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Quality Assurance Audit Evaluation

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Quality Assurance Audit Evaluation

On

Tetra Tech FW, Inc.

Digital Geophysical Survey Results

For The Ft. McClellan FWS Area

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USAESCH-ED-CS-G

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Report updated by R. J. Selfridge, USAESCH Chief Geophysicist, to incorporate additional information provided by TTeC on 15 February 2007.

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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 on the UXO Geophysical Investigation Process performed at the Fish and Wildlife Service (FWS) Area, former Ft. McClellan, Anniston, Alabama. This report documents the specific processes used to evaluate whether the product delivered to the government by the contractor met the project Geophysical Data Quality Objectives. The Audit concentrated on the following five (5) major Quality Control Elements to verify acceptable contractor performance:

1.) Acceptable Geophysical Prove-out Results

2.) Government Field Oversight Inspection of Data Acquisition Operations

3.) Successfully passing a Government Review of Digital Geophysical Data

4.) Comparison of Excavation Results with Geophysical Data Results

5.) Re-mapping Areas by a CEHNC Safety Specialist

The contractor's digital geophysical mapping (DGM) data was recognized to be of high quality in a challenging geologic environment except in areas of steep terrain. However, the contractor demonstrated a need to dramatically improve and increase the number of qualitative and especially quantitative quality control (QC) measures to avoid the multiple Quality Assurance (QA) failures that occurred in the "mag and flag" portions of the project.

2.0 Introduction

The purpose of this Government Quality Assurance Audit is to document the specific processes used and the results attained for the former Ft. McClellan, Alabama FWS Area Geophysical Investigation. The general objective of the geophysical investigations is to efficiently locate buried UXO for removal and proper disposal while complying with applicable laws, regulations, and sound technical practices. This audit evaluates the effectiveness of the Contractor's Quality Control Program, processes, and compliance of work-by-others.

3.0 Quality Assurance Audit Elements

The Government Geophysical Quality Assurance Inspection Audit provides a process that can effectively monitor and document 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. Any failure resulting from this audit by the contractor will result in a detailed review of the affected Data Quality Control Elements followed by remediation of the identified failures by the contractor. This Audit concentrates on five (5) major Quality Control Elements to verify acceptable contractor performance.

3.1 Geophysical Prove-Out Results

Tetra Tech FW, Inc. (TTFWI) satisfactorily performed a geophysical prove-out (GPO) for this project during March 2004. Details are included in the final report "***Geophysical Prove-Out Letter Report, Fort McClellan, Alabama, March 2004".*** Two TTFWI teams utilized the Geophysical Prove Out grid during project execution to maintain efficiency and performance levels as well as to continually test new innovative technologies that may be applicable to the Ft. McClellan clean up effort. The GPO Letter Report was verbally approved for Tetra Tech by CEHNC Project Manager Dan Copeland and Chief Geophysicist Bob Selfridge. The following image (Figure 1) of the GPO data is one example that was excerpted from the letter report.

