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**Government QA Report**



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**US Army Corps  
of Engineers®**



Quality Assurance Audit Evaluation

On

Tetra-Tech Foster Wheeler

Digital Geophysical Survey Results

For The M1.01 Parcel and M3 Miscellaneous  
Properties, Bravo Area, Fort McClellan, Alabama

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## 1.0 Executive Summary

The U.S. Army Engineering and Support Center at Huntsville (CEHNC) performed a Government Quality Assurance Audit of the Geophysical Investigation Process performed at the M1.01 Parcel and M3 Miscellaneous Properties, Bravo Area, Ft. McClellan, Alabama. This report documents the specific processes used to evaluate the data acquired by the contractor. The Audit concentrated on the following four (4) major Quality Control Elements to verify acceptable contractor performance:

- 1.) Acceptable Geophysical Prove-out Results
- 2.) Successfully passing a Government Review of Digital Geophysical Data
- 3.) Re-mapping Areas by a CEHNC Corps Safety Specialist.

## 2.0 Introduction

The purpose of this Government Quality Assurance Audit is to document the specific processes used and the results attained for a geophysical survey at M1.01 and M3 Miscellaneous Properties, Bravo Area, Ft. McClellan, Alabama. The objective of this geophysical investigation was to geophysically investigate six grids in these areas.

In 2002, this area was cleared of UXO to a depth of 1 foot. This six-grid survey-effort was requested by the Alabama Department of Environmental Management to determine if a 1 foot clearance was an adequate removal effort. This audit evaluates the effort to locate buried UXO for removal and proper disposal, while complying with applicable laws, regulations, and sound technical practices. This audit also evaluates the effectiveness of the Contractor's Quality Control Program and processes. Much of the following discussion has been excerpted from the *Final Letter Report of 2 Jan 05 by Tetra-Tech Foster Wheeler, Inc.*

In consultation with JPA and ADEM, these six grids were chosen to be remapped and anomalies dug without regard to any predetermined depth: D05, D41, E29, G20, G24, and G64. E29 could not be totally surveyed do to standing water so a portion of E50 was surveyed to make up the difference. An EM61 MKII and Constellation Laser Positioning System were used for the survey. Reacquisition was done via two methods: 1) pulling tapes from grid corners and using a Vulcan Laser Positioning System. Both a Cx-52 and Vallon VMX were used for reacquisition.

The EM61 MK2 is a time-domain electromagnetic instrument designed to detect, with high spatial resolution, shallow ferrous and non-ferrous metallic objects. The applicability of the instrument for OE detection has been widely demonstrated at sites across the United States and overseas. The instrument consists of two air-cored coils (1m x 0.5m), batteries, processing electronics, and a digital data recorder (see Figure 1). The lower coil is the source and both coils act as receivers. The coils are 40 cm apart. Secondary currents induced in both coils are measured in millivolts (mV). The MK2 system records multiple time-gates, recording the response in the receiver coil at four points in time after the electromagnetic pulse is generated. The Contractor measured top coil at 666uS, bottom coil at 666uS, bottom coil at 216uS, and bottom coil at 366uS. Earlier time-gates are able to detect smaller metallic sources, but may also demonstrate increased noise and a corresponding tendency to generate "false positive" targets.



