICIA, CALIFORNIA

CLIENT: BROWN & CALDWELL

JOB #: 99-141.24

NORCAL GEOPHYSICAL CONSULTANTS INC.

DATE: MAY 1999

DRAWN BY: G.RANDALL

APPROVED BY: DJK

PLATE 5

NORCAL CONSULTANTS INC.

NORCAL

DAILY FIELD REPORT

Date: 5-24-99 Client/Location: BROWN & CALDWELL / BENICIA ARSENAL

Personnel: DJK / LH Equipment: GPR EMLL

Project Description: INVESTIGATE FOR SUBSURFACE FEATURES INCLUDING UST'S, CISTERNS, DIP TANKS, ETC...

TIME	NOTES
7:30:	ARRIVE PETALUMA OFFICE, MOB FOR BENICIA
9:00:	ARRIVE BENICIA ARSENAL
	- MEET WITH WENDY LINCK OF B&C, CONDUCT SITE WALK
9:25:	CALIBRATE EQUIPMENT AT NORCAL ESTABLISHED TEST SITE
9:40:	INVESTIGATE BLDG 56A CORRIDOR & BORINGS 1B056AHA002 & 3
11:15:	INVESTIGATE BLDG 65B INTERIOR AREA & 1B065BHA001
	- FLOOR OF BLDG IS APPROXIMATELY 2-3 FEET HIGHER THAN FORMER GROUND SURFACE. THEREFORE, IF UST EXISTS AT THIS SITE, IT IS PROBABLY BURIED DEEPER THAN 7-8 FEET. WE ESTIMATE GPR DEPTH OF DETECTION TO BE APPROXIMATELY 2-4 FEET.
12:30	INVESTIGATE BORINGS (PROPOSED) 1B055SB001, 1B055SB002 1B056BSB001, 1B056BSB002, 1B056BSB003, 1B056SB004, 1B056SB001, 1B056SB002, 1B056SB003,
	NOTE: EXTREME CAUTION SHOULD BE USED WHEN DRILLING 1B055SB001. BORING SHOULD BE MOVED 3' WEST, HOWEVER, B&C STATED THAT THIS WAS NOT POSSIBLE BECAUSE OF LIMITED ACCESS FOR THE DRILL RIG.
2:20:	INVESTIGATE BLDG 57A INTERIOR & BORINGS 1B057AHP008 AND 1B057ASB001
3:35:	START BLDG 57C EXTERIOR INVESTIGATION (OVER)

FIELD DAY SUMMARY MOB: 2.5 HOURS FIELD: 7.5 HOURS

Don Kirke Signature

NORCAL Representative

Signature

CLIENT Representative

1350 INDUSTRIAL AVENUE SUITE A • PETALUMA, CA 94952
TELEPHONE (707) 763-1312 • FAX (707) 762-5587

NORCAL CONSULTANTS INC.

NORCAL

DAILY FIELD REPORT

Date: 5-25-99 Client/Location: BROWN & CALDWELL / BENICIA ARSENAL

Personnel: DJK / LH Equipment: GPR EMLL

Project Description: INVESTIGATE FOR SUBSURFACE FEATURES INCLUDING UST'S, CISTERNS, DIP TANKS, ETC...

TIME	NOTES
8:00:	ARRIVE BENICIA ARSENAL
	- CALIBRATE EQUIPMENT AT NORCAL ESTABLISHED TEST SITE
8:25:	INVESTIGATE BUILDING 57 EXTERIOR AREA
9:47:	CONTINUE INVESTIGATION AT BUILDING 57C EXTERIOR
10:40:	INVESTIGATE AREA NORTH OF BLDG 56
11:16:	INVESTIGATE AREA NORTH OF BLDG 55 & EAST OF BDG 56
1:00:	INVESTIGATE AREA EAST OF BUILDING 55A
	NOTE: IN ADDITION TO THE INVESTIGATIONS AT BUILDINGS 57C, 56, 55-56, AND 55A, WE INVESTIGATED PROPOSED BORINGS 1B057AHP007, 1B057AHP002, AND 1B057AHP003 FOR POSSIBLE DRILLING OBSTRUCTIONS AND UTILITIES.
1:35:	START INVESTIGATION SOUTH OF BUILDING 55
3:15:	COMPLETE BUILDING 55 (SOUTH)
	- INVESTIGATE 2 PROPOSED BORINGS (1B057AHP002) (1B066AS8001)
3:45:	RECALIBRATE EQUIPMENT AT NORCAL ESTABLISHED TEST SITE
4:00:	LEAVE BASE

FIELD DAY SUMMARY MOB: 2.5 HOURS FIELD: 8 HOURS

Don Kirker Signature
NORCAL Representative

Signature
CLIENT Representative

1350 INDUSTRIAL AVENUE SUITE A • PETALUMA, CA 94952
TELEPHONE (707) 763-1312 • FAX (707) 762-5587

NORCAL CONSULTANTS INC.

NORCAL

DAILY FIELD REPORT

Date: 5-26-99 Client/Location: BROWN & CALDWELL / BENICIA ARSENAL

Personnel: DJK / LH Equipment: GPR EMLL

Project Description: INVESTIGATE FOR SUBSURFACE FEATURES INCLUDING UST's, CISTERNS, DIP TANKS, ETC...

TIME	NOTES
6:30:	ARRIVE PETALUMA OFFICE, MOB FOR BENICIA
8:00:	ARRIVE BENICIA ARSENAL - CALIBRATE EQUIPMENT AT NORCAL ESTABLISHED TEST SITE
8:05:	ARRIVE AT BUILDING 120 - STANDBY FOR OWNER TO ARRIVE TO OPEN BLDG.
8:40:	INVESTIGATE PROPOSED BORINGS (1B053SB001) (1B053SB002)
	NOTE: COULD NOT ACCESS BUILDING 120 BECAUSE OWNER DID NOT SHOW UP.
9:25:	RECALIBRATE EQUIPMENT AT NORCAL ESTABLISHED TEST SITE.
9:30:	LEAVE SITE

FIELD DAY SUMMARY MOB: 2.5 HOURS FIELD: 1.5 HOURS

Don Kirker Signature

NORCAL Representative

Signature

CLIENT Representative

1350 INDUSTRIAL AVENUE SUITE A • PETALUMA, CA 94952
TELEPHONE (707) 763-1312 • FAX (707) 762-5587

NORCAL CONSULTANTS INC.

NORCAL

DAILY FIELD REPORT

Date: 5-27-99 Client/Location: BROWN & CALDWELL / BENICIA ARSENAL

Personnel: DJK Equipment: GPR EMLL

Project Description: INVESTIGATE SUBSURFACE FEATURES INCLUDING UST's, CISTERNS, DIP TANKS, ETC.

TIME	NOTES
6:30:	ARRIVE PETALUMA OFFICE, MOB FOR BENICIA
8:00:	ARRIVE BENICIA ARSENAL
	- CALIBRATE EQUIPMENT AT NORCAL ESTABLISHED
	TEST SITE
8:08:	INVESTIGATE WEST PORTION OF INTERIOR
	OF BUILDING 120 (WHERE ACCESS ALLOWED)
9:00:	INVESTIGATE EXTERIOR PORTION OF BLDG 120.
9:40:	MOVE BACK INTO BUILDING, INVESTIGATE
	EAST PORTION OF INTERIOR WHERE ACCESS
	WAS POSSIBLE. NUMEROUS ~~STACK~~ STORED
	BOXES PRECLUDED ACCESS TO MOST OF SURVEY
	AREA.
10:05:	INVESTIGATE TWO PROPOSED BORINGS
	(1B120SB001) (1B120SB002)
	- CONDUCT SITE WALK WITH WENDY LINCK TO
	TWO PROPOSED TRENCH AREAS.
11:40:	RECALIBRATE EQUIPMENT AT NORCAL ESTABLISHED
	TEST SITE
11:55:	LEAVE BASE

FIELD DAY SUMMARY MOB: 2.5 HOURS FIELD: 4 HOURS

Don Kirker Signature

NORCAL Representative

Signature

CLIENT Representative

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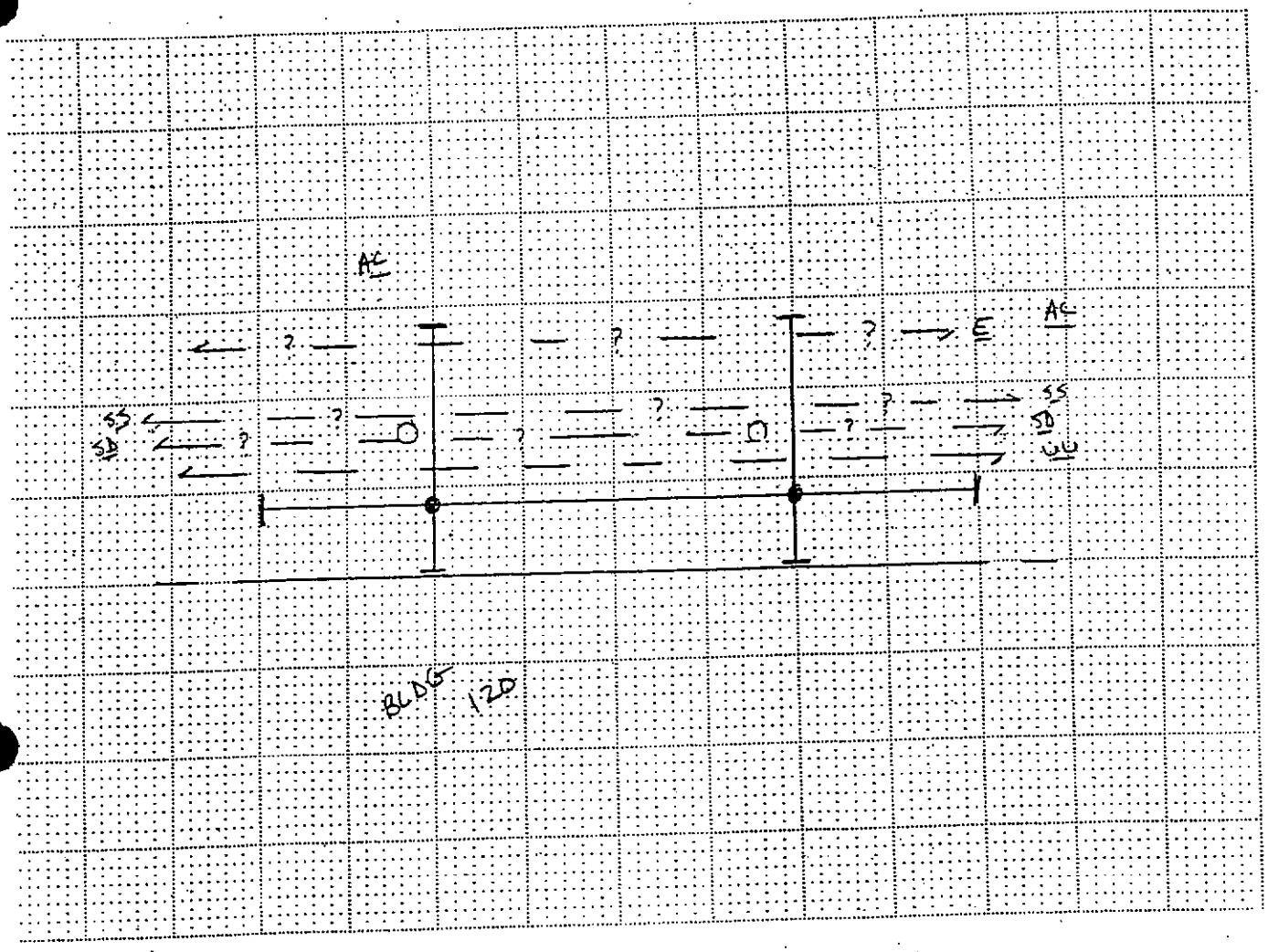
TELEPHONE (707) 763-1312 • FAX (707) 762-5587

NORCAL GEOPHYSICAL CONSULTANTS INC.