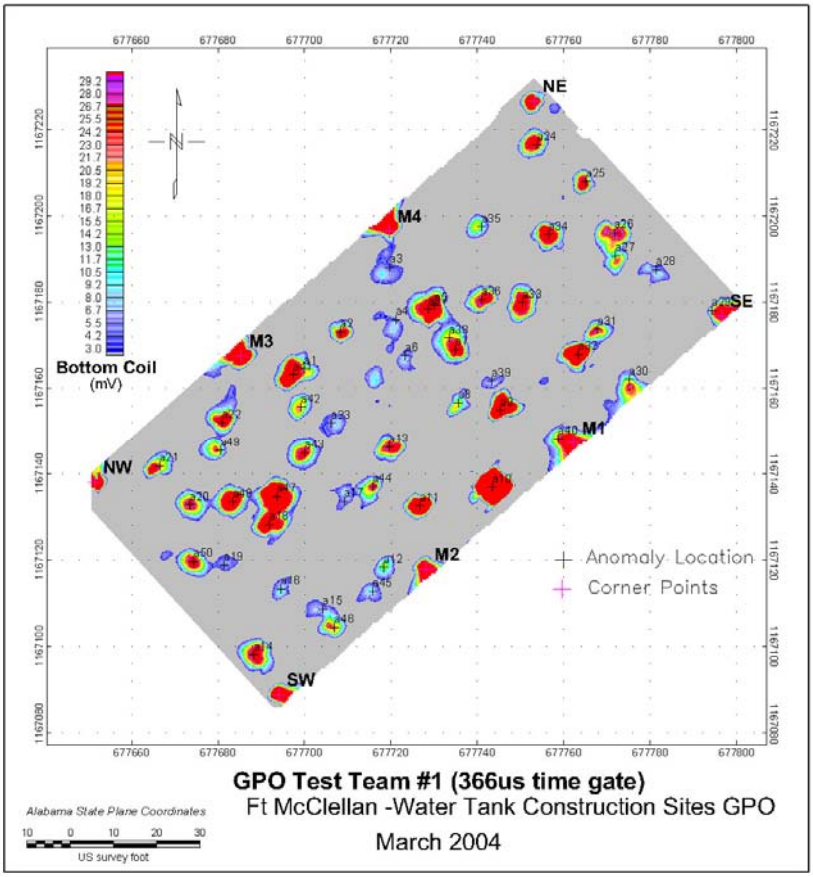

Figure 1. GPO results.

The purpose of the GPO is to demonstrate the effectiveness of all instrumentation, methods, and personnel prior to the initiation of production fieldwork. The GPO included a background survey to determine the baseline response of the area of investigation and allow anomaly avoidance practices to be implemented. The second phase of the geophysical prove-out occurred after the seed items were emplaced.

The digital geophysical detector used for McClellan is the Geonics EM61 MK2. The contractor used 5 EM61 MK2 in a towed-array configuration using an ATV (see Fig 2 and 3 below).