**Figure 1. An example of the EM61 MKII with a GPS Receiver.**

### **3.0 Quality Assurance Audit Elements**

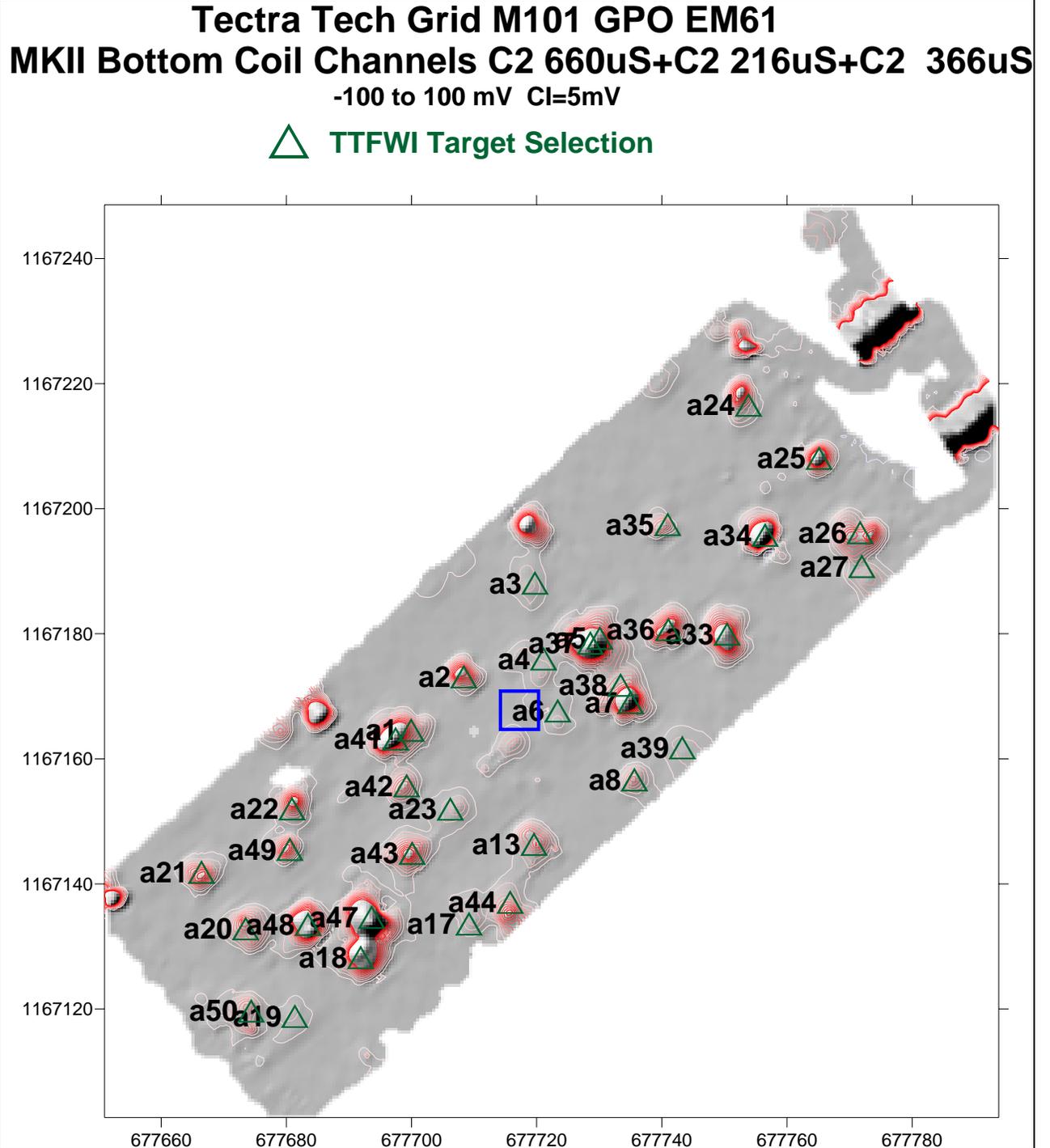
The Government's Geophysical Quality Assurance Inspection Audit provides a document process that effectively monitors the contractor's performance in the areas of;

- a.) Initial data acquisition, processing, and interpretation
- b.) Target anomaly reacquisition and excavation.

The Inspection Audit is a multi-layered approach that verifies whether the contractor's team is performing the UXO Detection and Clearance operations to an acceptable standard. This Audit concentrated on following four (4) major Quality Control Elements to verify acceptable contractor performance:

### **3.1 Geophysical Prove-out Results and Quality Control**

The purpose of the prove-out is to demonstrate the effectiveness of all instrumentation, methods, and personnel prior to the initiation of fieldwork, and to determine the threshold of the smallest seed item, in this case a 37mm.



**Figure 2. Results of the December 2004 GPO survey.**

The Contractor ran the instruments across 70% of the existing GPO grid. Tetra Tech FW, Inc. (TTFWI) satisfactorily performed this geophysical prove-out (GPO) for this project during

December 2004 (see Figure 2). GPO anomaly ID **a6** is a 37mm buried at 16 inches and according to TTFWI, has a peak signature just over 5 mV on one line and a slightly lower peak for the "next over" detection pass. Using the Geosoft program, the contractor chose a 3- to 4-mV above background for the selecting criteria to reassure confidence that all positions of 37mm-like anomalies (and/or larger items) at detectable depths would be cataloged. Below are the geophysical maps of each grid processed via Surfer 8. The Contractor selected every anomaly above the 3mV to 4mV and intrusively investigated all of them.

CEHNC processed the geophysical data for the grids and GPO via Surfer 8. CEHNC added the bottom coil readings to one value and plotted this data in Surfer 8. Note some targets selected by TTFWI cannot be seen in the Surfer 8 maps, most likely due to the way Surfer and Geosoft interprets the data. But these types of targets are very rare.

The Contractor selected every anomaly above the 3mV to 4mV cutoff and intrusively investigated them. No stone was left unturned. Dig results shown on the grid maps are only MEC maps because to label what the items are makes the maps too cluttered. Dig results can be seen in the report ***Final Letter Report of 2 Jan 05 by Tetra-Tech Foster Wheeler, Inc.***

Below are the results of the 6-grid surveys.