LOCATION: BENICIA ARSENAL

BORING: (1B01205B001)(1B01205B002)



Scale: 1" = 10'

EXPLANATION

- ○ Original Boring Location
- ● Final Boring Location
- —|— GPR Traverse
- ⊐ OR — Localized GPR Anomaly
- — — — Utility Alignment

Utilities

- T (Telephone, Comm.)
- E (Electric)
- NG (Natural Gas)
- CA (Compressed Air)
- STM (Steam)
- SS (Sanitary Sewer)
- SD (Storm Drain)
- W (Water)
- FS (Fire Supression)
- UU (Undifferentiated Utility)

Surface

- RC (Reinforced Concrete)
- AC (Asphalt)
- C (Concrete)
- Soil
- Gravel
- other

NOTES

Equipment:
- GPR (Radar)
- RD 400
- M Scope
- other

Procedure:
- EMC (Conduction)
- EMI (Induction)
- Ambient
- GPR

Surface Conditions:
- Wet
- Dry
- other

REMARKS

N

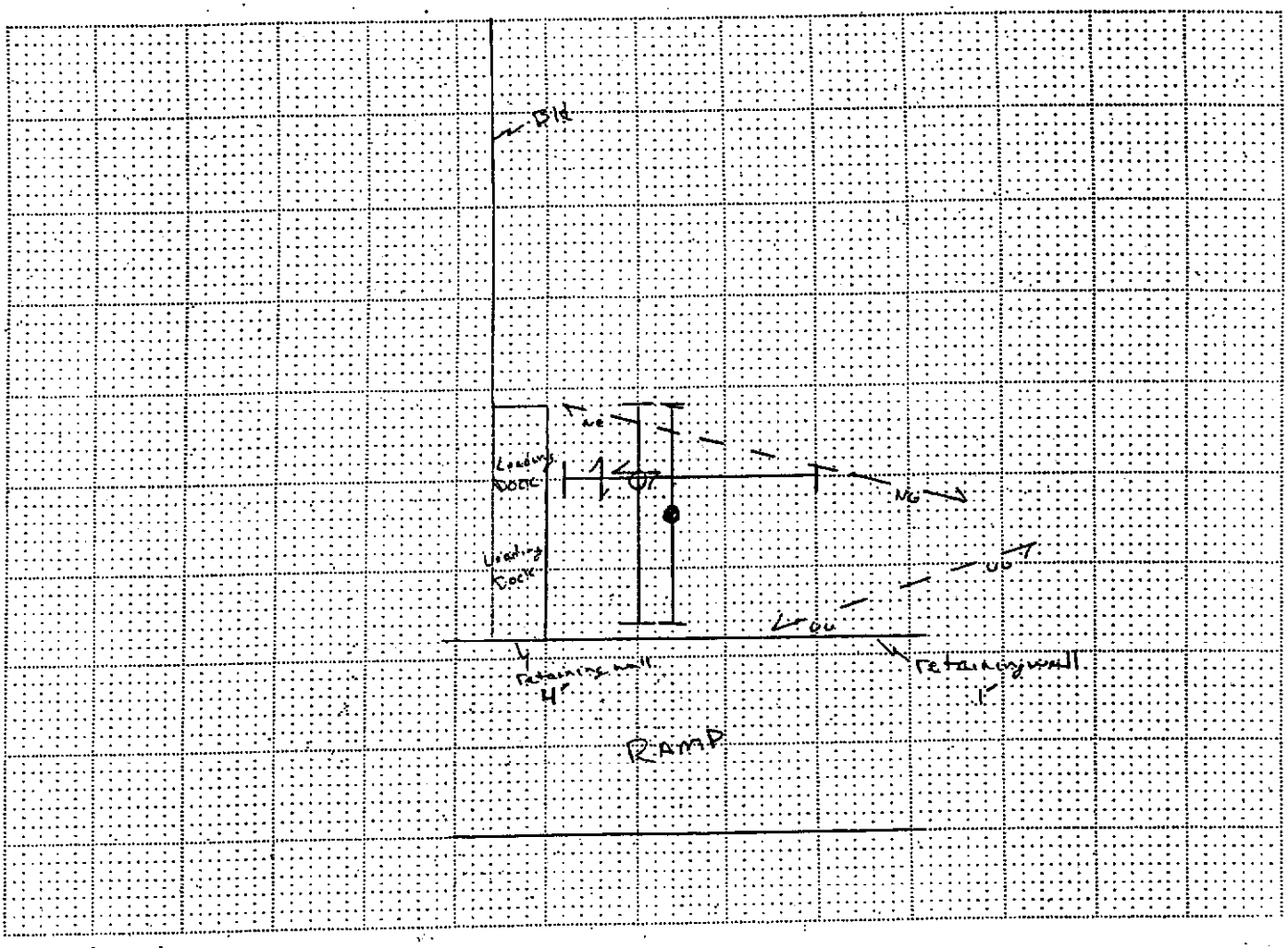
GPR DEPTH OF DETECTION LIMITED TO LESS THAN 2' AT THIS LOCATION. THE LOCATION OF THE SD & SS WERE BASED ON LINE OF SIGHT BETWEEN MANHOLE COVERS. EXTREME CAUTION SHOULD BE TAKEN WHEN DRILLING THESE BORINGS. HAND AUGER FIRST FIVE FEET.

JOB: | DATE: 5/25/99

NORCAL GEOPHYSICAL CONSULTANTS INC.

LOCATION: Benecia Arsenal

BORING: FB0535B007



Scale: 1" = 10'

EXPLANATION

- ○ Original Boring Location
- ● Final Boring Location
- —— GPR Traverse
- □ OR —— Localized GPR Anomaly
- — — — Utility Alignment

Utilities

- _ T (Telephone, Comm.)
- _ E (Electric)
- ✓ NG (Natural Gas)
- _ CA (Compressed Air)
- _ STM (Steam)
- _ SS (Sanitary Sewer)
- _ SD (Storm Drain)
- _ W (Water)
- _ FS (Fire Supression)
- ✓ UU (Undifferentiated Utility)

Surface

- ✓ RC (Reinforced Concrete)
- ✓ AC (Asphalt)
- _ C (Concrete)
- _ Soil
- _ Gravel
- _ other

NOTES

Equipment:
- ✓ GPR (Radar)
- ✓ RD 400
- ✓ M Scope
- _ other

Procedure:
- _ EMC (Conduction)
- _ EMI (Induction)
- ✓ Ambient
- ✓ GPR

Surface Conditions:
- _ Wet
- ✓ Dry
- _ other

REMARKS

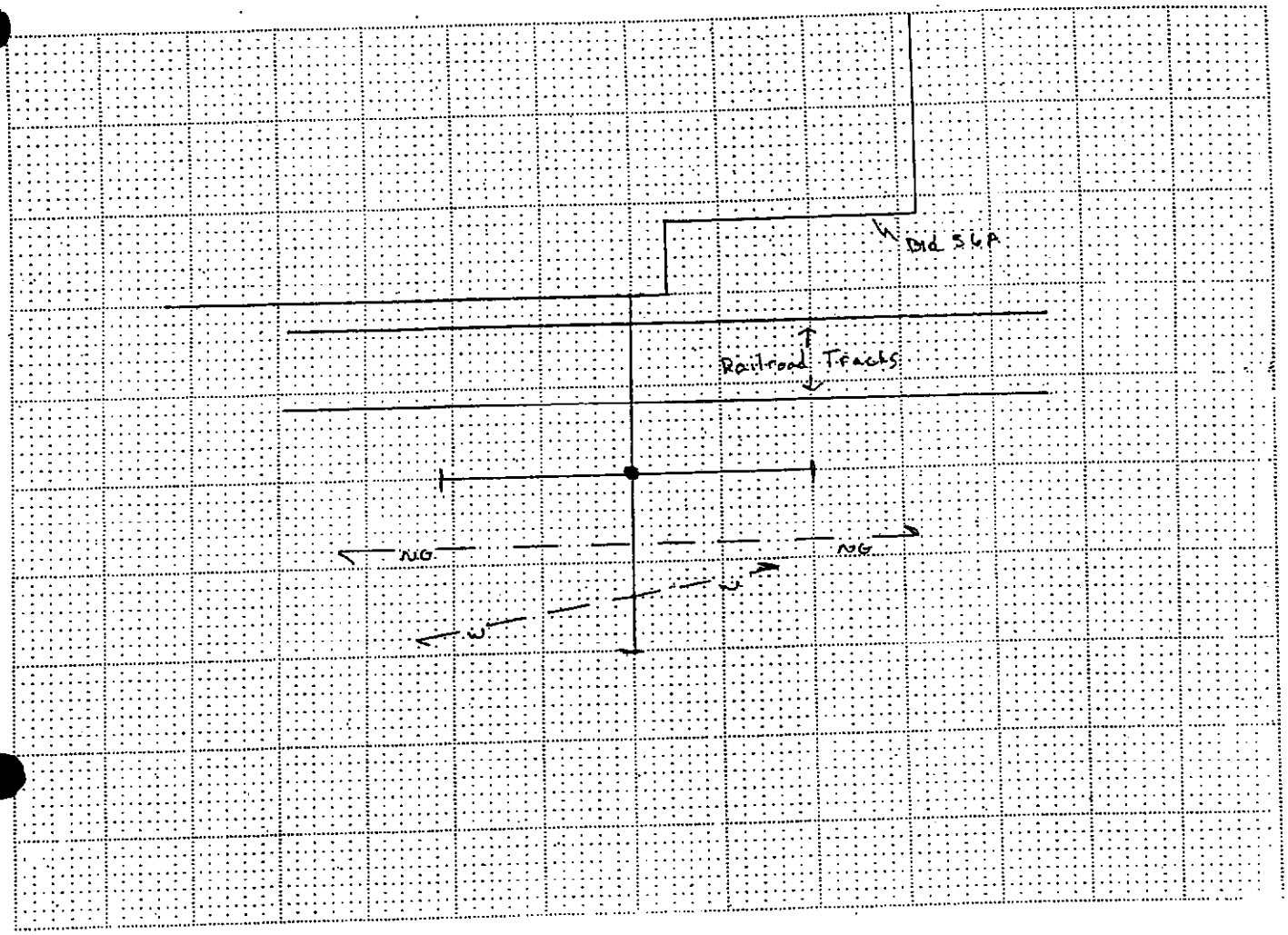
N

GPR DEPTH OF DETECTION WAS LIMITED TO LESS THAN 3' IN THIS AREA. CAN NOT DETECT STORM DRAIN AND SANITARY SEWER.

NORCAL GEOPHYSICAL CONSULTANTS INC.

LOCATION: Benecia Arsenal

BORING: IBOS3SB002



Scale: 1" = 10'

EXPLANATION

- Original Boring Location
- Final Boring Location
- GPR Traverse
- OR — Localized GPR Anomaly
- Utility Alignment

Utilities

- _ T (Telephone, Comm.)
- _ E (Electric)
- ✓ NG (Natural Gas)
- _ CA (Compressed Air)
- _ STM (Steam)
- _ SS (Sanitary Sewer)
- _ SD (Storm Drain)
- ✓ W (Water)
- _ FS (Fire Supression)
- _ UU (Undifferentiated Utility)

Surface

- _ RC (Reinforced Concrete)
- ✓ AC (Asphalt)
- _ C (Concrete)
- _ Soil
- _ Gravel
- _ other

NOTES

Equipment:
- ✓ GPR (Radar)
- _ BD 400
- ✓ M Scope
- _ other

Procedure:
- _ EMC (Conduction)
- _ EMI (Induction)
- ✓ Ambient
- ✓ GPR

Surface Conditions:
- _ Wet
- ✓ Dry
- _ other

REMARKS

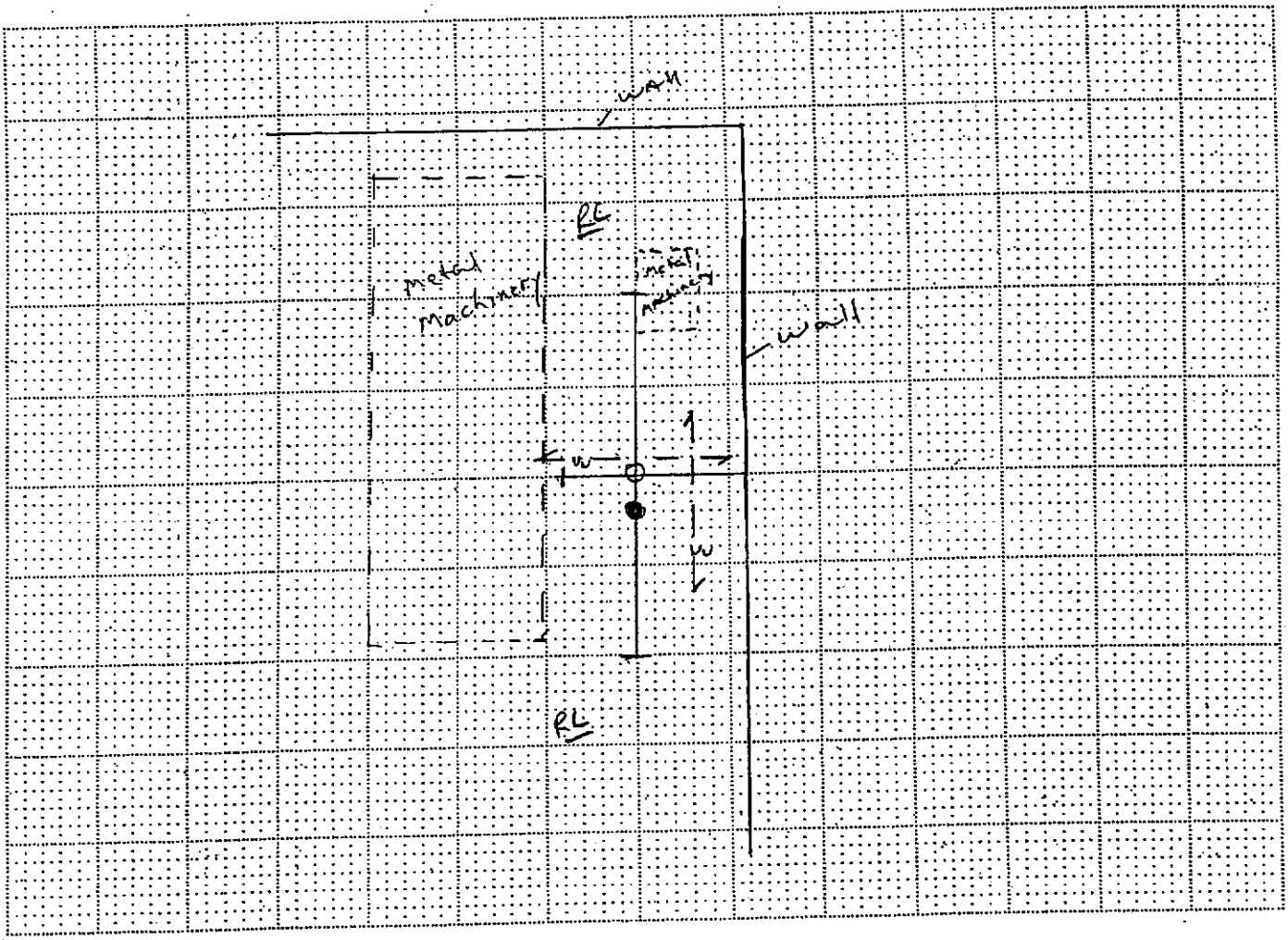
N

JOB: DATE: 5/24/11

NORCAL GEOPHYSICAL CONSULTANTS INC.