Figure 2. The EM61 Towed Array

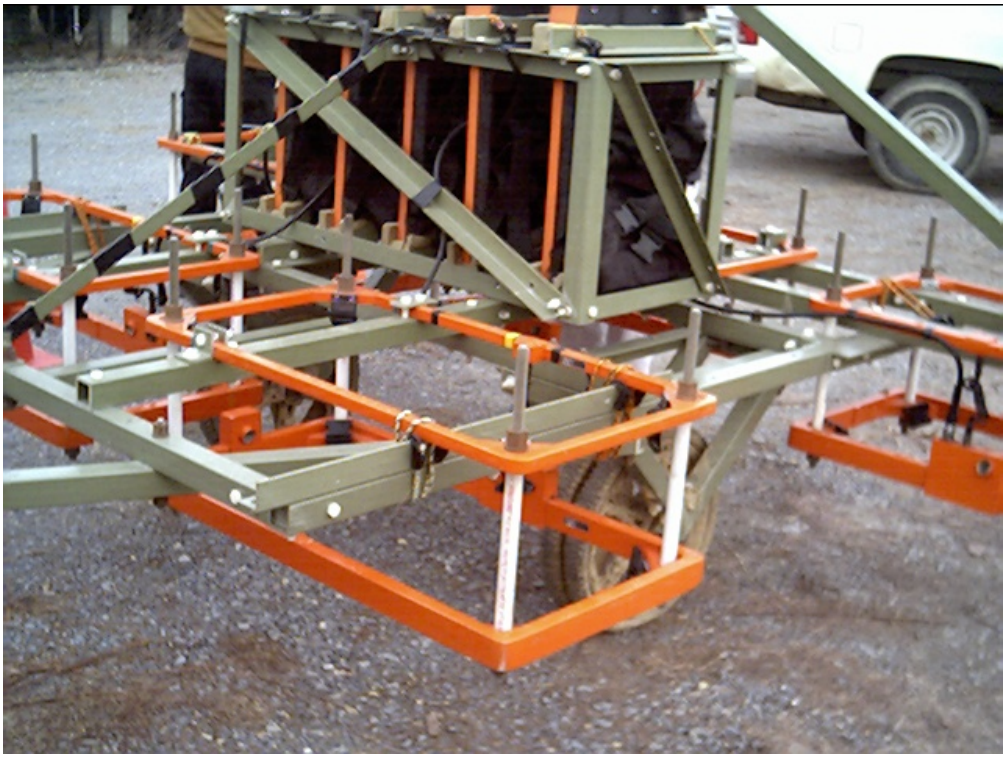

Figure 3. The EM61 Towed Array

The EM61-MK2 metal detector generates an electromagnetic pulse that triggers eddy currents in the subsurface. After the electromagnetic pulse is turned off, the eddy current produces a secondary magnetic field that is monitored by a receiving coil and recorded by an attached data logger. The EM61-MK2 can be operated as single coil, or a double coil antenna system that receives the signal at two separate heights above the ground surface. The lower and upper coils are separated by a distance of 40 centimeters. The EM61 data logger collects data at automatic time intervals determined by the user or at a pre-programmed distance interval measured by an attached set of wheels with all terrain tires.

In the open range areas, the contractor used a Lieca DGPS or a Lieca Robotic Total Station (RTS) unit for precise detector positioning. Along the trails, firebreaks, and roads, the contractor utilized metallic nails or chains as easily identifiable fiducial points at distances no greater than 200 feet apart. If there was a turn in the road resulting in a loss of line-of-sight, the contractor made a fiducial point (control point) and placed a nail. This allowed the contractor to find a known point as the signatures are easily seen in the data. At every 4th or 5th fiducial, the contractor placed a full length chain (control point) to further help the contractor understand where, along the trails, anomalies could be re-acquired by measuring from a control point. The operator of the towed array would make a fiducial data-mark at every control point.

The objective of the survey was to use the EM61 MK2 to map all trails, roads, and firebreaks in addition to several ranges. The towed array was used to survey these byways to a width of 15 feet on either side of the byways. The survey clearance of unimproved roads and paved roads was a 40-foot width. The

contractor stated that due to physical factors such as steep slopes and rough terrain, some areas were cleared with a UXO team performing mag and flag operations because of unacceptable noise caused by the rough terrain in the EM61 data.

3.2 Government Field Oversight of Data Acquisition Operations

Representatives from the Huntsville Corps of Engineers monitored field work performed by the contractor and as a result of observations, aided in the seeding of inert items to test potential weaknesses in the Geophysical Prove-Out operation. A partial listing of the items monitored by CEHNC representatives included:

Safety

-Use buddy system
-Pre-sweep area for surface ordnance
-No stakes w/o safety inspection
-Obey exclusion and decontamination zone boundaries
-Wear boots with fiberglass rather than steel toe/shank protection

EM

-Secure cable leads
-Sweep operator and assistant to be" metal free"
-Check battery levels
-Check cable and connector integrity
-Warm up sensors prior to recording
-Conduct stationary noise level test daily
-record amplitude response with uniform test object daily
-Maintain consistent ground clearance and coupling while surveying

Survey grid
-Purpose: main survey grids to be cleared of target UXO
-Locate grid corners with land survey
-Measure corner positions with whatever digital data positioning system is being used
-Maintain logical and consistent file naming conventions
-Document naming convention and data structures in field log book
-Document instrument changes including operator and battery changes in field log

3.3 Government Review of Digital Geophysical Data

Geophysical data was transmitted on an approximately weekly basis from TTFWI to USAESCH for review. Random selections of grids (see examples in Figures 4 and 5

below) were reprocessed by government QA personnel and dig lists made and compared to TTFWI dig lists. Dig lists produced by the government data processors and contractor processors for the DGM portions of the project are comparable. (see Figures 4 and 5).