**Tectra Tech Grid M101 D05 EM61**  
**MKII Bottom Coil Channel C2 660uS+C2 216uS+C2 366uS**  
-100 to 100 mV CI=5mV

 **TTFWI Target Selection**  
 **Grid Boundary**

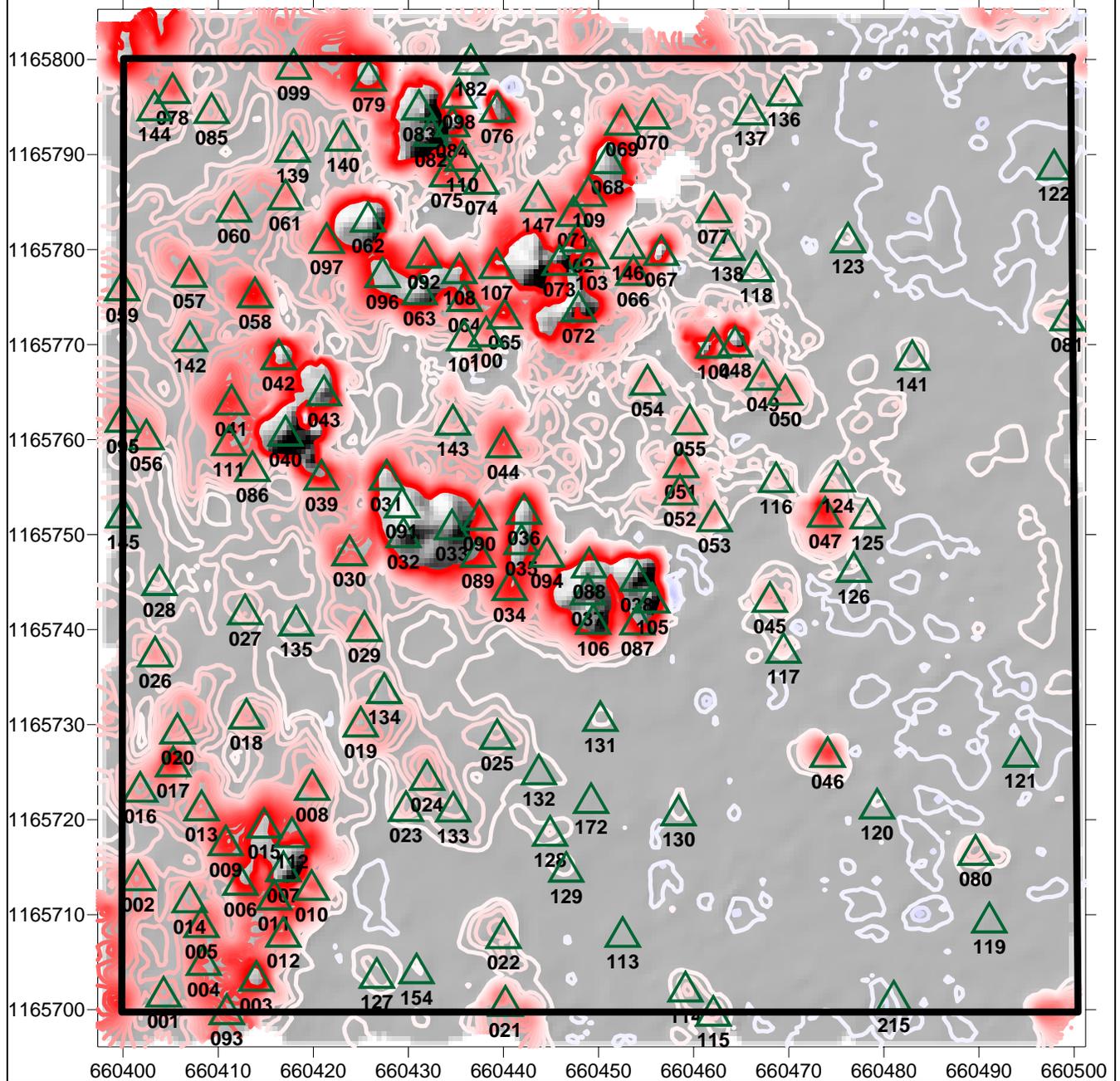


Figure 3. Grid D05.

**Tectra Tech Grid M101 G64 EM61**  
**MKII Bottom Coil Channel C2 660uS+C2 216uS+C2 366uS**  
 -50 to 50 mV CI=2mV First Contour +/- 4mV