LOCATION: Denecia Arsenal Interior Bld#55

BORING: IB0555 Bool



Scale: 1" = 10'

EXPLANATION

- ○ Original Boring Location
- ● Final Boring Location
- —|—— GPR Traverse
- ▭ OR —— Localized GPR Anomaly
- — — — Utility Alignment

Utilities

- _ T (Telephone, Comm.)
- _ E (Electric)
- _ NG (Noturol Gas)
- _ CA (Compressed Air)
- _ STM (Steam)
- _ SS (Sanitary Sewer)
- _ SD (Storm Drain)
- _ W (Water)
- _ FS (Fire Supression)
- _ UU (Undifferentiated Utility)

Surface

- ✓ RC (Reinforced Concrete)
- _ AC (Asphalt)
- _ C (Concrete)
- _ Soil
- _ Gravel
- _ other

NOTES

Equipment:
- ✓ GPR (Radar)
- ✓ RD 400
- _ M Scope
- _ other

Procedure:
- _ EMC (Conduction)
- _ EMI (Induction)
- ✓ Ambient
- ✓ GPR

Surface Conditions:
- ✓ Wet
- _ Dry
- _ other

REMARKS

N

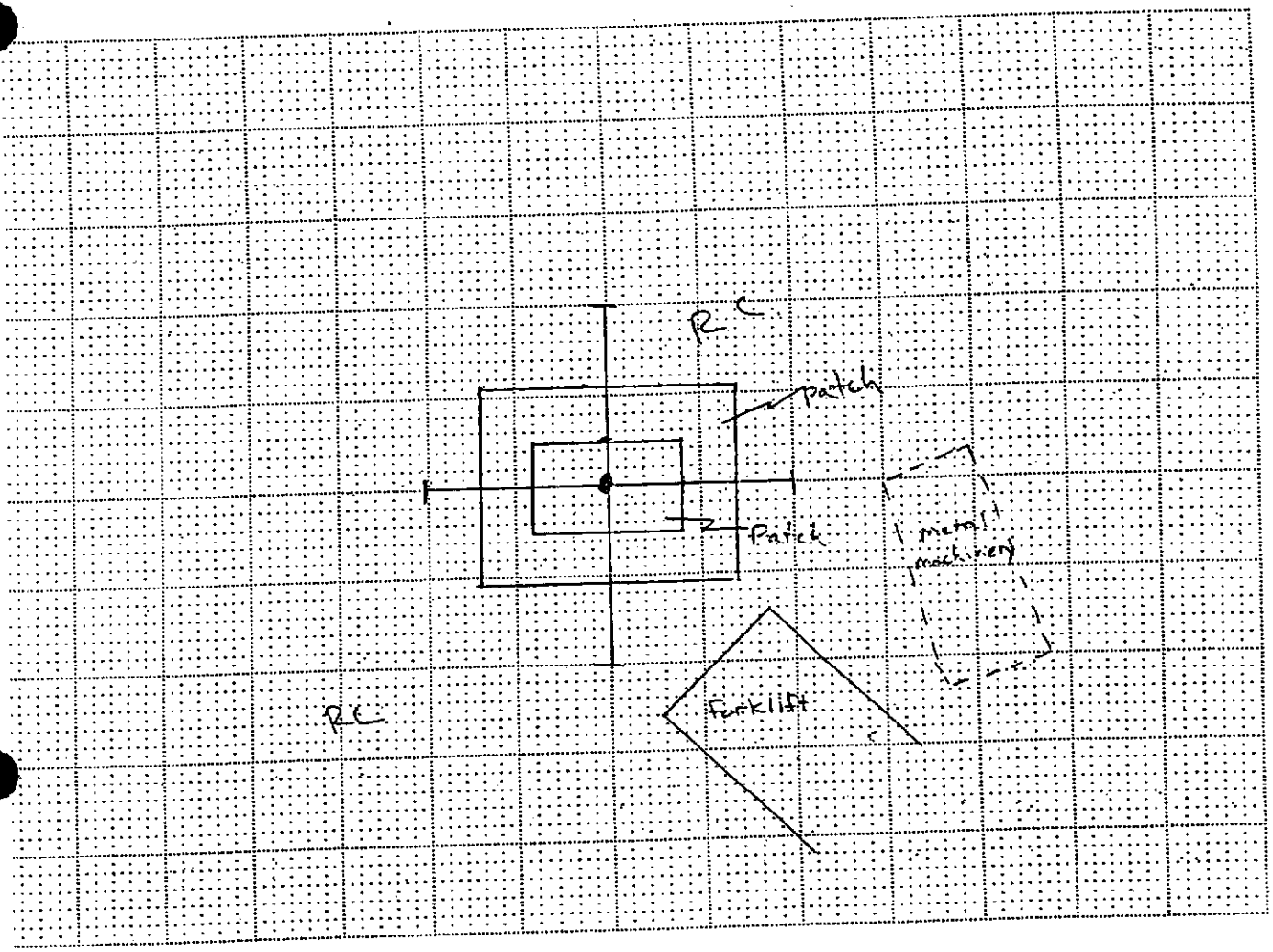
USE EXTREME CAUTION WHEN DRILLING THIS LOCATI PROPOSED BORING SHOULD BE MOVED 3' TO THE WES

HOWEVER, B&C INDICATED THAT THIS WAS NOT POSSIBLE BECAUS OF ACCESS FOR THE DRILL RIG

ORCAL GEOPHYSICAL CONSULTANTS INC. NORCAL

LOCATION: Benecia Arsenal Interior IR#55

BORING: IB055SB002



Scale: 1" = 10'

EXPLANATION

- ○ Original Boring Location
- ● Final Boring Location
- GPR Traverse
- Localized GPR Anomaly
- Utility Alignment

Utilities

- T (Telephone, Comm.)
- E (Electric)
- NG (Natural Gas)
- CA (Compressed Air)
- STM (Steam)
- _ SS (Sanitary Sewer)
- _ SD (Storm Drain)
- _ W (Water)
- _ FS (Fire Supression)
- _ UU (Undifferentiated Utility)

Surface

- RC (Reinforced Concrete)
- AC (Asphalt)
- C (Concrete)
- _ Soil
- _ Gravel
- _ other

NOTES

Equipment:	Procedure:	Surface Conditions:
✓ GPR (Radar)	_ EMC (Conduction)	_ Wet
_ RD 400	_ EMI (Induction)	✓ Dry
_ M Scope	✓ Ambient	_ other
_ other	✓ GPR	

REMARKS

note: Due to reinforced concrete in this area the M-Scope was not used.

note: patch perimeters are lined with vertical steel

JOB:

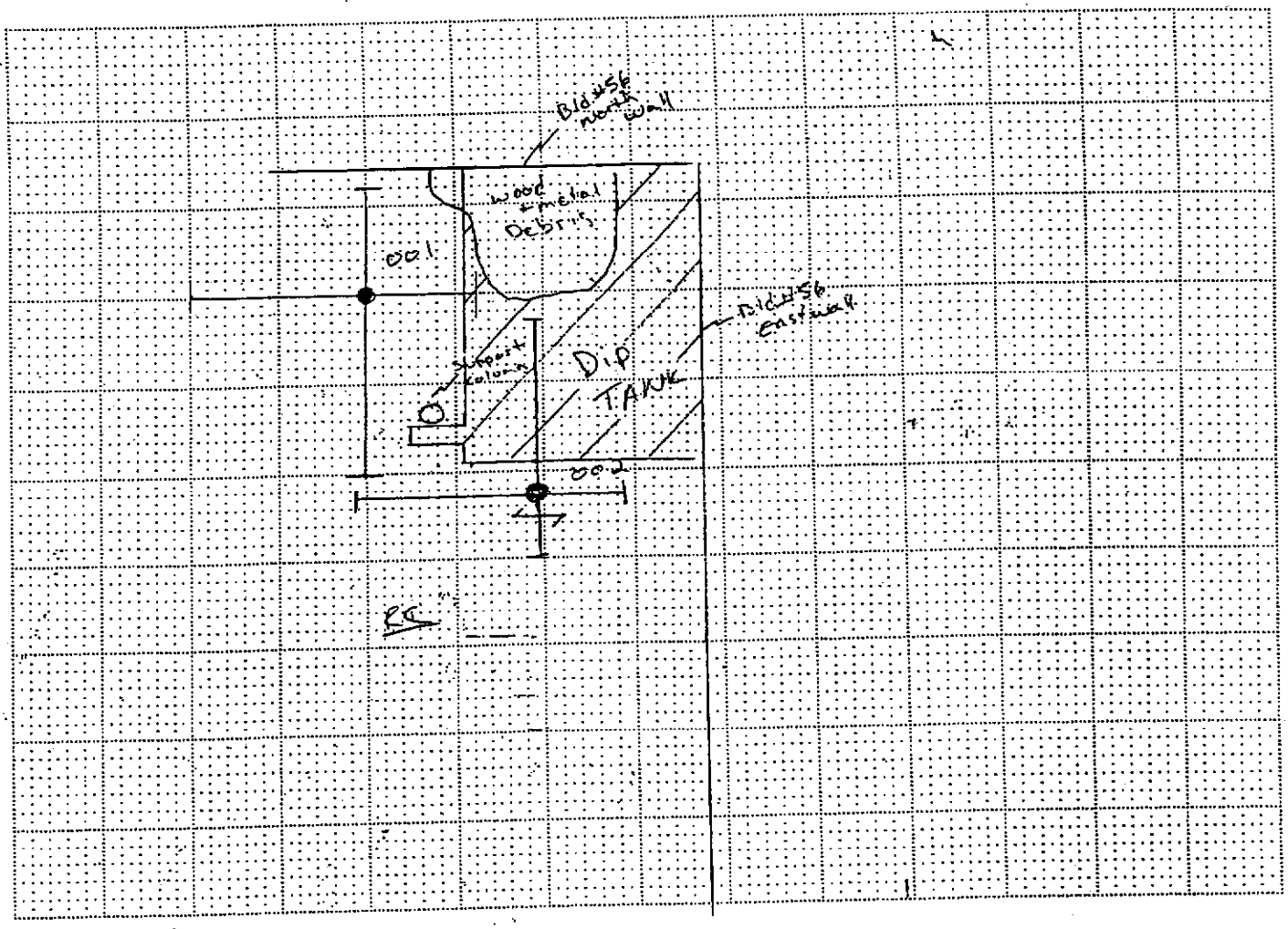
DATE: 5/24/99

NORCAL GEOPHYSICAL CONSULTANTS INC.

NORCAL

LOCATION: Benecia Arsenal Bld 56 interior

BORING: IOB56SB001/IOB56SB002



Scale: 1" = 10'

EXPLANATION

- ○ Original Boring Location
- ● Final Boring Location
- ⊢——⊣ GPR Traverse
- □ OR —— Localized GPR Anomaly
- — — — Utility Alignment

Utilities

- _ T (Telephone, Comm.)
- _ E (Electric)
- _ NG (Natural Gas)
- _ CA (Compressed Air)
- _ STM (Steam)
- _ SS (Sanitary Sewer)
- _ SD (Storm Drain)
- _ W (Water)
- _ FS (Fire Supression)
- _ UU (Undifferentiated Utility)

Surface

- / RC (Reinforced Concrete)
- _ AC (Asphalt)
- _ C (Concrete)
- _ Soil
- _ Gravel
- _ other

NOTES

Equipment:
- / GPR (Radar)
- / RD 400
- _ M Scope
- _ other

Procedure:
- _ EMC (Conduction)
- _ EMI (Induction)
- / Ambient
- / GPR

Surface Conditions:
- / Wet
- _ Dry
- _ other

REMARKS

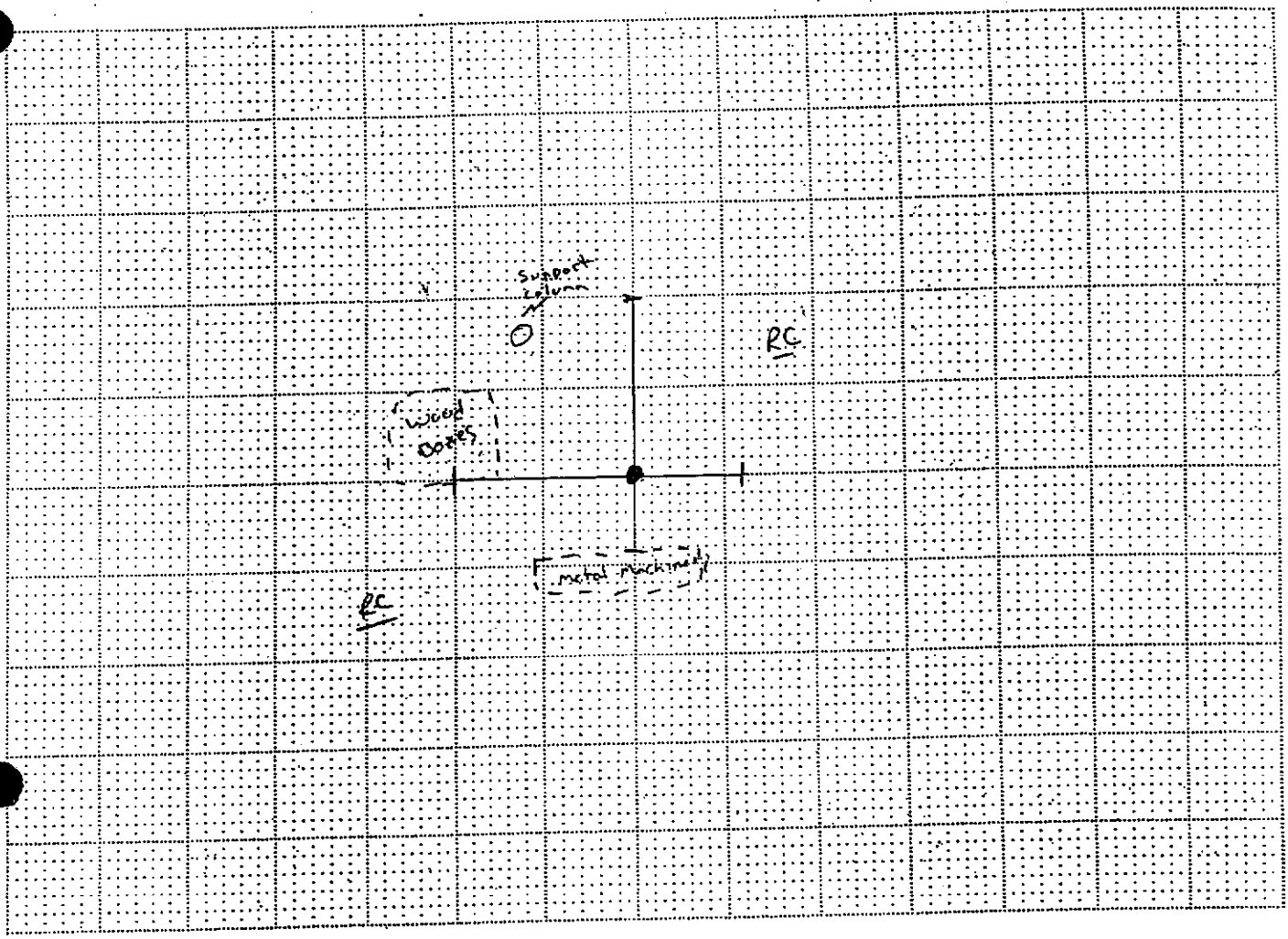
N

MAGNETIC INTERFERENCE FROM REBAR IN CONCRET PRECLUDED USE OF M-SC IN THIS AREA.