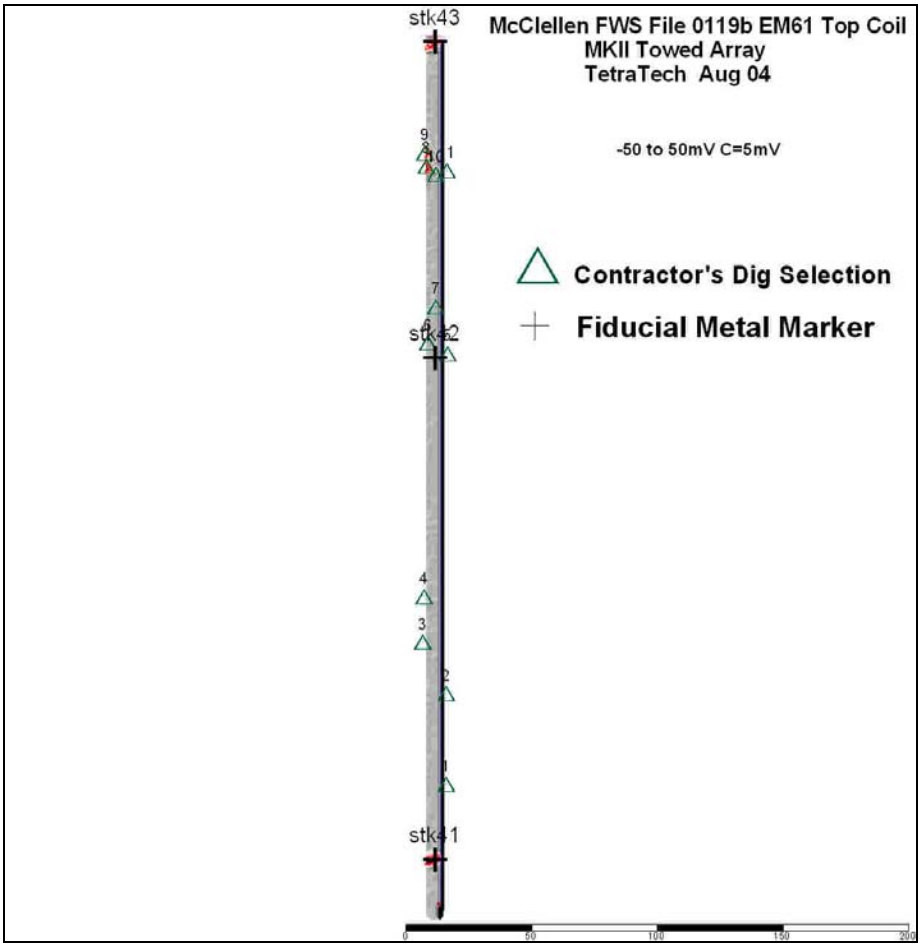

Figure 4. File 0119b.