△ TTFWI Target Selections

— Grid Boundary

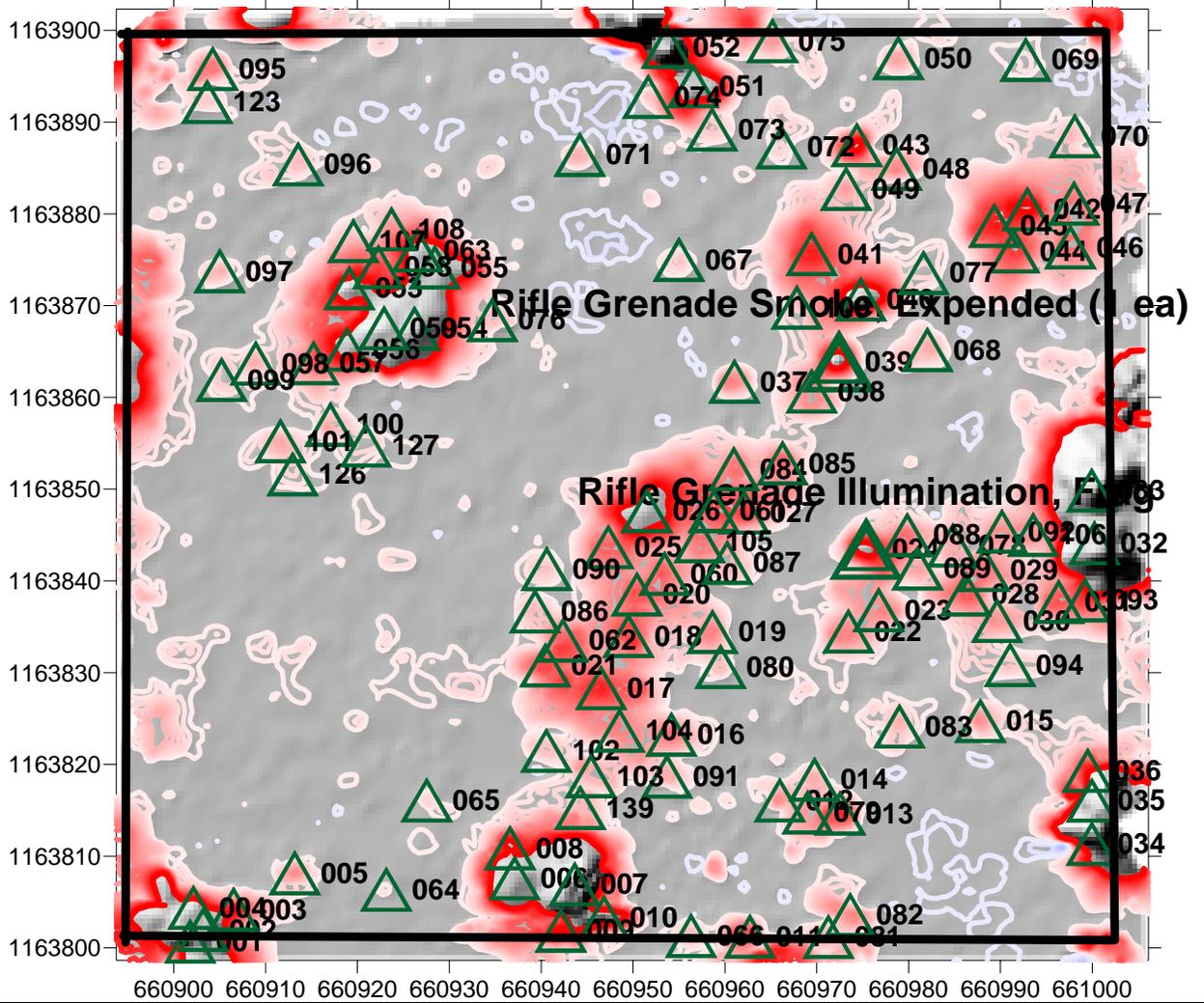


Figure 4. Grid G64.