NORCAL GEOPHYSICAL CONSULTANTS INC.

LOCATION: Benecia Arsenal

BORING: IOBSGSB003



Scale: 1" = 10'

EXPLANATION

- ○ Original Boring Location
- ● Final Boring Location
- GPR Traverse
- OR Localized GPR Anomaly
- Utility Alignment

Utilities

- _ T (Telephone, Comm.)
- _ E (Electric)
- _ NG (Natural Gas)
- _ CA (Compressed Air)
- _ STM (Steam)
- _ SS (Sanitary Sewer)
- _ SD (Storm Drain)
- _ W (Water)
- _ FS (Fire Supression)
- _ UU (Undifferentiated Utility)

Surface

- ✓ RC (Reinforced Concrete)
- _ AC (Asphalt)
- _ C (Concrete)
- _ Soil
- _ Gravel
- _ other

NOTES

Equipment:
- ✓ GPR (Radar)
- ✓ RD 400
- _ M Scope
- _ other

Procedure:
- _ EMC (Conduction)
- _ EMI (Induction)
- ✓ Ambient
- ✓ GPR

Surface Conditions:
- _ Wet
- ✓ Dry
- _ other

REMARKS

N

MAGNETIC INTERFERENCE FROM REBAR IN CONCRETE PRECLUDED USE OF M-SCOPE IN THIS AREA.

JOB:

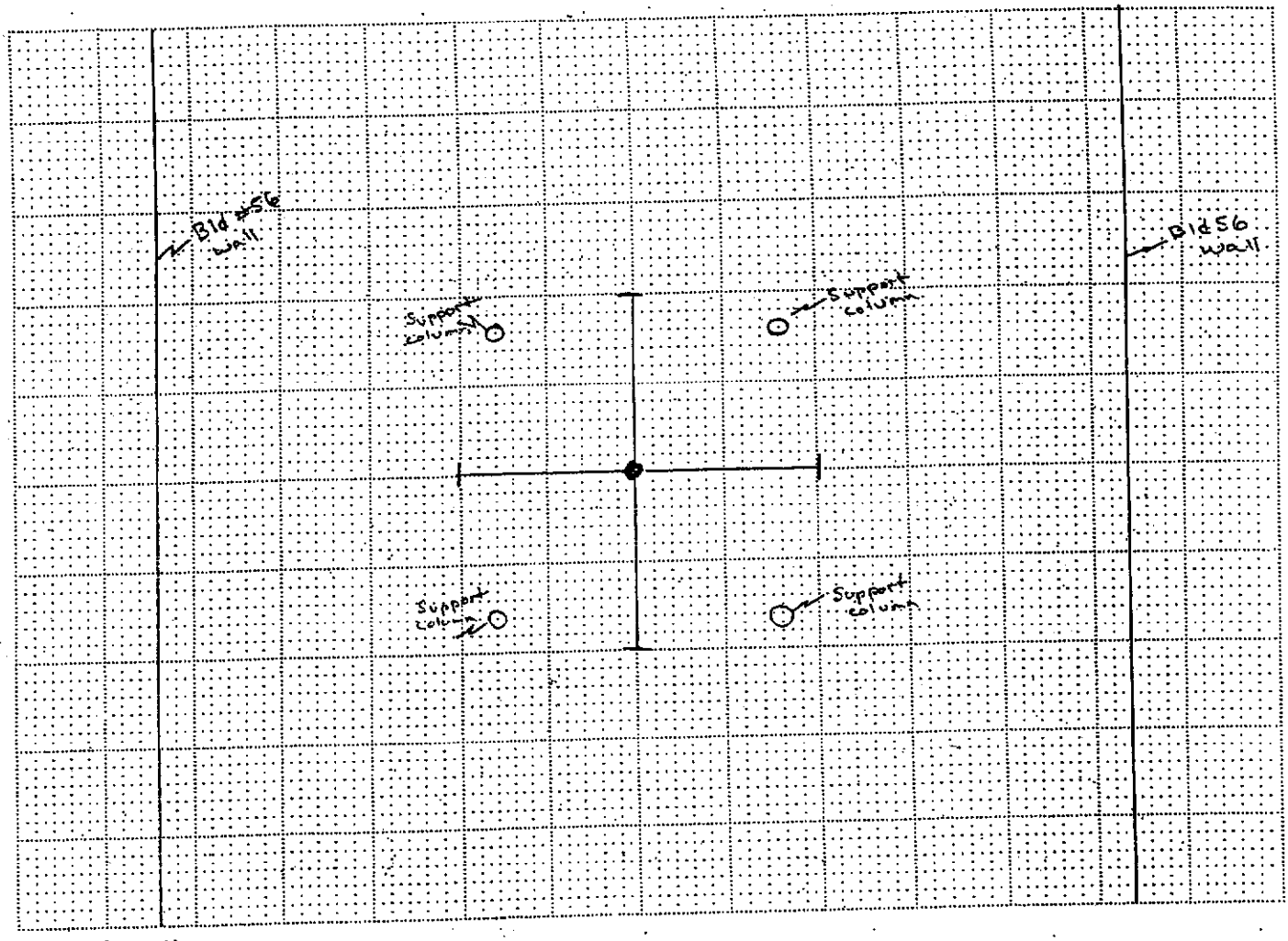
DATE: 5/24/99

NORCAL GEOPHYSICAL CONSULTANTS INC.

NORCAL

LOCATION: Benecia Arsenal

BORING: IB056B004



Scale: 1" = 10'

EXPLANATION

- ○ Original Boring Location
- ● Final Boring Location
- —— GPR Traverse
- ▭ OR —— Localized GPR Anomaly
- — — — Utility Alignment

Utilities

- _ T (Telephone, Comm.)
- _ E (Electric)
- _ NG (Natural Gas)
- _ CA (Compressed Air)
- _ STM (Steam)
- _ SS (Sanitary Sewer)
- _ SD (Storm Drain)
- _ W (Water)
- _ FS (Fire Supression)
- _ UU (Undifferentiated Utility)

Surface

- ✓ RC (Reinforced Concrete)
- _ AC (Asphalt)
- _ C (Concrete)
- _ Soil
- _ Gravel
- _ other

NOTES

Equipment:
- _ GPR (Radar)
- ✓ RD 400
- _ M Scope
- _ other

Procedure:
- _ EMC (Conduction)
- _ EMI (Induction)
- ✓ Ambient
- ✓ GPR

Surface Conditions:
- _ Wet
- _ Dry
- _ other

REMARKS

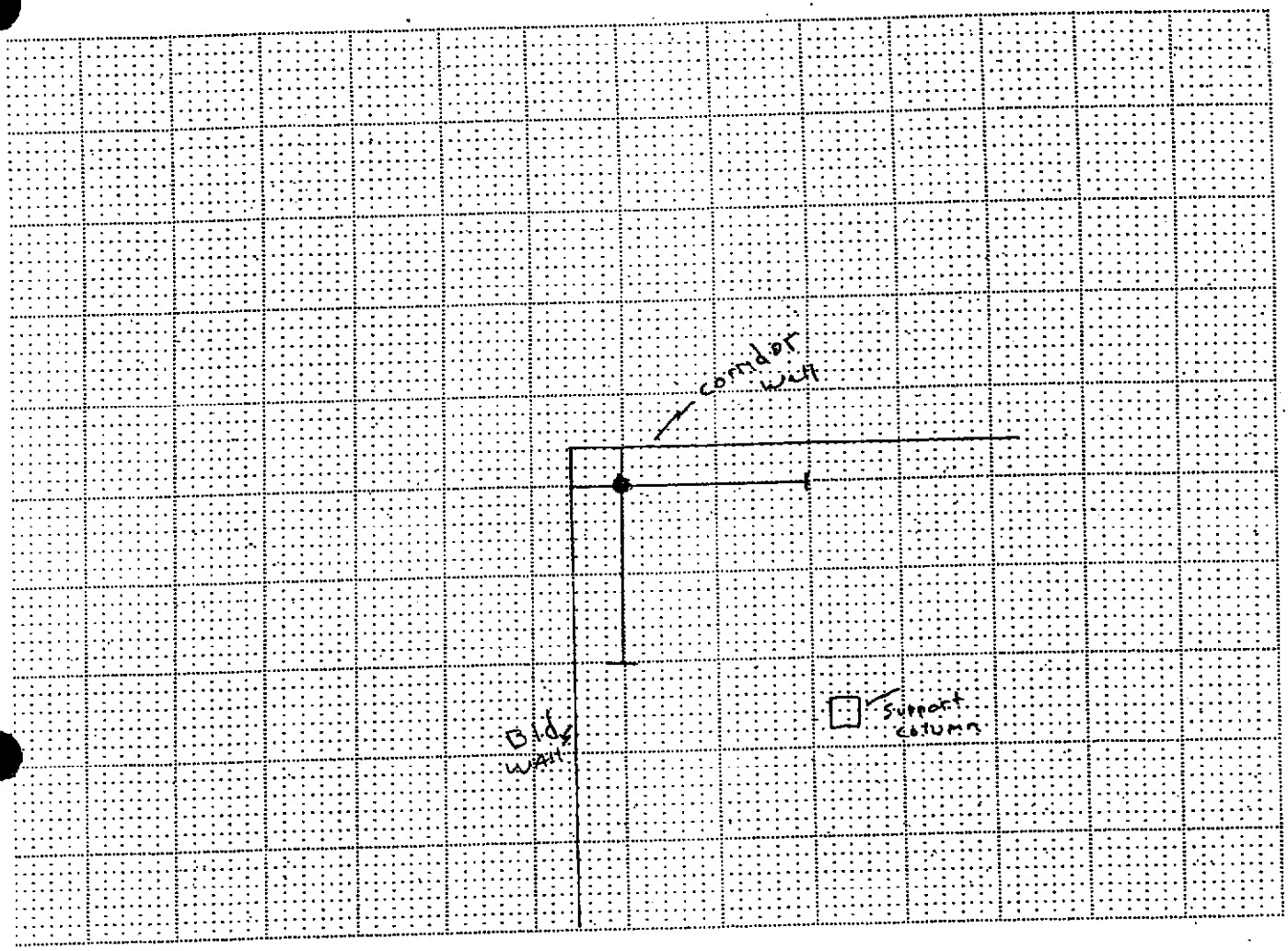
N

INTERFERENCE FROM REBAR IN CONCRETE PRECLUDED USE OF M-SCOPE IN THIS AREA.

NORCAL GEOPHYSICAL CONSULTANTS INC.

LOCATION: Corridor at bld #56 Benicia Arsenal

BORING: FB056A1HA002



Scale: 1" = 10'

EXPLANATION

- ○ Original Boring Location
- ● Final Boring Location
- GPR Traverse
- Localized GPR Anomaly
- Utility Alignment

Utilities

T (Telephone, Comm.)	_ SS (Sanitary Sewer)
E (Electric)	_ SD (Storm Drain)
NG (Natural Gas)	_ W (Water)
CA (Compressed Air)	_ FS (Fire Supression)
STM (Steam)	_ UU (Undifferentiated Utility)

Surface

RC (Reinforced Concrete)	_ Soil
AC (Asphalt)	_ Gravel
C (Concrete)	_ other

NOTES

Equipment:	Procedure:	Surface Conditions:
✓ GPR (Radar)	_ EMC (Conduction)	_ Wet
✓ RD 400	_ EMI (Induction)	_ Dry
_ M Scope	✓ Ambient	_ other
_ other	✓ GPR	

REMARKS

INTERFERENCE FROM REBAR IN CONCRETE PRECLUDED USE OF M-SCOPE IN THIS AREA.