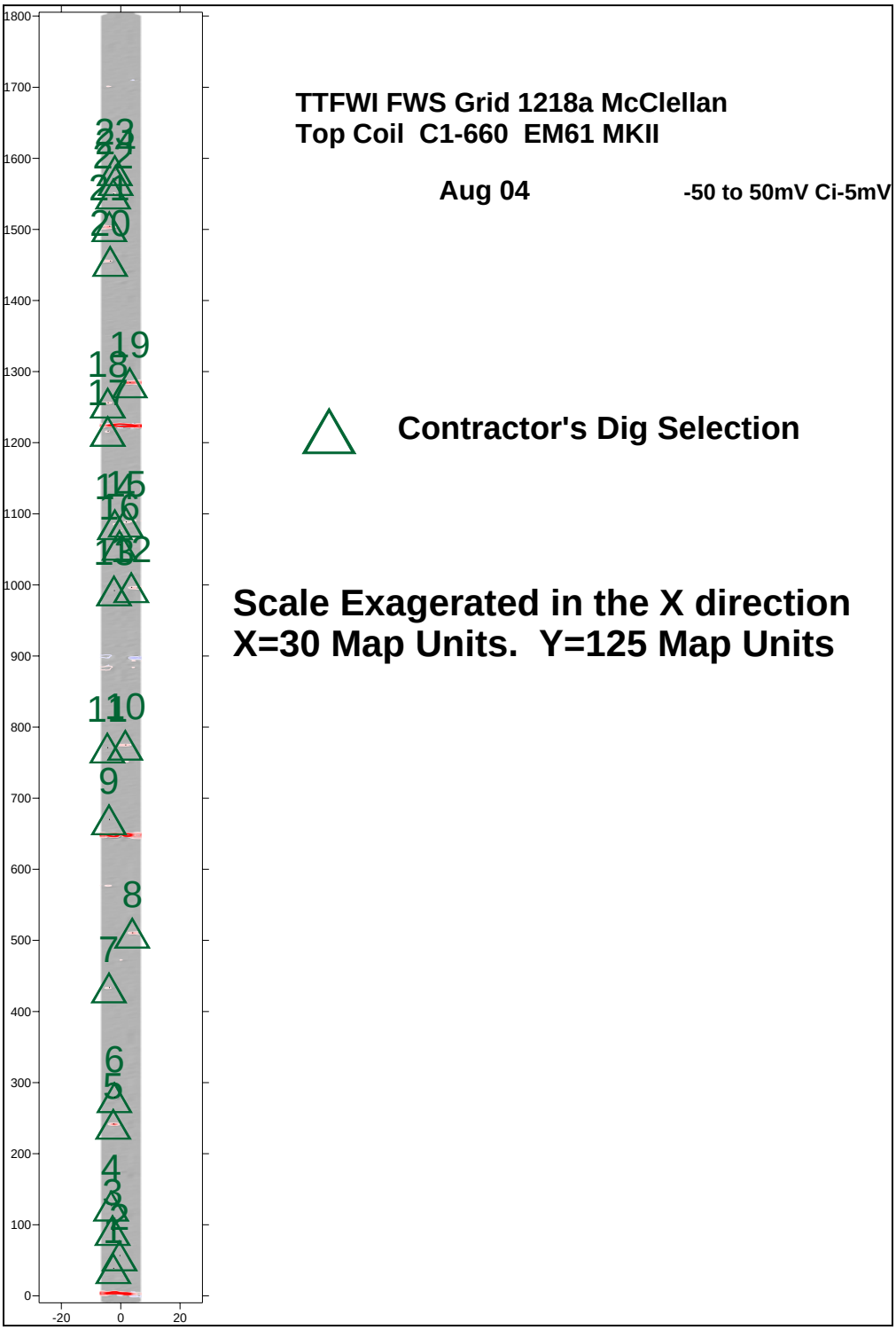

Figure 5. File 1218a.

3.4 Comparison of Excavation Results with Geophysical Data Results

The recovered targets from the dig results identified by the DGM grid and transect anomalies were compared to the geophysical response by the Contractor utilizing a database to track and identify potential problems. Several (Government QA reviewed 142 instances) potential targets were re-examined and re-visited by the contractor to ensure all potential ordnance items were excavated. The causes of these anomalies ranged from a 6" spike marking the corner of a previous survey area to ruts in the road surface, metal sign posts, coil strikes with the side of the road, and coils bumping into trees during original data collection. The contractor re-acquired these areas and verified the cause of the anomaly (non-ordnance) or that no anomaly was still present.

3.5 Re-mapping Area's by CEHNC Safety Specialist

The criterion for accepting grids that have completed surface and subsurface clearance for this project was: "No ferrous objects with a "width" (diameter) between a 37 mm projectile and an 81mm mortar, at a depth of less than 11 diameters of the object."

USAESCH Safety personnel performed QA checks using a Schonstedt 52-Cx on approximately 20 to 25 percent of the area surveyed. On areas with low concentrations of anomalies, the Safety person checked an averaged of 10% but increased that to approximately 40% in areas with higher concentrations. Within the FWS area, QA checks were performed randomly. The Safety person swept not only the geophysically surveyed-segments but also swept 15 feet to the right and left of the segments. The following areas failed this QA check:

Segment 101 **failed** a Government QA Inspection when an expended 75mm shrapnel projectile was found at a depth of 10 inches & parallel to the surface. (see Figure 6). It was 102 feet from fiducial point 461, & 76 feet from fiducial/control point 6030 (measured down center of road). It was 11.5 feet off right side of trail between these 2 points (461 to 6030) (see Figure 6)

