
Draft

Geophysical Survey Work Plan

FWA 102 Former Communications Site Fort Wainwright, Alaska

Prepared for
Department of the Army
U.S. Army Corps of Engineers,
Alaska District



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**US Army Corps
of Engineers®**
Engineer Research and
Development Center
Cold Regions Research
and Engineering Laboratory

Taku Gardens Geophysical Survey Work Plan

Cold Regions Research and Engineering Laboratory



OBJECTIVE:

The objective of this geophysical survey is to determine locations and depths of buried debris at the Taku Gardens Housing Area.

Five priority areas were identified specifically by a team of Army, State of Alaska, and US EPA personnel for rapid geophysical investigation (Table 1, Figure 1). Other areas will be investigated subsequent to the initial investigation of the five priority areas.

Priority	Grid Number	Data Need	Expected Outcome	Expected Field Date	Previous Geophysics
1	GRID 1 (New Area J)	Determine if buried material is located in the fenced areas of the SAS building. Historic activities indicate that various garrison barracks and facility were located in this area.	Define northern boundary of Communications Site; determine if items from previous activities were disposed of at or near the SAS building.	March-April 2007	2004
2	GRID 2 (Western portion of new Area F)	Determine if buried material is located near the existing family housing quarters adjacent to the Communication Site	Define western boundary of communication Site; determine if items from previous activities were disposed of at or near adjacent family housing.	March-April 2007	2004
3	GRID 3 (East part of new Area F)	Determine extent of buried drums and other debris that have been discovered around Building 48 and 49	Delineate extend of drums that are buried at or near this location. Drums that were removed in 2006 contained various waste items, and drums that remain could potentially pose a risk to groundwater. Information will be used to remove, to the extent practicable, the remaining drums in this area.	March-April 2007	2004, limited 2006

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4	GRID 4 (West portion of Area C)	Determine if buried material is located in the northern drainage area adjacent to nearby existing family housing quarters.	Define northwest boundary of the Communication Site; determine if items from previous activities were disposed of at or near adjacent occupied family housing.	March-April 2007	2004
5	GRID 5 (new Area I2)	Determine if buried material is located in the eastern, unfenced portion of the site, just west of the PX gas station (line may not be an exact square)	Define northeast boundary of the Communication Site.	March-April 2007	2004, limited 2006

* The soil berm will be completed after snowmelt.

CRREL conducted a limited pre-construction geophysical survey in October 2003 using electromagnetic induction with an EM61 instrument manufactured by Geonics Limited. The areas surveyed in 2003 were based on locations of debris piles in aerial photographs from 1948 through 1957 and were confined to cleared areas on this formerly wooded site. Numerous metallic anomalies were detected during this survey within a cleared area in the northeastern portion of Taku Gardens (Fig. 2).

In 2004, R&M consultants conducted a pre-construction geophysical survey of the entire site using a magnetometer and EM31 instrument after trees were removed from the site. The survey results included a map with polygons indicating areas of numerous magnetic anomalies (Fig. 3).

In 2006, Sage Earth Sciences performed a geophysical survey on 25 acres of the site using a magnetometer to determine test pit locations. Ground penetrating radar (GPR) and EM61 data were collected on 1 acre of the 25 acres to validate the magnetometer data.

In 2006, test pits at the site encountered buried drums near building 49. The extent of these drums and associated debris has not been completely delineated. This new geophysical survey will address this data gap as well as the ones listed in the above table.