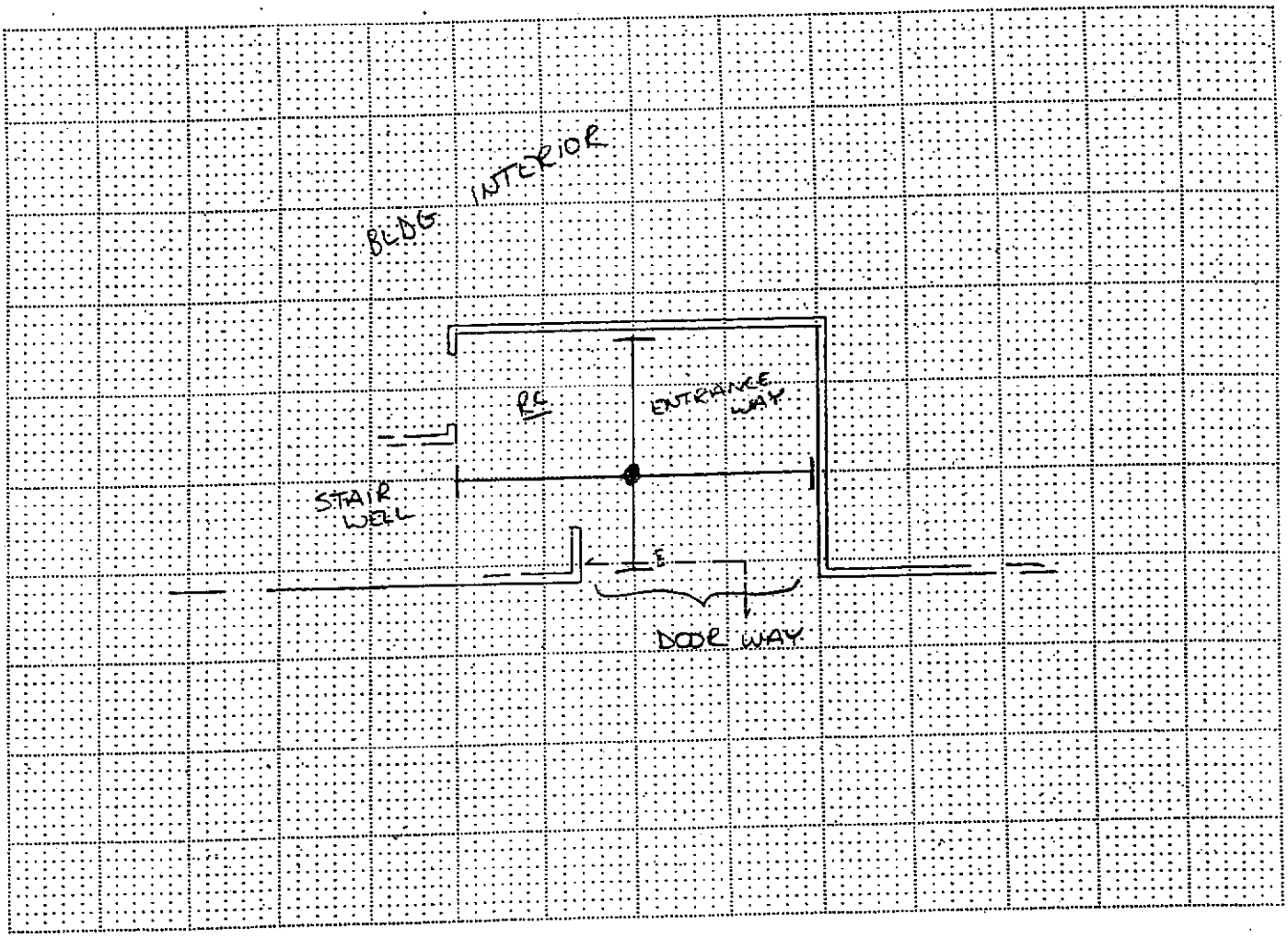
N

JOB: | DATE: 5-24-99

NORCAL GEOPHYSICAL CONSULTANTS INC.

LOCATION: BLDG 56 INTERIOR

BORING: IB056AH4003



Scale: 1" = 10'

EXPLANATION

- ○ Original Boring Location
- ● Final Boring Location
- GPR Troverse
- OR Localized GPR Anomaly
- Utility Alignment

Utilities

- _ T (Telephone, Comm.)
- ✓ E (Electric)
- _ NG (Natural Gas)
- _ CA (Compressed Air)
- _ STM (Steam)
- _ SS (Sanitary Sewer)
- _ SD (Storm Drain)
- _ W (Water)
- _ FS (Fire Supression)
- _ UU (Undifferentiated Utility)

Surface

- ✓ RC (Reinforced Concrete)
- _ AC (Asphalt)
- _ C (Concrete)
- _ Soil
- _ Gravel
- _ other

NOTES

Equipment:	Procedure:	Surface Conditions:
✓ GPR (Radar)	_ EMC (Conduction)	_ Wet
✓ RD 400	_ EMI (Induction)	✓ Dry
_ M Scope	✓ Ambient	_ other
_ other	✓ GPR	

REMARKS

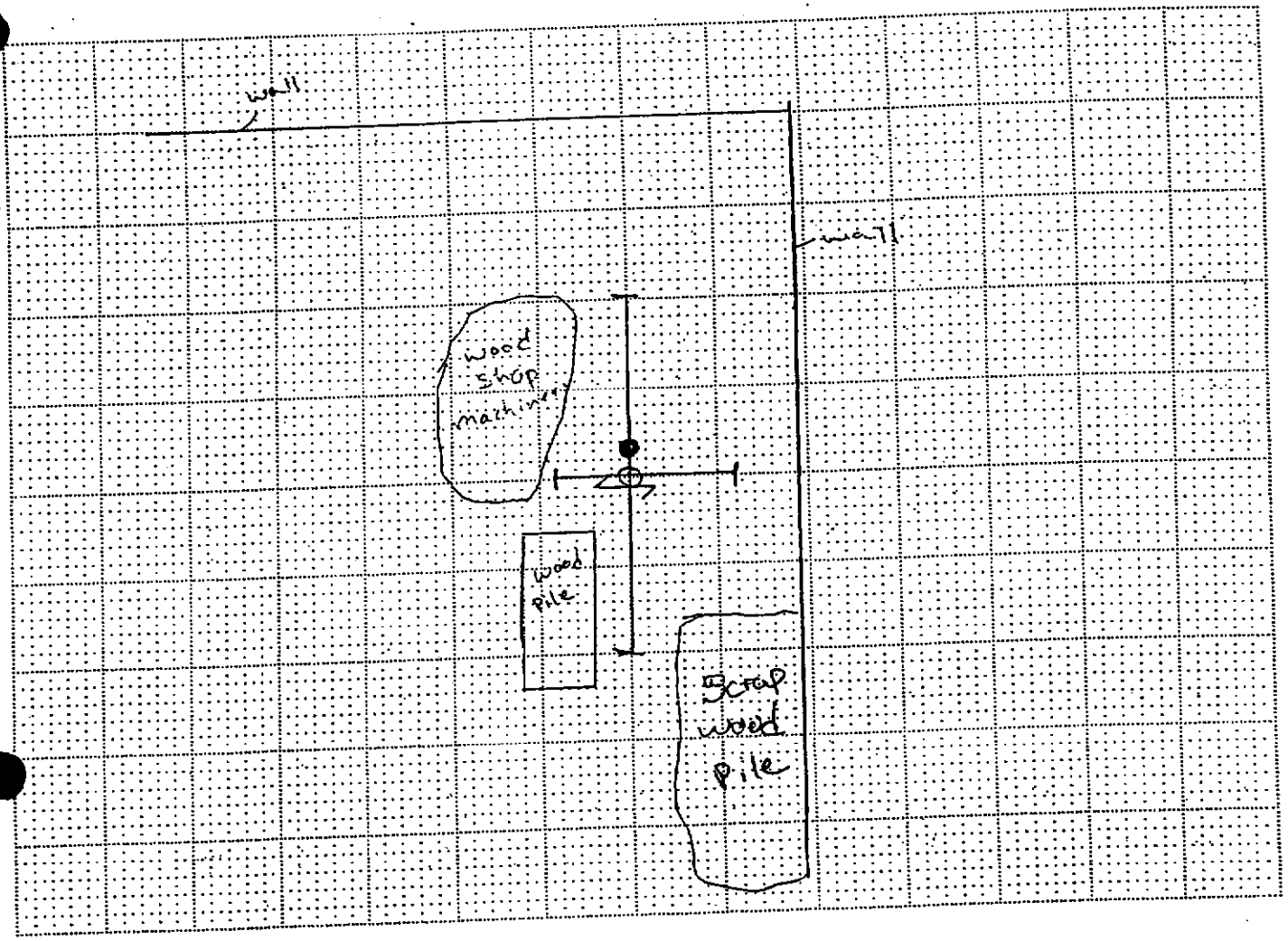
N

INTERFERENCE FROM REBAR IN CONCRETE PRECLUDED USE OF M-SCOPE IN THIS AREA.

NORCAL GEOPHYSICAL CONSULTANTS INC.

LOCATION: Benecia Arsenal Interior Bld 56B

BORING: IB056BSB001



Scale: 1" = 10'

EXPLANATION

- ○ Original Boring Location
- ● Final Boring Location
- GPR Traverse
- OR Localized GPR Anomaly
- Utility Alignment

Utilities

- _ T (Telephone, Comm.)
- _ E (Electric)
- _ NG (Natural Gas)
- _ CA (Compressed Air)
- _ STM (Steam)
- _ SS (Sanitary Sewer)
- _ SD (Storm Drain)
- _ W (Water)
- _ FS (Fire Supression)
- _ UU (Undifferentiated Utility)

Surface

- _ RC (Reinforced Concrete)
- _ AC (Asphalt)
- _ C (Concrete)
- _ Soil
- _ Gravel
- _ other

NOTES

Equipment:
- ✓ GPR (Radar)
- ✓ RD 400
- _ M Scope
- _ other

Procedure:
- _ EMC (Conduction)
- _ EMI (Induction)
- ✓ Ambient
- ✓ GPR

Surface Conditions:
- _ Wet
- _ Dry
- _ other

REMARKS

note: INTERFERENCE FROM REBAR IN CONCRETE PRECLUDED USE OF M-SCOPE IN THIS AREA.

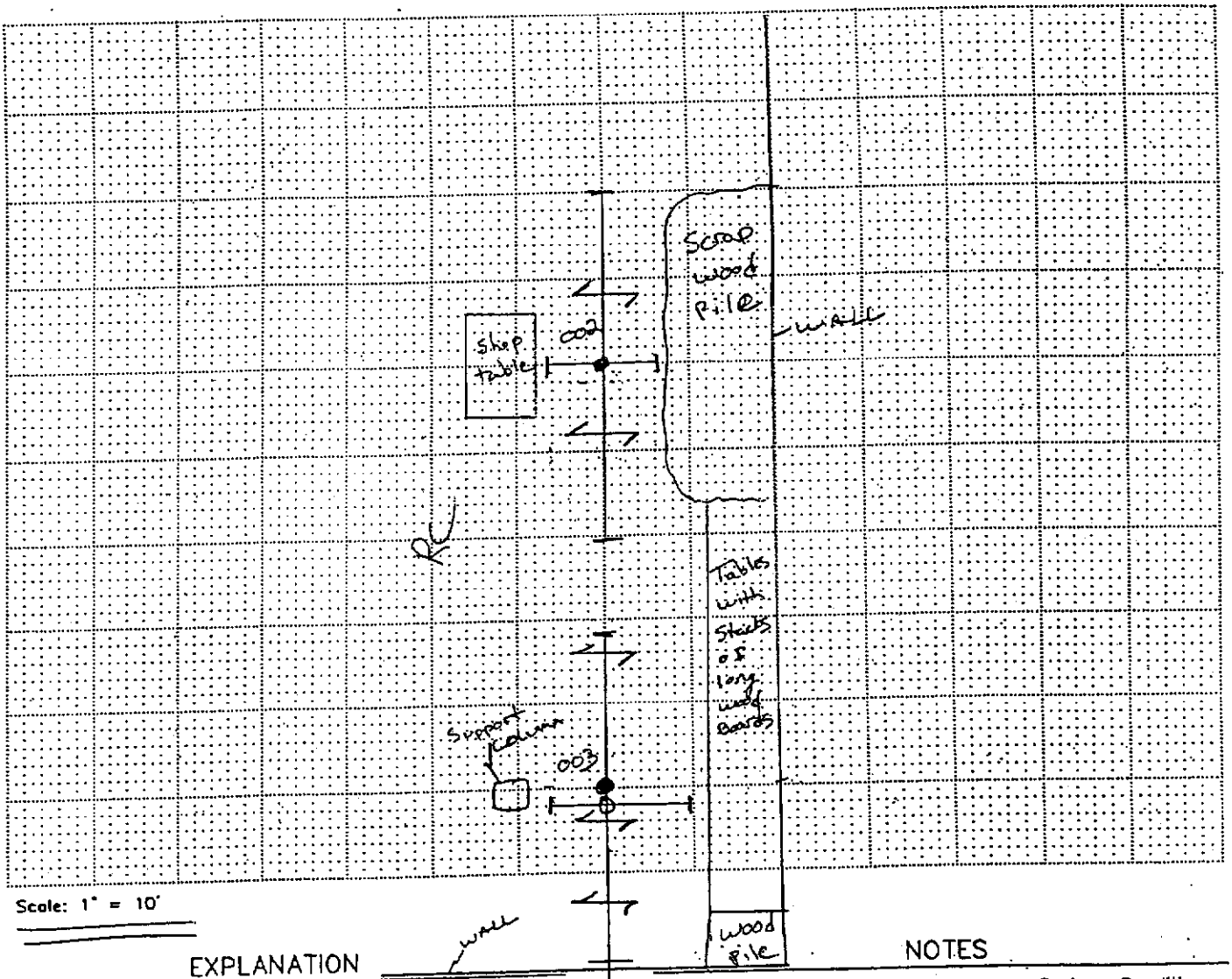
N

JOB: | DATE: 5/24/98

NORCAL GEOPHYSICAL CONSULTANTS INC.