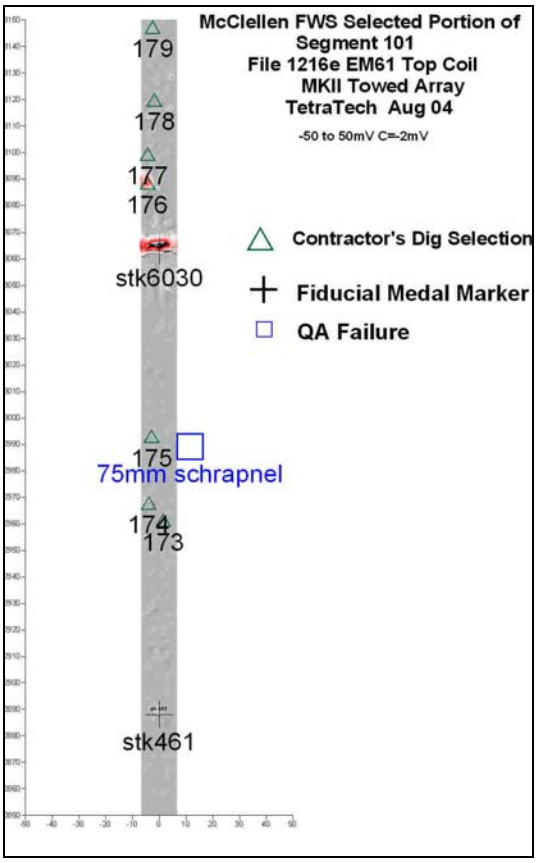

Figure 6. Segment 101 showing location of 75mm shrapnel that resulted in segment failure.

Segment 164 **Failed** Government QA when a 75mm expended shrapnel projectile was found at a depth of 6" , 71'6" from fiducial point 816 and 11'11" left from the center of road. (see figure 7).

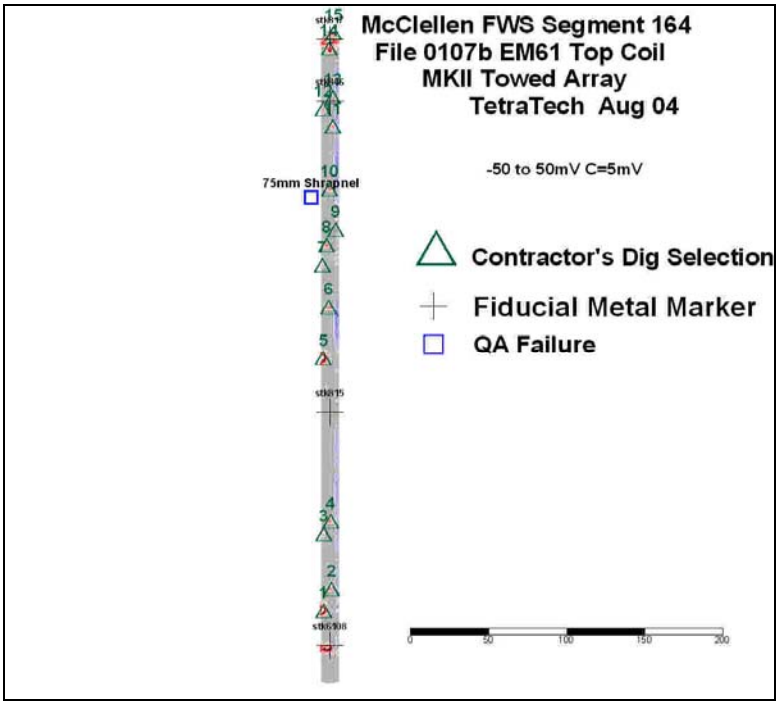

Figure 7. Segment 164 showing location of 75mm shrapnel that resulted in segment failure.

Range 24A **Failed** Government QA when 3 items were found. 1).steel aproximately3"x5"x3" deep, 2) steel object approximately 3"x8"x4" deep, and 3) steel cable approximately 48"x 1 1/2" (Major Dia.)x2" deep. According to the CEHNC Safety Specialist, he did not us a GPS system and he had nothing to tie the location to with tapes, so there is no way to determine which anomalies may relate to these items.