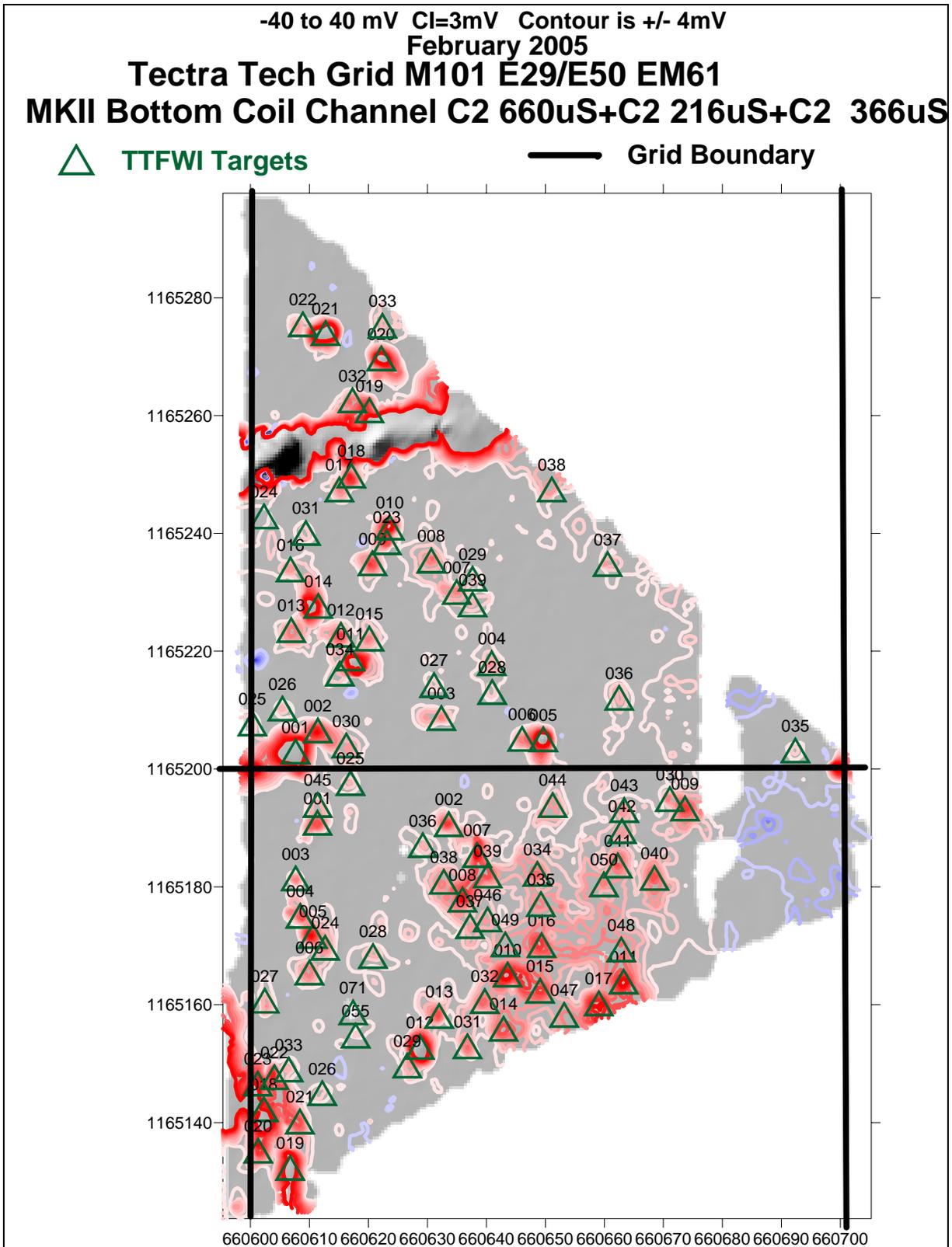


Figure 5. Grid E29/E50

-40 to 40 mV CI=2mV First Contour is +/- 4mV  
 February 2005  
**Tetra Tech Grid M101 D41 EM61**  
**MKII Bottom Coil Channels C2 660uS+C2 216uS+C2 366uS**

TTFWI Targets                  Grid Boundary

**Black Numerals are the depths of Item found in Inches.**

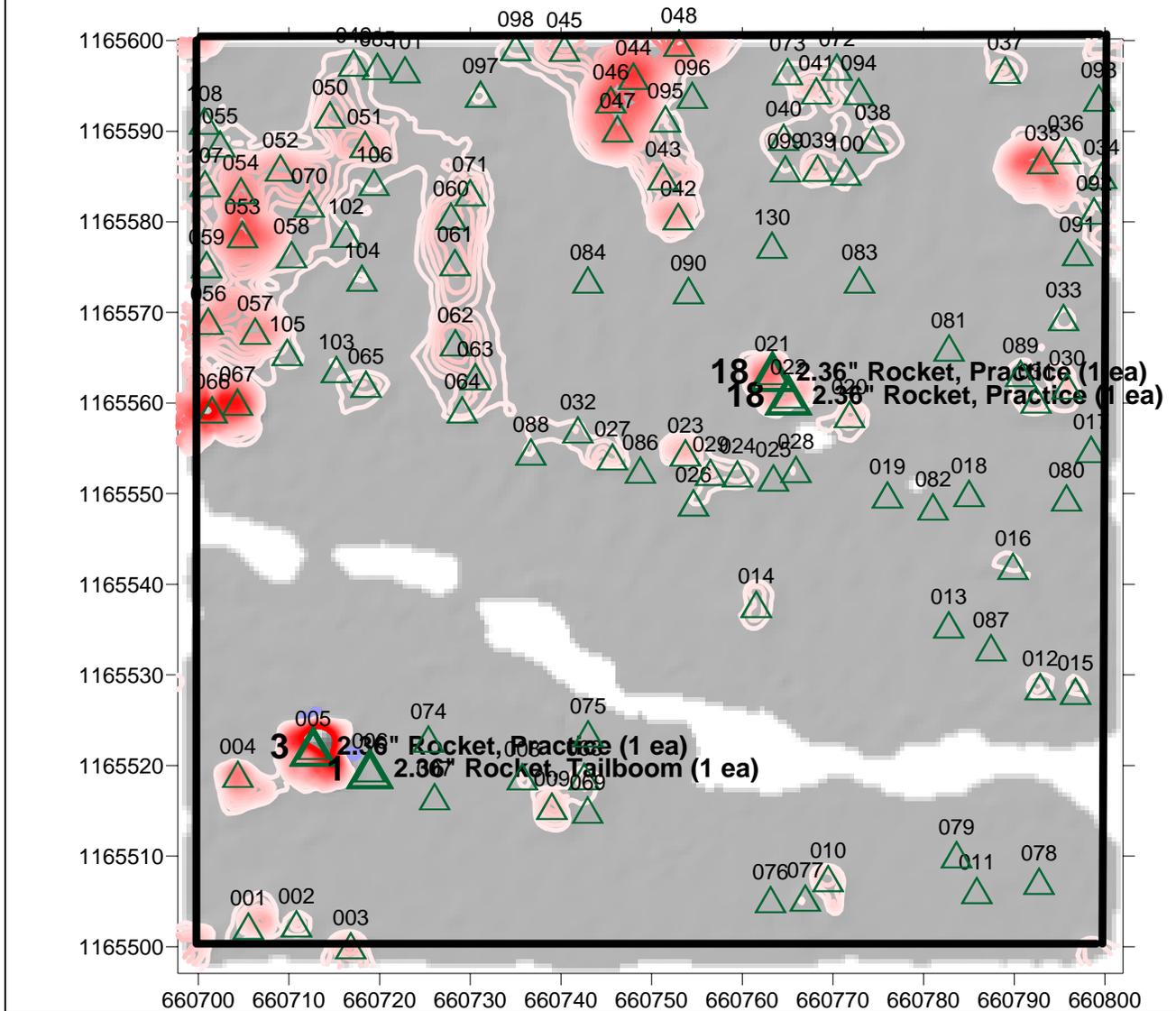


Figure 6. Grid D41.