LOCATION: Benecia Arsenal Interior Bld 56B

BORING: IB056DSB002/IB056BSB003



Scale: 1" = 10'

EXPLANATION

- ○ Original Boring Location
- ● Final Boring Location
- GPR Traverse
- ▭ or — Localized GPR Anomaly
- — — — Utility Alignment

Utilities

- _ T (Telephone, Comm.)
- _ E (Electric)
- _ NG (Natural Gas)
- _ CA (Compressed Air)
- _ STM (Steam)
- _ SS (Sanitary Sewer)
- _ SD (Storm Drain)
- _ W (Water)
- _ FS (Fire Supression)
- _ UU (Undifferentiated Utility)

Surface

- ✓ RC (Reinforced Concrete)
- _ AC (Asphalt)
- _ C (Concrete)
- _ Soil
- _ Gravel
- _ other

NOTES

Equipment:	Procedure:	Surface Conditions:
✓ GPR (Radar)	_ EMC (Conduction)	_ Wet
✓ RD 400	_ EMI (Induction)	✓ Dry
_ M Scope	✓ Ambient	_ other
_ other	✓ GPR	

REMARKS

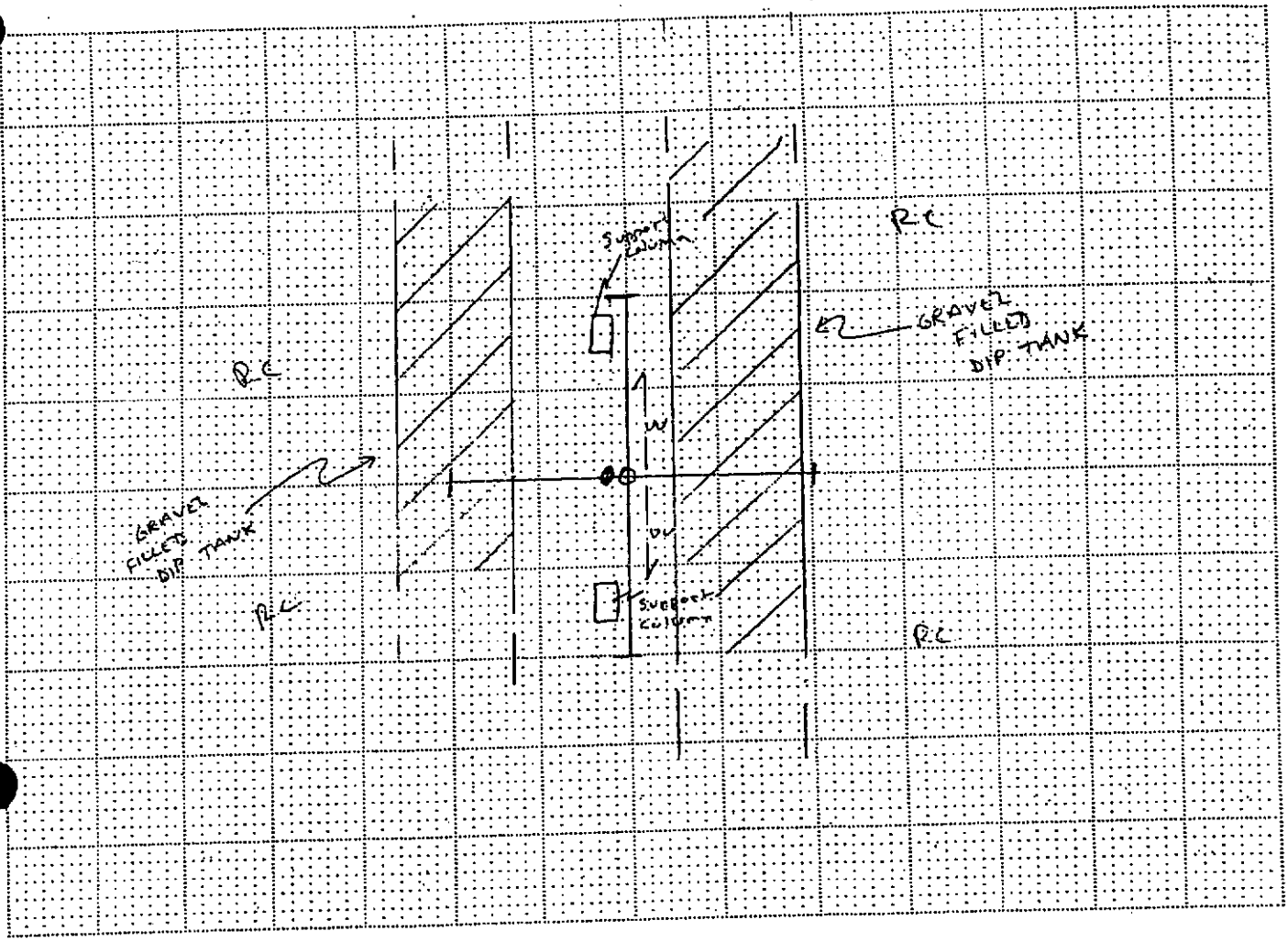
Note: INTERFERENCE FROM REBAR IN CONCRETE PRECLUDED USE OF M-SCOPE IN THIS AREA

N

NORCAL GEOPHYSICAL CONSULTANTS INC.

LOCATION: Benecia Arsenal Interior Bld 57A

BORING: IB057AHP008



Scale: 1" = 10'

EXPLANATION

- ○ Original Boring Location
- ● Final Boring Location
- ⊢——⊣ GPR Traverse
- ▭ OR ⟵ Localized GPR Anomaly
- — — — Utility Alignment

Utilities

- _ T (Telephone, Comm.)
- _ E (Electric)
- _ NG (Natural Gas)
- _ CA (Compressed Air)
- _ STM (Steam)
- _ SS (Sanitary Sewer)
- _ SD (Storm Drain)
- _ W (Water)
- _ FS (Fire Supression)
- _ UU (Undifferentiated Utility)

Surface

- _ RC (Reinforced Concrete)
- _ AC (Asphalt)
- _ C (Concrete)
- _ Soil
- _ Gravel
- _ other

NOTES

Equipment:
- _ GPR (Radar)
- _ RD 400
- _ M Scope
- _ other

Procedure:
- _ EMC (Conduction)
- _ EMI (Induction)
- _ Ambient
- _ GPR

Surface Conditions:
- _ Wet
- _ Dry
- _ other

REMARKS

N

MAGNETIC INTERFERENCE FROM REBAR IN CONCRETE PRECLUDED USE OF M-SCOPE IN THIS AREA

JOB:

DATE: 5/25/99

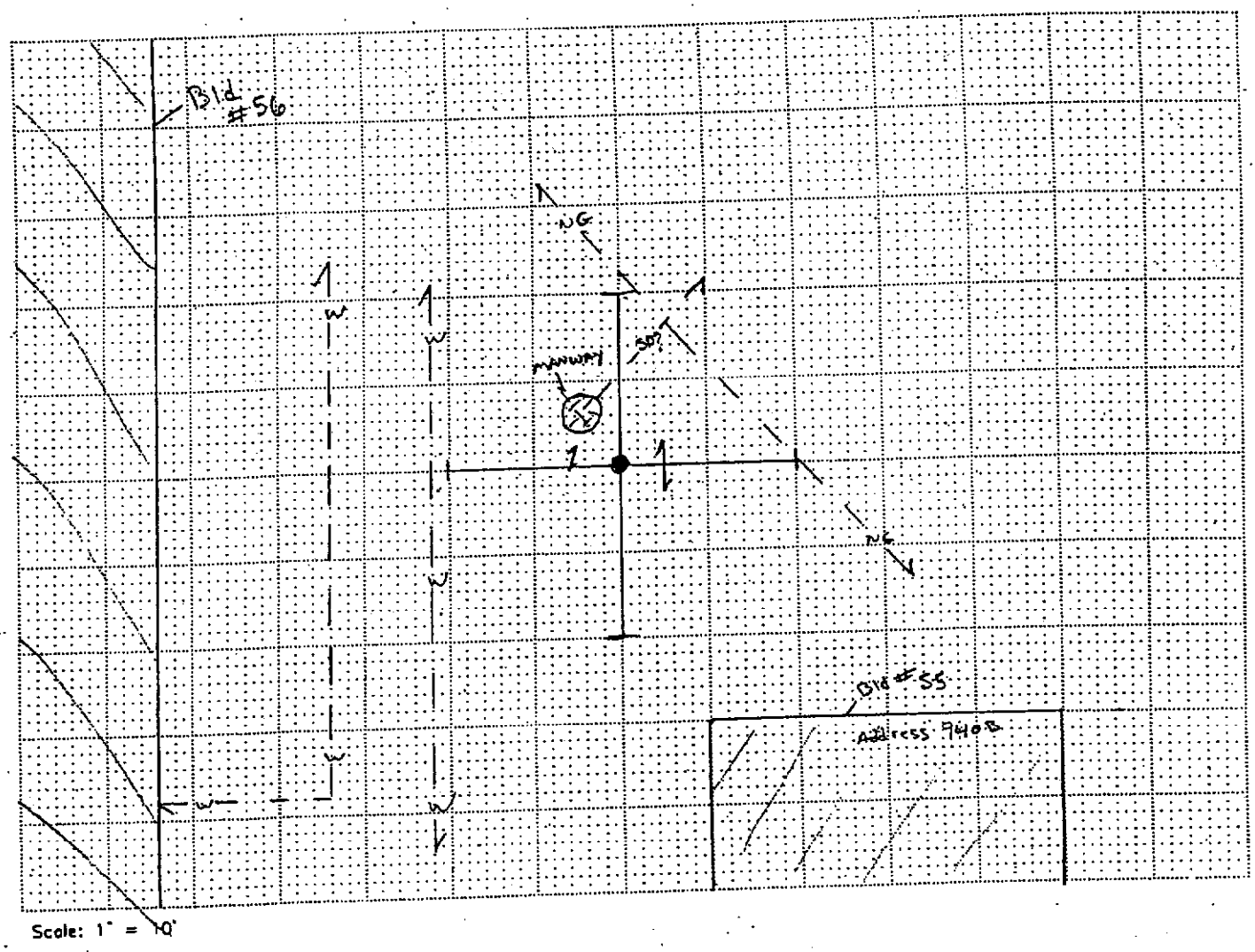
NORCAL GEOPHYSICAL CONSULTANTS INC.

NORCAL

LOCATION: Benecia Arsenal Building 55/56 exterior

1B057A

BORING: HP003



Scale: 1" = 10'

EXPLANATION

- Original Boring Location
- Final Boring Location
- GPR Traverse
- Localized GPR Anomaly
- Utility Alignment

Utilities

- _ T (Telephone, Comm.)
- _ E (Electric)
- _/ NG (Natural Gas)
- _ CA (Compressed Air)
- _ STM (Steam)
- _ SS (Sanitary Sewer)
- _/ SD (Storm Drain)
- _ W (Water)
- _ FS (Fire Supression)
- _ UU (Undifferentiated Utility)

Surface

- _/ RC (Reinforced Concrete)
- _ AC (Asphalt)
- _ C (Concrete)
- _ Soil
- _ Gravel
- _ other

NOTES

Equipment:
- _/ GPR (Radar)
- _/ RD 400
- _ M Scope
- _ other

Procedure:
- _ EMC (Conduction)
- _ EMI (Induction)
- _/ Ambient
- _/ GPR

Surface Conditions:
- _/ Wet
- _ Dry
- _ other

REMARKS

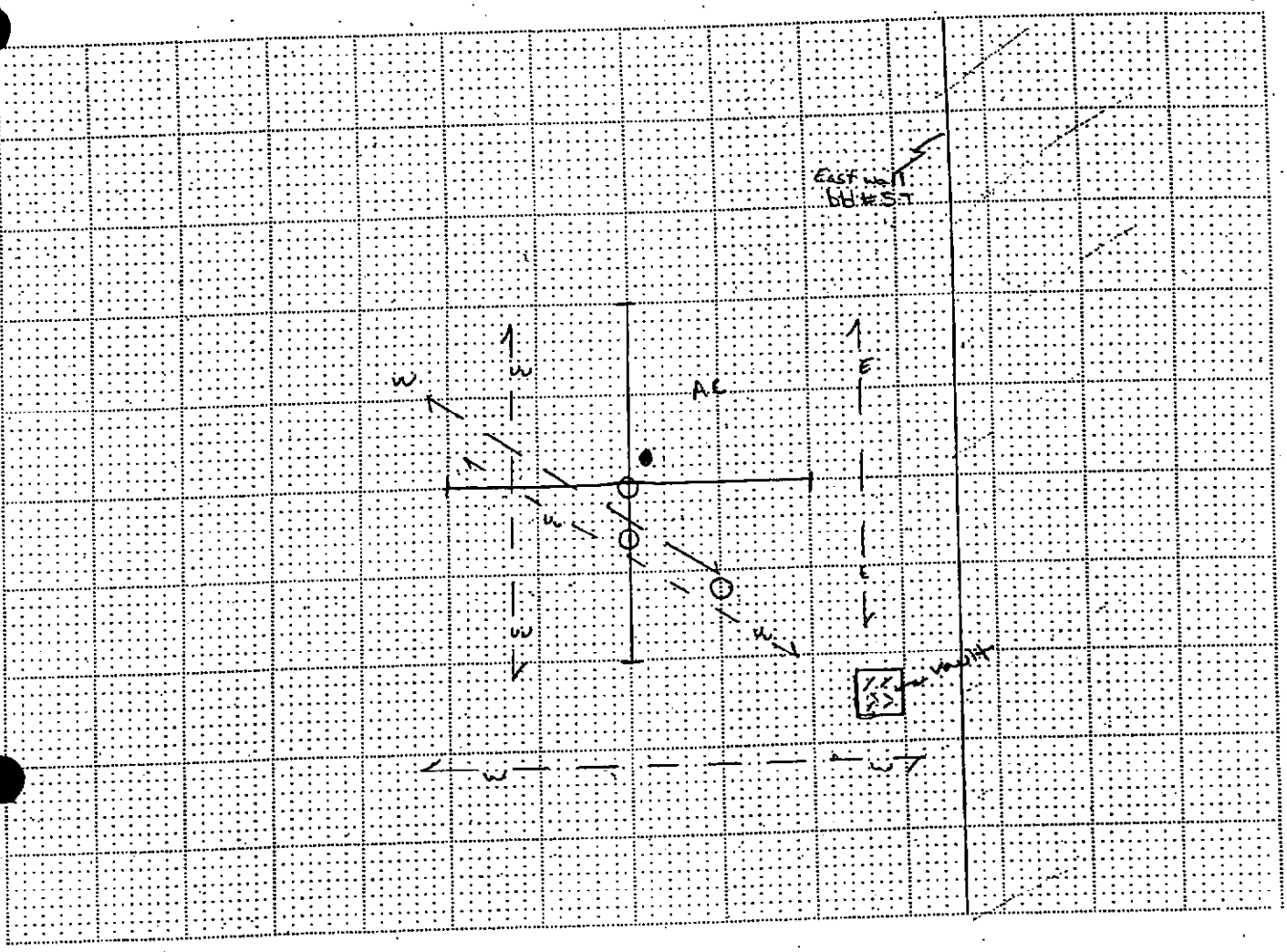
N

JOB: | DATE: 5/25/94

NORCAL GEOPHYSICAL CONSULTANTS INC.