CRREL 2003 EM61 Survey

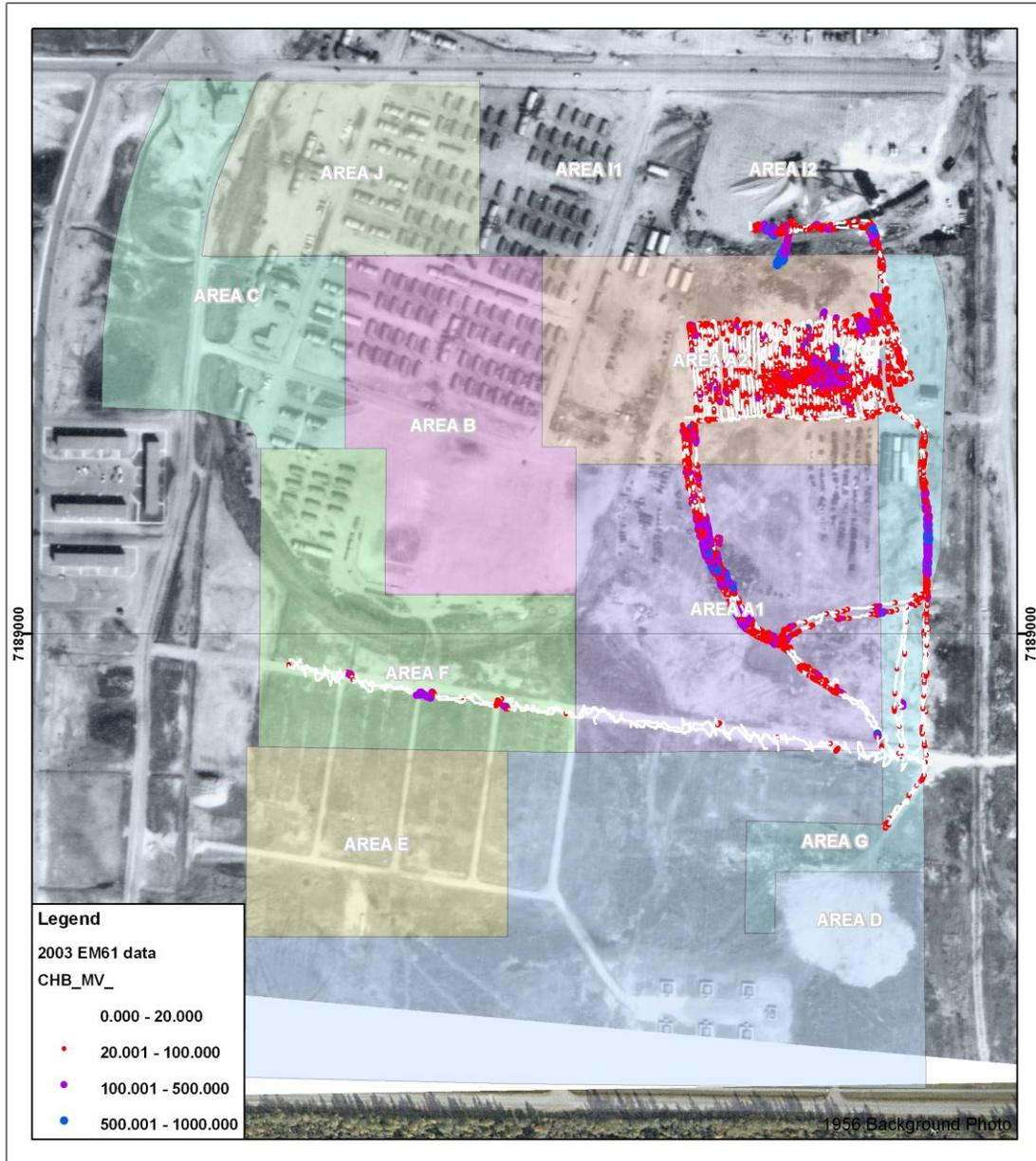


Figure 2. 2003 limited EM61 survey results.