**Tetra Tech Grid M101 G24 EM61**  
**MKII Bottom Coil Channel C2 660uS+C2 216uS+C2 30**  
-20 to 20 mV CI=5mV First Contour +/-4mV

△ TTFWI Target Selections

— Grid Boundary

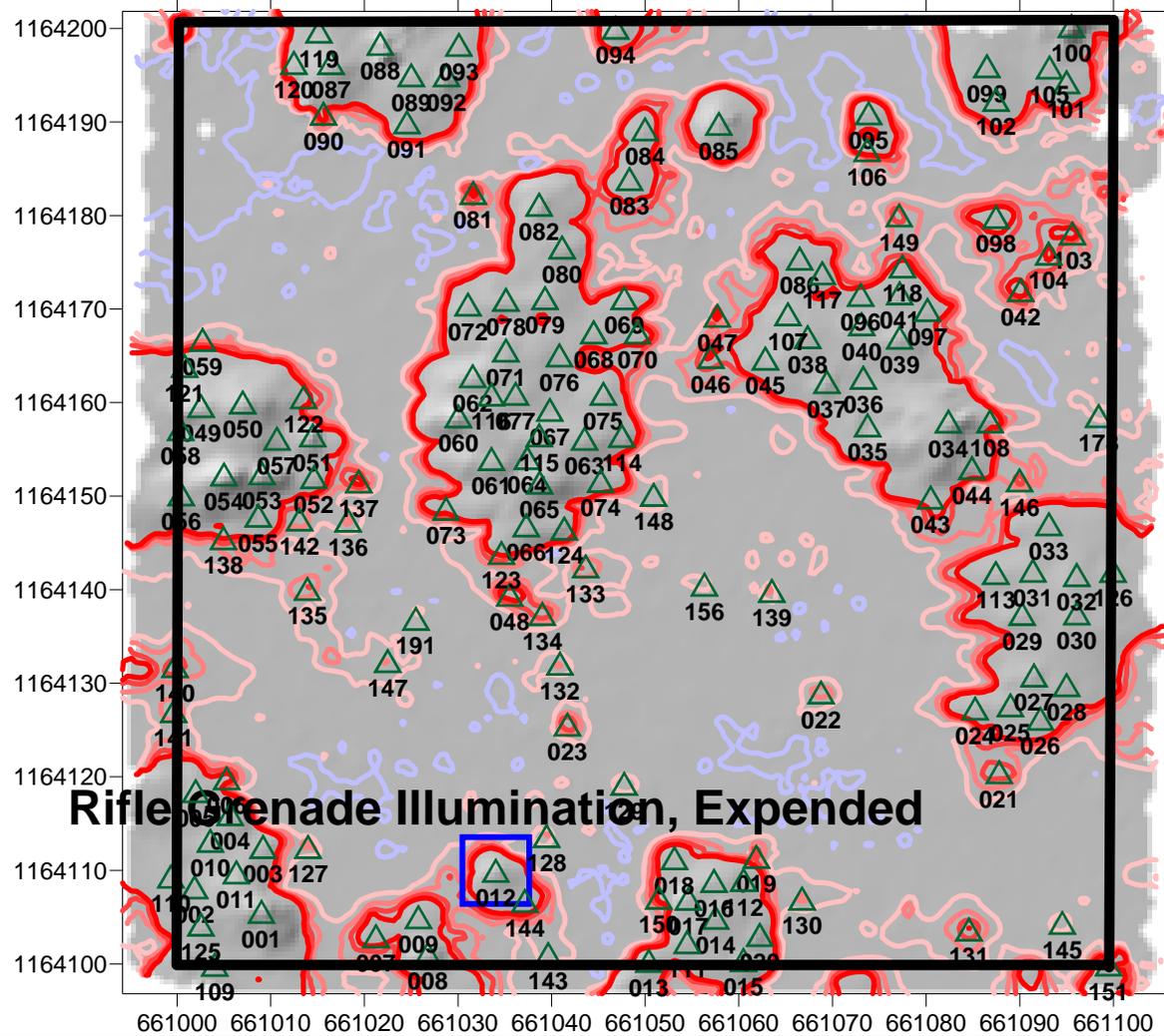


Figure 7. Grid G24

**Tectra Tech Grid M101 G20 EM61  
MKII Bottom Coil Channel C2 660uS+C2 216uS+C2 366uS**

- △ TTFWI Target Selection -50 to 50 mV CI=2mV First Counter +/-4mV
- + TTFWI Target Selection/Zapata GPO Items....all simulants or Rebar
- Location of Zapata's GPO Items Grid Bountry Boundary