LOCATION: Benicia Arsenal exterior Building 57

BORING: IB057A HP007



EXPLANATION

- Original Boring Location
- Final Boring Location
- GPR Traverse
- OR — Localized GPR Anomaly
- Utility Alignment

Utilities

- _ T (Telephone, Comm.)
- ✓ E (Electric)
- _ NG (Natural Gas)
- _ CA (Compressed Air)
- _ STM (Steam)
- _ SS (Sanitary Sewer)
- _ SD (Storm Drain)
- ✓ W (Water)
- _ FS (Fire Supression)
- ✓ UU (Undifferentiated Utility)

Surface

- RC (Reinforced Concrete)
- ✓ AC (Asphalt)
- _ C (Concrete)
- _ Soil
- _ Gravel
- _ other

NOTES

Equipment:
- ✓ GPR (Radar)
- ✓ RD 400
- ✓ M Scope
- _ other

Procedure:
- _ EMC (Conduction)
- _ EMI (Induction)
- ✓ Ambient
- ✓ GPR

Surface Conditions:
- _ Wet
- ✓ Dry
- _ other

REMARKS

N

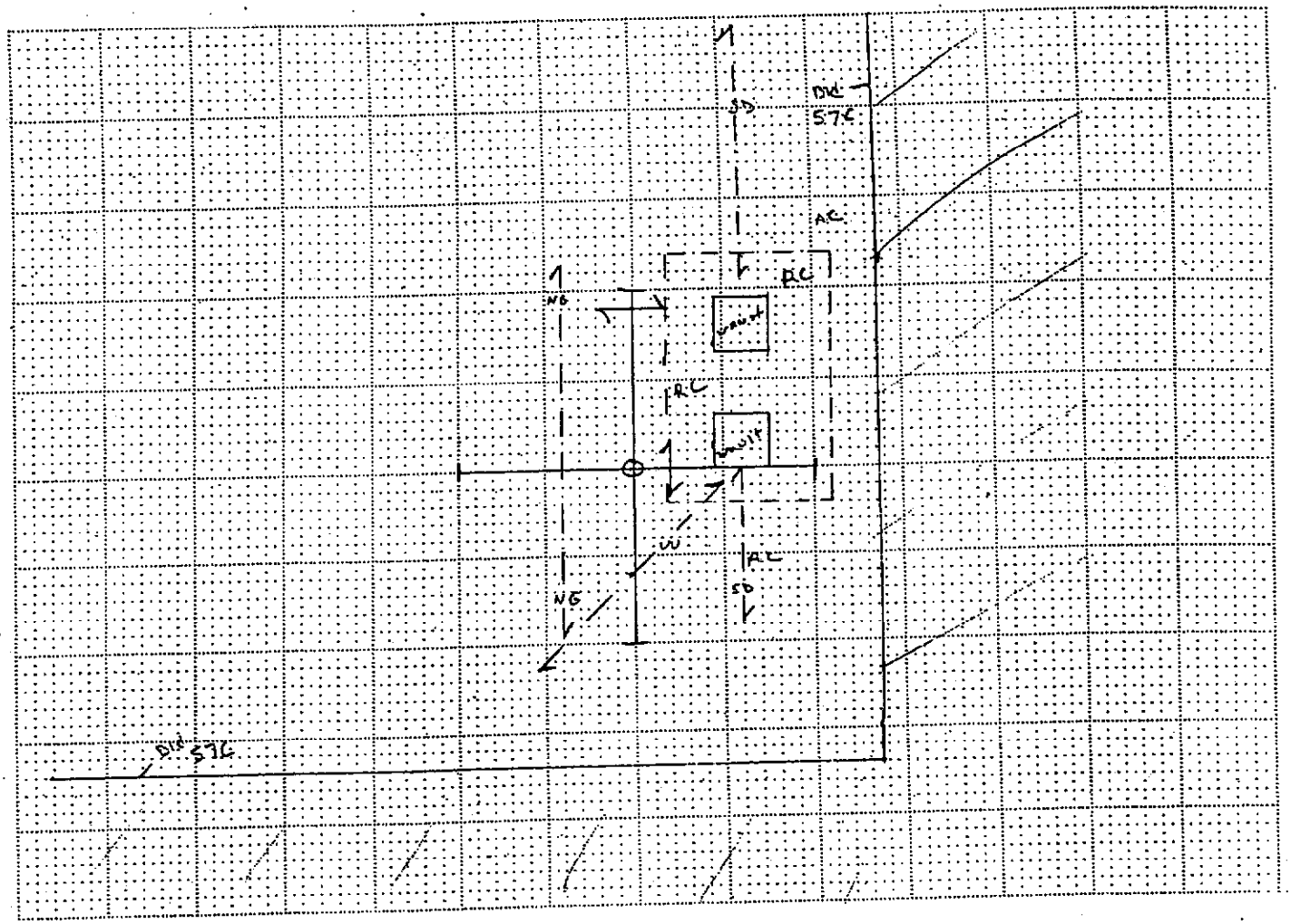
JOB:

DATE: 5/25/99

NORCAL GEOPHYSICAL CONSULTANTS INC.

LOCATION: Benecia Arsenal Building 57 exteri

BORING: 1B057A HP001



Scale: 1" = 10'

EXPLANATION

- ○ Original Boring Location
- ● Final Boring Location
- —— GPR Traverse
- ▭ OR —— Localized GPR Anomaly
- — — — Utility Alignment

Utilities

- _ T (Telephone, Comm.)
- _ E (Electric)
- ✓ NG (Natural Gas)
- _ CA (Compressed Air)
- _ STM (Steam)
- _ SS (Sanitary Sewer)
- ✓ SD (Storm Drain)
- _ W (Water)
- _ FS (Fire Supression)
- ✓ UU (Undifferentiated Utility)

Surface

- ✓ RC (Reinforced Concrete)
- ✓ AC (Asphalt)
- _ C (Concrete)
- _ Soil
- _ Gravel
- _ other

NOTES

Equipment:
- ✓ GPR (Radar)
- ✓ RD 400
- ✓ M Scope
- _ other

Procedure:
- _ EMC (Conduction)
- _ EMI (Induction)
- ✓ Ambient
- ✓ GPR

Surface Conditions:
- _ Wet
- ✓ Dry
- _ other

REMARKS

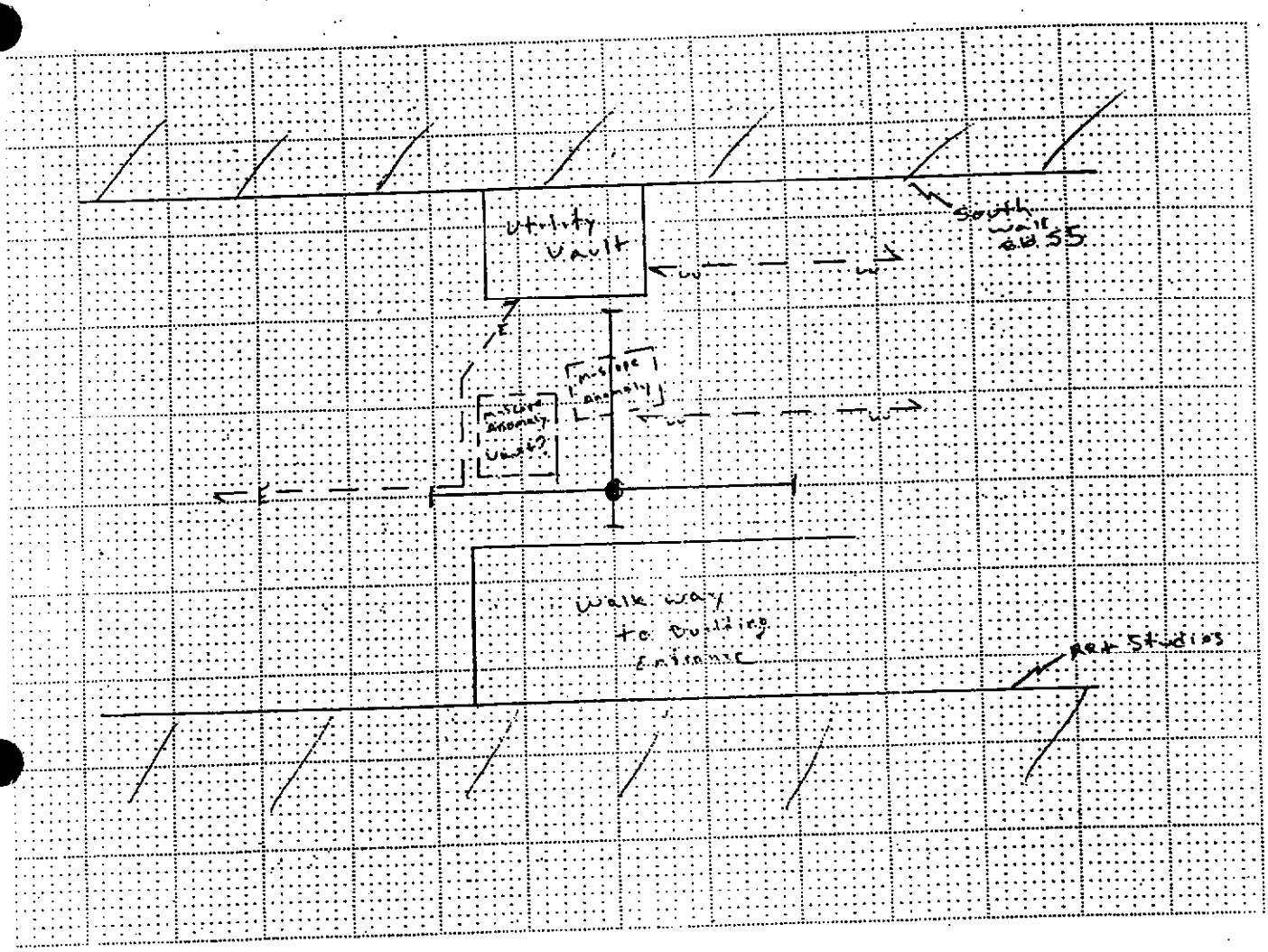
Note: Vaults are suspected oil water Separater

N

NORCAL GEOPHYSICAL CONSULTANTS INC.

LOCATION: Benecia Arsenal

BORING: IB057AHP002



Scale: 1" = 10'

EXPLANATION

- ○ Original Boring Location
- ● Final Boring Location
- GPR Traverse
- Localized GPR Anomaly
- Utility Alignment

Utilities

- T (Telephone, Comm.)
- E (Electric)
- NG (Natural Gas)
- CA (Compressed Air)
- STM (Steam)
- SS (Sanitary Sewer)
- SD (Storm Drain)
- W (Water)
- FS (Fire Supression)
- UU (Undifferentiated Utility)

Surface

- RC (Reinforced Concrete)
- AC (Asphalt)
- C (Concrete)
- Soil
- Gravel
- other

NOTES

Equipment:	Procedure:	Surface Conditions:
GPR (Radar)	EMC (Conduction)	Wet
RD 400	EMI (Induction)	Dry
M Scope	Ambient	other
other	GPR	