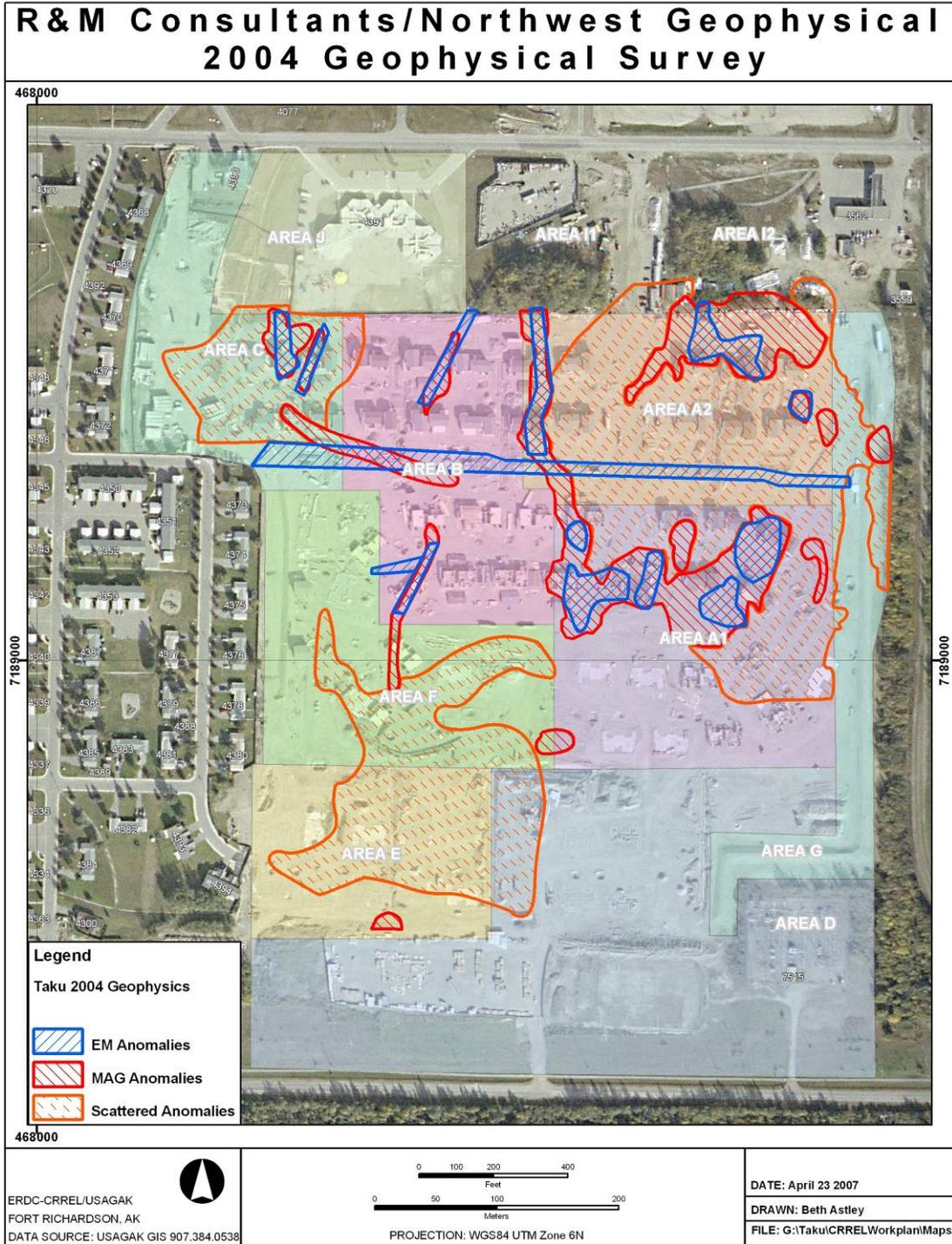


Figure 3. 2004 geophysical results, magnetometer and EM31.

APPROACH:

We will use a combination of electromagnetic induction (EM61 and EM61-MK2) and ground-penetrating radar to define the extent and depth of burial of potentially hazardous

materials. Other geophysical methods will be used as necessary to fully characterize the extent of buried debris.

Geophysical Methods

Electromagnetics

To detect buried metallic debris we will use EM61 and EM61-MK2 electromagnetic units manufactured by Geonics LTD, Mississauga, Ontario. They are time-domain metal detectors that can operate in highly conductive settings where radar techniques are less effective. The units respond to both ferrous and non-ferrous metal. The EM-61 consists of a cable attached transmitter assembly and 1 meter sq. coaxial coil antennas while the EM61-MK2 has 0.5 meter x 1 meter antennas. The vertically separated antennas consist of a single transmit and two receive coil antennas (vertical magnetic dipoles). The antennas can be mounted on wheels or a sled and towed behind the operator. Data will be collected per manufacturer instructions.

The data will be processed to correct the GPS positions, remove external noise, and correct for drift if necessary. Maps showing contours of the EM61 results will be provided as soon as possible after data collection.

EM Quality Control

A metal-free area within the site will be designated as the control grid for purposes of determining daily background levels for the EM61 instrument. The instrument will be tested at the beginning and end of each day over the same location first by itself, then with the addition of a 2 lb iron disk. The readings will be used to adjust the data for external electromagnetic noise and drift.

Ground-Penetrating Radar

GPR data will be collected in areas identified with the EM61 data as containing buried metal of concern. The GPR equipment consists of a Geophysical Survey Systems Incorporated (GSSI) 3000 radar controller with 400 MHz and 200 MHz antennas.

The GPR signal is reflected and diffracted at material interfaces, including the water table and other stratigraphic changes, with signal amplitude strength determined by the contrast in relative dielectric permittivity across the interface. The GPR data will provide information on depth and extent of buried debris.

GPR Quality Control

In order to more accurately determine depth to targets of interest, the dielectric permittivity of the soils at Taku Gardens could be tested by burying various targets at known depths and then collecting GPR data at the surface. This test is contingent on the removal of the current digging ban. If this test is not accomplished, we can assume a permittivity value based on previous GPR studies from Fort Wainwright with similar alluvial soils (Arcone and Delaney 1989).

Survey Methods

Geophysical grid locations will be marked with wooden lath and recorded using a survey grade Global Positioning System (GPS). The coordinate system and projection for data will be UTM WGS84 zone 6 unless otherwise specified by the Army.

The geophysical line spacing will be 2 or less meters over the site. In areas where significant buried anomalies exist, 1 meter or smaller spacing will be used. Each grid will be surveyed first with the EM61/EM61-MK2. Areas with significant buried metallic anomalies will then be surveyed with GPR to define the depth of burial and number of objects.

REFERENCES:

Arcone, Steven A., and Delaney, Allan J., Investigations of dielectric properties of some frozen materials using cross-borehole radiowave pulse transmissions. CRREL Report 89-4, March 1989.

CRREL's QUALIFICATIONS:

The U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) is one of seven laboratories that make up the Army's Engineering Research and Development Center (ERDC). CRREL has conducted extensive environmental investigations at DOD sites in Alaska over the past 15 years using a suite of geophysical tools to characterize the subsurface.

PRODUCTS:

1. Technical memo containing a preliminary map containing locations of buried material.
2. Technical report containing processed data and interpretations.

2007 SCHEDULE:

March-April	GPR/EM61 data collection
May 31	Report preliminary results
August 31	Technical report with detailed interpretations

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