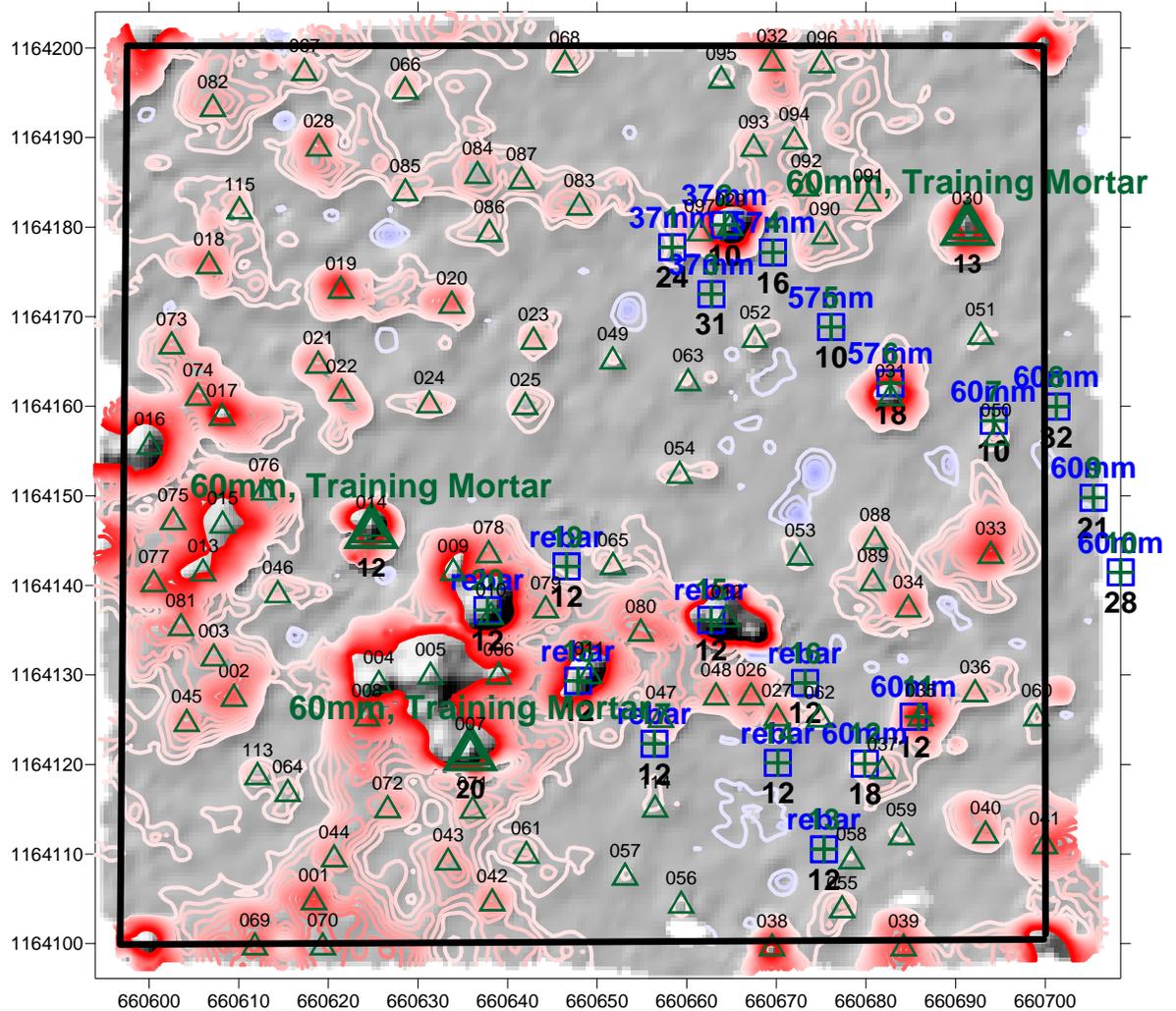


Figure 8. Grid G20. . The anomalies designated with a  are the simulant seed-items and rebar for a GPO done in 2000. All were recovered.

To establish confidence in the data reliability, the Contractor randomly selected lanes in each grid and geophysically surveyed these lanes. The

Contractor then intrusively investigated anomalies along these lanes. Figure 9 shows the QC survey for grid G64 and the items unearthed. See *Final Letter Report of 2 Jan 05 by Tetra-Tech Foster Wheeler, Inc* for other grids.