Segment 085 **Failed** Government QA when multiple surface anomalies were found. Items range in size from 3"x3"x6" to 3"x3" steel. Target location is approximately 20' south of stake 398 and 13-15 feet from center of road. (see Figure 8)

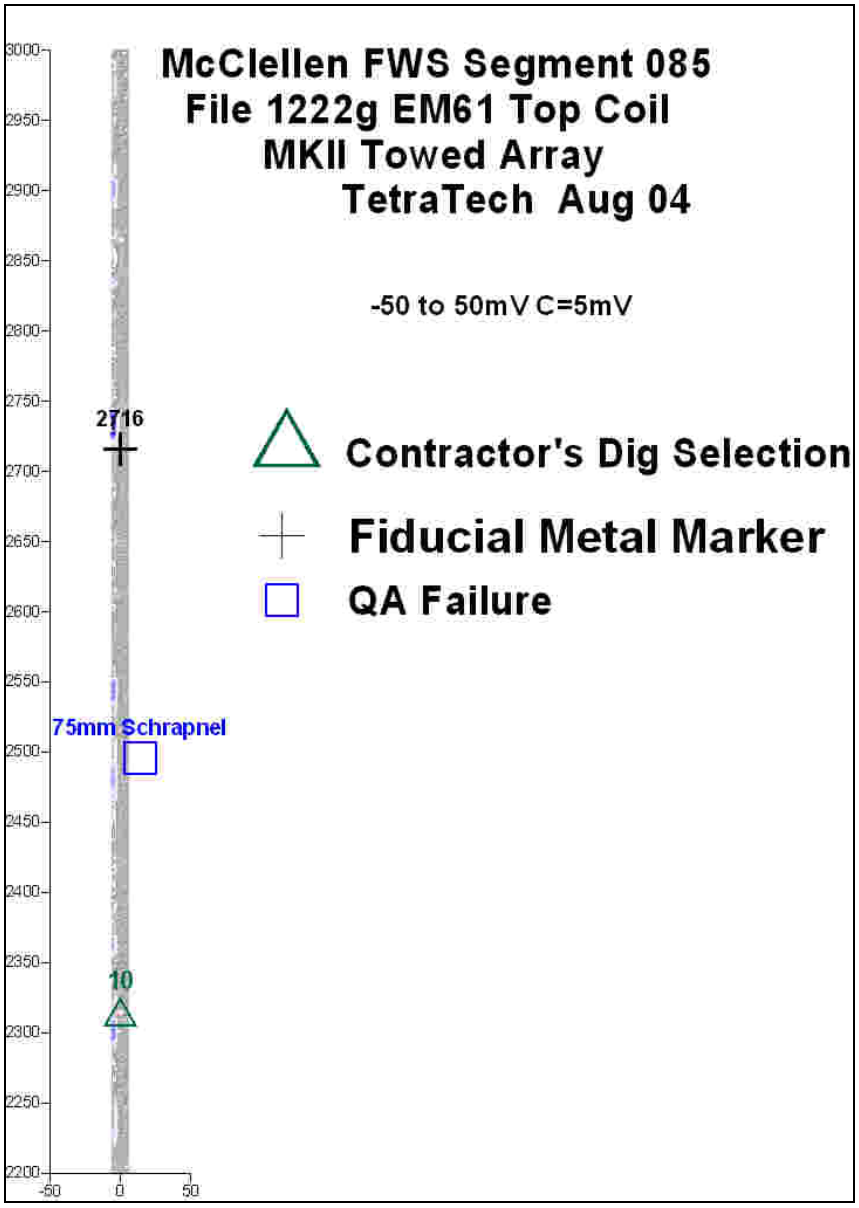

Figure 8. Segment 085 showing location of 75mm shrapnel that resulted in segment failure.