REMARKS

N

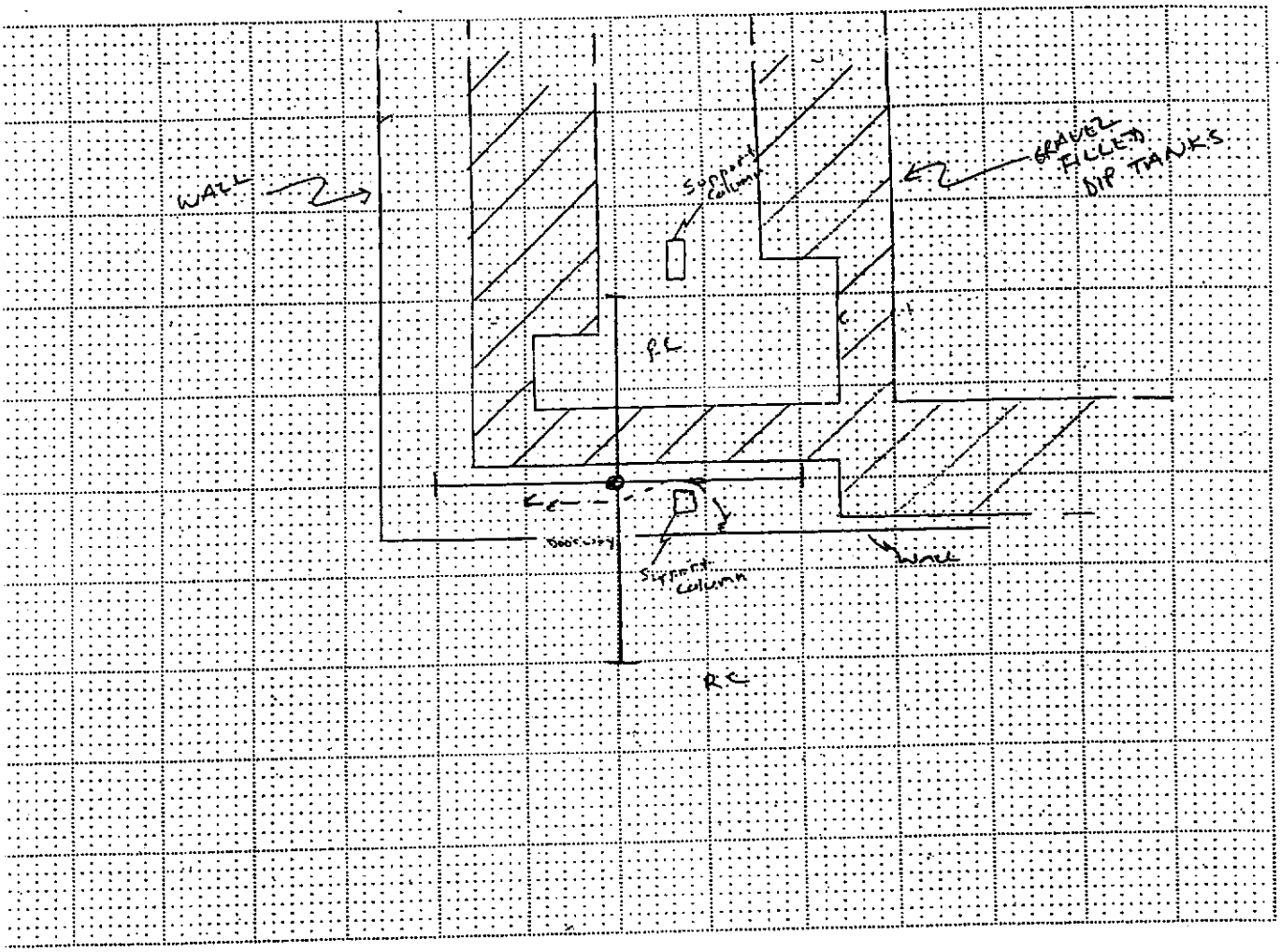
GPR DEPTH OF DETECTION WAS LIMITED TO LESS THAN THREE FEET IN THIS AREA. CAN NOT DETECT STORM DRAIN AND SANITARY SEWER.

DATE: 5/24/99

ORCAL GEOPHYSICAL CONSULTANTS INC. NORCAL

LOCATION: Benecia Arsenal Interior Bld 57A.

BORING: IB057ASB001



Scale: 1" = 10'

EXPLANATION

- ○ Original Boring Location
- ● Final Boring Location
- GPR Traverse
- OR Localized GPR Anomaly
- Utility Alignment

Utilities

- ✓ T (Telephone, Comm.)
- _ E (Electric)
- _ NG (Natural Gas)
- _ CA (Compressed Air)
- _ STM (Steam)
- _ SS (Sanitary Sewer)
- _ SD (Storm Drain)
- _ W (Water)
- _ FS (Fire Supression)
- _ UU (Undifferentioted Utility)

Surface

- ✓ RC (Reinforced Concrete)
- _ AC (Asphalt)
- _ C (Concrete)
- _ Soil
- ✓ Gravel
- _ other

NOTES

Equipment:	Procedure:	Surface Conditions:
✓ GPR (Radar)	_ EMC (Conduction)	_ Wet
_ RD 400	_ EMI (Induction)	✓ Dry
_ M Scope	✓ Ambient	_ other
_ other	✓ GPR	

REMARKS

MAGNETIC INTERFERENCE FROM REBAR IN CONCRETE PRECLUDED USE OF M-SCOPE IN THIS AREA

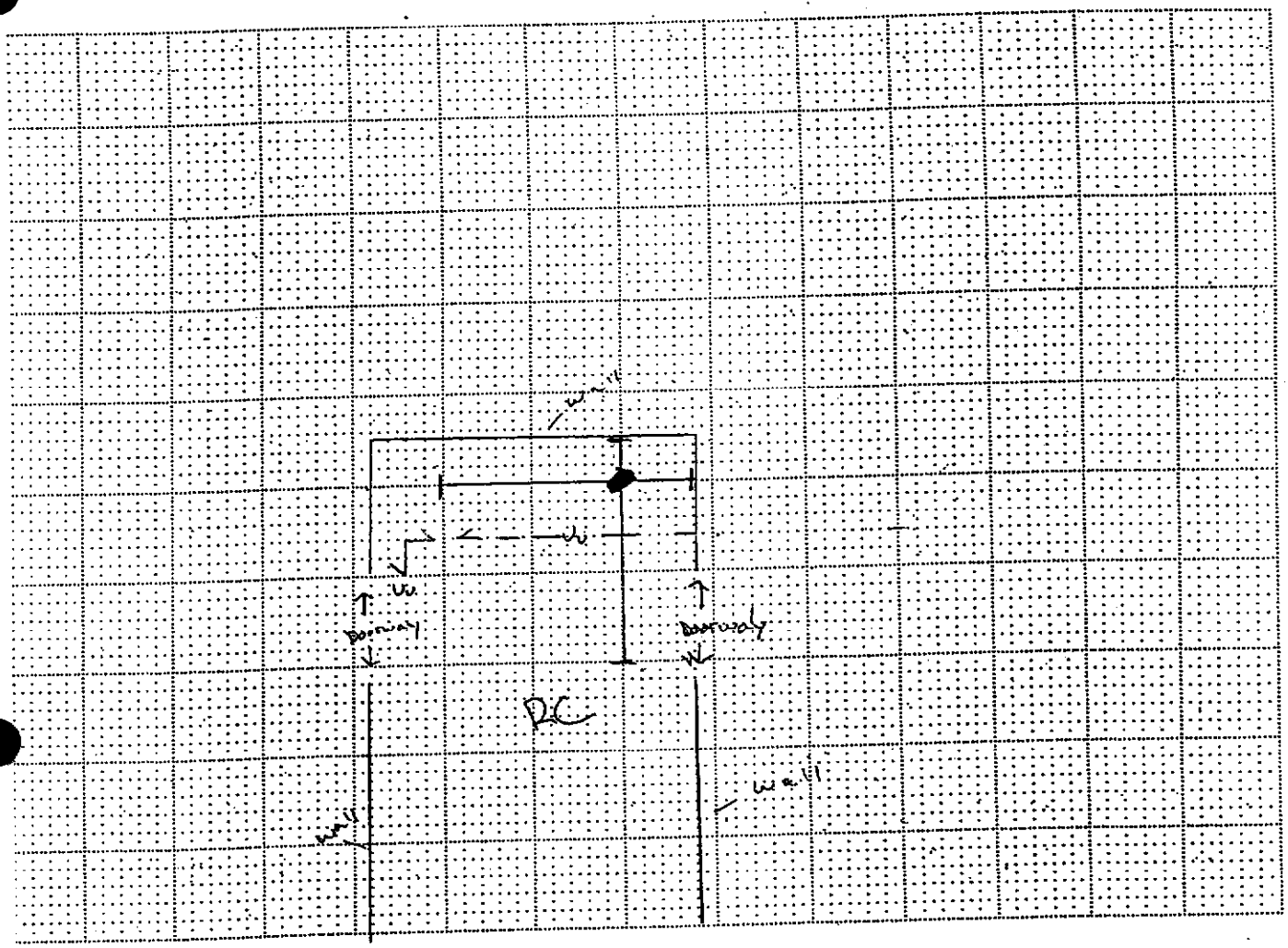
N

DATE: 05/24/99

NORCAL GEOPHYSICAL CONSULTANTS INC.

LOCATION: Benecia Arsenal Bld 65B Interior

BORING: 1D065BHA001



Scale: 1" = 10'

EXPLANATION

- ○ Original Boring Location
- ● Final Boring Location
- GPR Traverse
- Localized GPR Anomaly
- Utility Alignment

Utilities

- T (Telephone, Comm.)
- E (Electric)
- NG (Natural Gas)
- CA (Compressed Air)
- STM (Steam)
- _ SS (Sanitary Sewer)
- _ SD (Storm Drain)
- _ W (Water)
- _ FS (Fire Supression)
- _ UU (Undifferenliated Utility)

Surface

- RC (Reinforced Concrete)
- AC (Asphalt)
- C (Concrete)
- _ Soil
- _ Gravel
- _ other

NOTES

Equipment:
- ✓ GPR (Radar)
- _ RD 400
- _ M Scope
- _ other

Procedure:
- _ EMC (Conduction)
- _ EMI (Induction)
- _ Ambient
- ✓ GPR

Surface Conditions:
- _ Wet
- ~~✓ Dry~~
- _ other

REMARKS

N

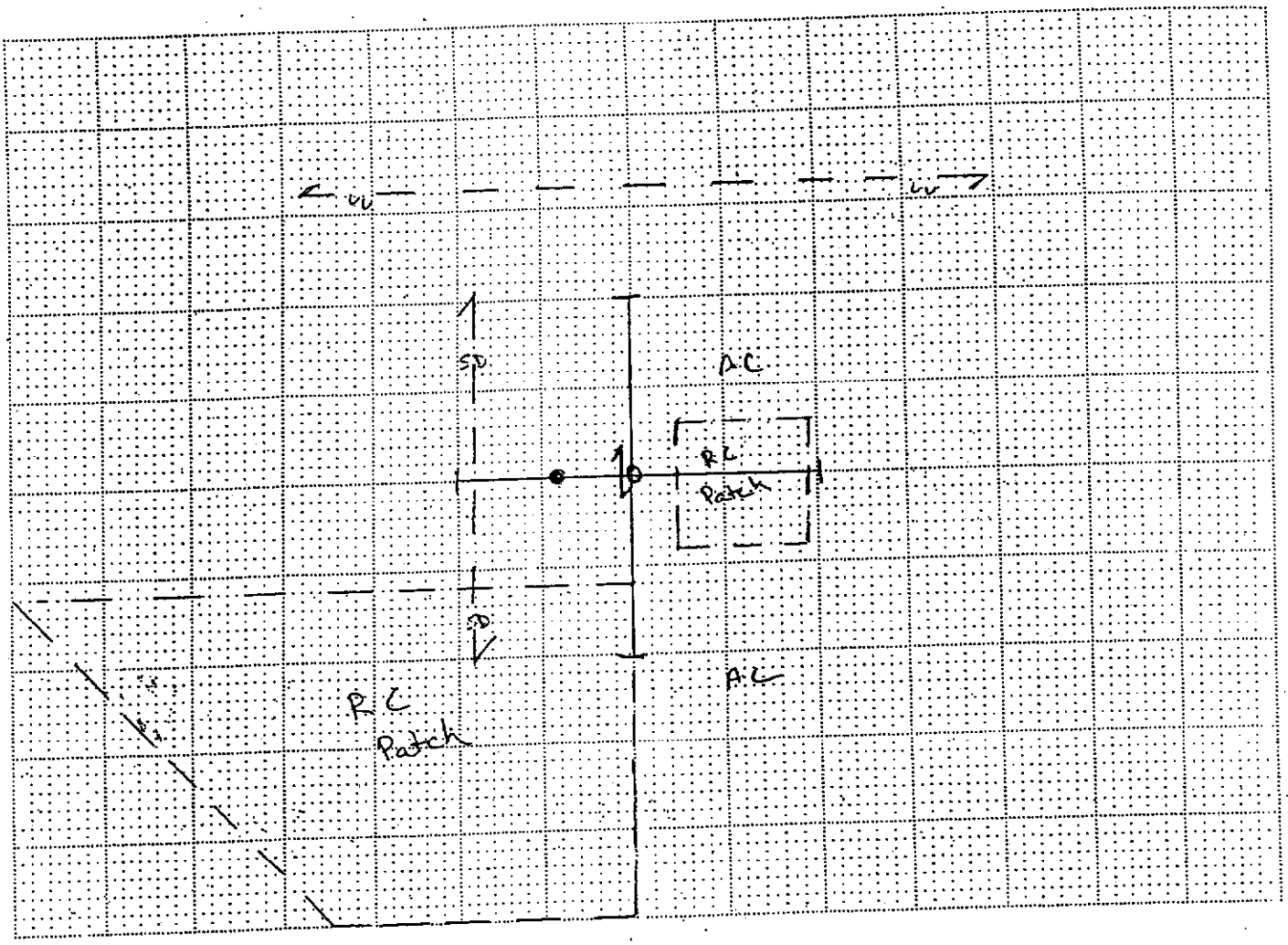
INTERFERENCE FROM REBAR IN CONCRETE PRECLUDED USE OF M-SCOPE IN THIS AREA.

JOB: | DATE: 5/25/99

NORCAL GEOPHYSICAL CONSULTANTS INC.

LOCATION: Benecia Arsenal

BORING: IBO66eASB001



Scale: 1" = 10'

EXPLANATION

- ○ Original Boring Location
- ● Final Boring Location
- GPR Traverse
- □ OR — Localized GPR Anomaly
- Utility Alignment

Utilities

- _ T (Telephone, Comm.)
- _ E (Electric)
- _ NG (Natural Gas)
- _ CA (Compressed Air)
- _ STM (Steam)
- _ SS (Sanitary Sewer)
- ✓ SD (Storm Drain)
- _ W (Water)
- _ FS (Fire Supression)
- ✓ UU (Undifferentiated Utility)

Surface

- ✓ RC (Reinforced Concrete)
- ✓ AC (Asphalt)
- _ C (Concrete)
- _ Soil
- _ Gravel
- _ other

NOTES

Equipment:
- ✓ GPR (Radar)
- _ RD' 400
- ✓ M Scope
- _ other

Procedure:
- _ EMC (Conduction)
- _ EMI (Induction)
- ✓ Ambient
- ✓ GPR

Surface Conditions:
- _ Wet
- ✓ Dry
- _ other

REMARKS

N

GPR DEPTH OF DETECTION WAS LIMITED TO LESS THAN 3' IN THIS AREA CAN NOT DETECT STORM DRAIN AND SANITARY SEWER.