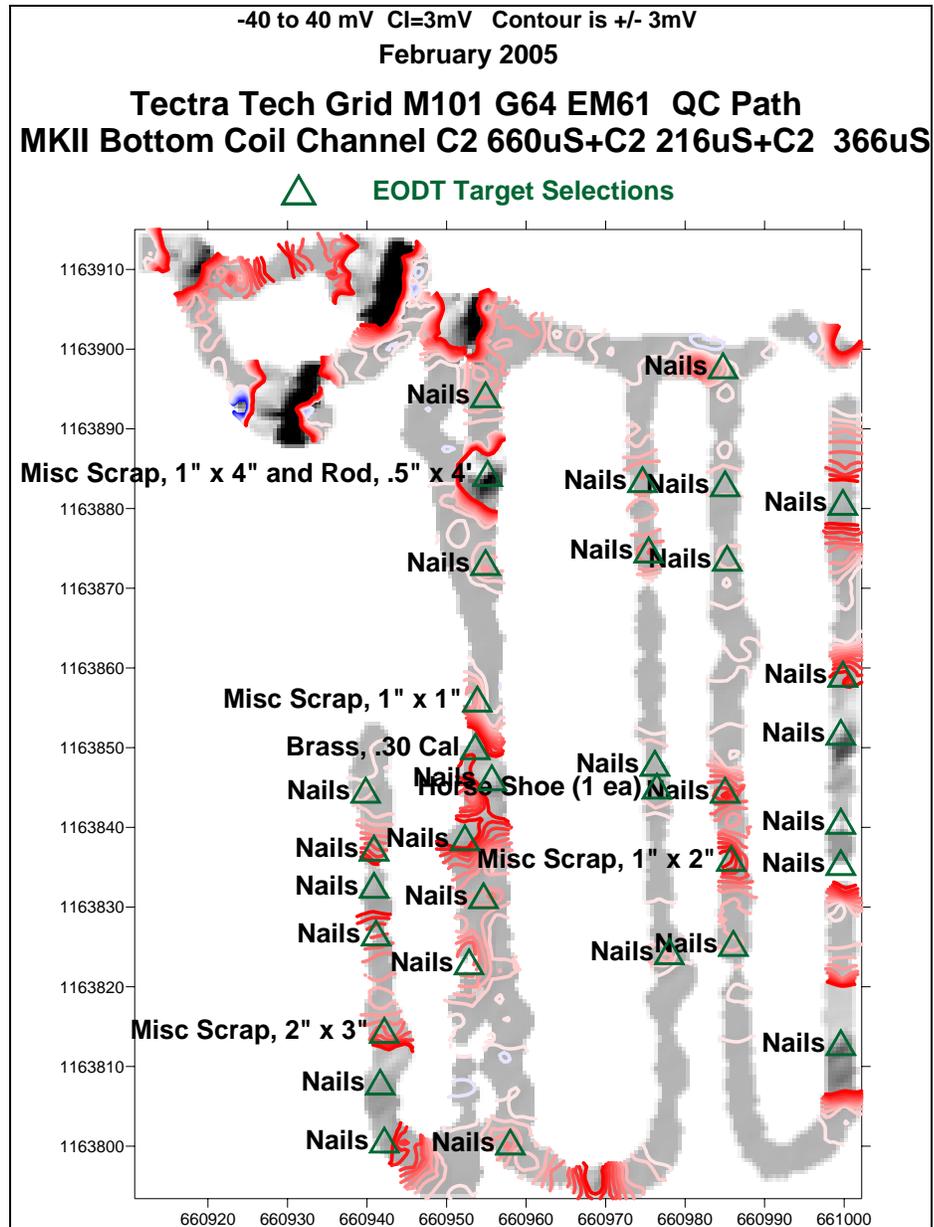


Figure 9. Dig Results of the QC phase of Grid G64.

### **3.2 Government Review of Digital Geophysical Data**

The geophysical data was review by CEHNC after the field work was complete. The purpose of the review was to determine if too many targets were investigated or too few selected. Once again, some targets selected by TTFWI cannot be seen in the Surfer 8 maps, most likely due to the way Surfer and Geosoft interprets the data. But these types of targets are very rare. CEHNC has no additional target selections.

Digital data was checked for location accuracy, lag corrections, leveling corrections, proper filtering and thresholding. To assure the EM61 was in working order, the Contractor ran static QC checks daily, one in the morning prior to surveying and one in the evening after surveying.

### **3.3 Re-mapping select grids by CEHNC Safety-Specialist.**

The CEHNC Safety person swept all the grids with a handheld magnetometer and all passed QA(see Figure 10).

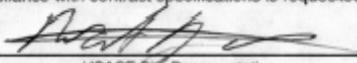
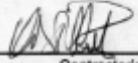
U.S. ARMY ENGINEERING AND SUPPORT CENTER, HUNTSVILLE ORDNANCE AND EXPLOSIVE GROUP MEMO		
TO: TETRA TECH F.W.	DATE: 1/13/04	TIME: 1130
CONTRACT NUMBER: DACA-87-99-0-0010	PROJECT LOCATION: FT Mc CLELLAN	
DO #: 0001	ANNISTON, AL	
SUBJECT ITEM(S)		(Check all that apply):
<input type="checkbox"/> Work Plan	<input checked="" type="checkbox"/> Quality Control	
<input type="checkbox"/> Safety Violation	<input type="checkbox"/> Other	PROJECT 948#2
<input type="checkbox"/> Safety Comments		
DESCRIPTION: GRIDS D05 D41 E29 G20 G24 AND G64 IN THE M101 AREA PASSED GOVERNMENT QA		
<input type="checkbox"/> Prompt correction or compliance with contract specifications is requested.		
		 USACE Site Representative
RECEIPT ACKNOWLEDGED: 		Contractor's Representative
ACTION TAKEN:		
CEHNC FORM 948 (Revised) 1 APR 96		
COPY 1 - Contractor's Representative		

Figure 10. Results of the CEHNC quality assurance.

#### 4.0 Quality Assurance Audit Summary and Recommendations

The government reprocessed the GPO data and performed an analysis of the threshold and target selections made by the contractor. The target selection criteria used by the contractor for these grids are deemed appropriate based on the response to the expected MEC items in the GPO plot. Further, many of the recovered non-MEC items (such as the piles of nails) had geophysical responses greater than those of the items of concern in the GPO plot. Therefore, the target selection criteria cannot be raised to eliminate these non-MEC items without risking leaving MEC items behind.

The contractor was successful in meeting all of the Quality Assurance elements. The Contractor's EM61 raw and processed data and data interpretations are recognized to be of a high quality in a challenging geologic environment. The Contractor has the tools and procedures in place to find the target objectives identified for this project.

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