Segment 056. 100-foot boundary surface sweep **Failed** Government QA when an 81mm was found on the surface just 25' from the road. (see below discussion and Investigation Report for Segments 55, 56, 62, and 63, Fort McClellan AL, Section 3.1.1:on file)

The Contractor encountered problems in mapping segments 57-59. Upon review of the digital data, the contractor states that instrument noise caused by the rough terrain and ruts in segments 57-59 made the digital geophysical data unacceptable for use in confidently locating all of the target objectives. The contractor elected to proceed with utilizing a "mag and dig" approach for all of these sectors. According to the Contractor, the VTA (vehicle towed array) team mapped segments 55-59 in one pass. Because the mapping file was for segments 55-59, the entire group was reassigned to mag and dig.

Some MEC items found in segments 55, 56, 62, and 63 are reported to have been moved to the side of the road (segments) by the Contractor. In response to section A.1. of the Emergency Administrative Order No. 04-086-EHW (the "Order") issued by the Alabama Department of Environmental Management (ADEM) on July 30, 2004, the Contractor re-surveyed the 4 segments and prepared a report (see Investigation Report for Segments 55, 56, 62, and 63, Fort McClellan AL: on File). The report documents activities conducted to reinvestigate segments 55, 56, 62 and 63 in accordance with investigation plans submitted to and approved by ADEM.

Following the initial investigation of these four segments, the Contractor determined that only segments 56 and 63 were involved in items being removed and moved to the side. The following items were subsequently found near segments 56 and 63:

Anomaly ID	**Database ID Number**	**ITEM**	**Distance from Cleared Area**
56-1	0000-01	81mm Practice Mortar, Not Fuzed	28'
56-3	0000-03	81mm Practice Mortar, Not Fuzed	38'5"
56-4	0000-04	81mm Practice Mortar, Not Fuzed	37'5"
56-5	0000-05	81mm Practice Mortar, Not Fuzed	30'9"
56-6	0000-06	81mm Practice Mortar, Not Fuzed	37'5"
56-7	0000-07	81mm Practice Mortar, Not Fuzed	33'
56-8	0000-08	81mm Practice Mortar, Not Fuzed	47'7"
56-9	0000-09	81mm Practice Mortar, Not Fuzed	47'7"
56-10	0000-10	81mm Practice Mortar, Not Fuzed	34'
56-11	0000-11	81mm Practice Mortar, Fuzed	22'8"
56-12	0000-12	81mm Practice Mortar, Not Fuzed	13'
56-13	0000-13	81mm Practice Mortar, Not Fuzed	30'9"
56-14	0000-14	81mm Practice Mortar, Fuzed	21'5"
56-15	0000-15	81mm Practice Mortar, Fuzed	28'8"
56-17	0000-17	81mm Practice Mortar, Not Fuzed	10'
56-22	0000-22	81mm Mortar, Fuzed	18'5"
56-24	0000-24	81mm Mortar, Partial Fuzed	26'6"
56-25	0000-25	81mm Mortar, Partial Fuzed	10'8"
56-26	0000-26	81mm Mortar, Fuze Sheared Off	10'8"
56-27	0000-27	81mm Mortar, Fuzed	10'8"
56-28	0000-28	81mm Mortar, Fuzed	36'4"
56-29	0000-29	81mm Practice Mortar, Not Fuzed	20'
56-32	0000-32	81mm Practice Mortar, Not Fuzed	31'3"
56-35	0000-35	81mm Practice Mortar, Fuzed	31'3"

63-1	0000-01	81mm Practice Mortar, Fuzed	30’0”	

However, as discussed above, the CEHNC Safety Specialist swept a 100-foot boundary surface around the segments. The Government QA Safety specialist failed the section when an 81mm was found on the surface just 25’ from the road.

4.0 Quality Assurance Audit Summary and Recommendations

The contractor’s digital geophysical mapping (DGM) data was recognized to be of high quality in a challenging geologic environment except in areas of steep terrain. However, the contractor demonstrated a need to dramatically improve and increase the number of qualitative and especially quantitative quality control (QC) measures to avoid the multiple Quality Assurance (QA) failures that occurred in the “mag and flag” portions of the project.

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