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CROWS LANDING
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FINAL REPORT

MUNITIONS AND EXPLOSIVES OF CONCERN DREDGED SOIL BERM – SITE B

NASA Crows Landing Flight Facility
Crows Landing, California

Initial Geophysical Survey Results
Contract Number N62474-98-D-2076
Contract Task Order 0110

August 17, 2005

Submitted to:

Naval Facilities Engineering Command (NAVFAC)
Southwest Division

Submitted by:

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Subject: Final Report for Initial Geophysical Survey for MEC Clearance at Site B (Dredged Soil Berm), NASA Crows Landing Flight Facility, California

Transmitted herein is the final report for the initial geophysical survey conducted for the dredged soil berm at Site B at NASA Crows Landing Flight Facility. The geophysical survey of the soil berm was performed by Shaw Environmental, Inc. on June 23 and 24, 2003 following a discovery of four 20-millimeter (mm) shells by a local farm worker on June 5, 2003. The survey was conducted using EM61HH MKII and the Geometrics, Inc. G858G. This procedure was essentially the same as what has recently been followed for other sites subject to MEC verification and clearance.

A draft version of this report was previously submitted to the Navy and was forwarded to DTSC on October 9, 2003. This report is being transmitted as final and contains description of the survey procedures followed in the field and results, including graphical presentation of anomalies detected and a summary of the target list. Based on the geophysical findings, a minimum of 66 targets will require investigation, following the procedures described in the MEC Verification and Clearance Work Plan[1].

Enclosure – MEC Site B Soil Berm, Initial Geophysical Survey Results, Final Report, dated August 17, 2005

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[1] Shaw Environmental, Inc., 2005, *Munitions and Explosives of Concern Verification and Clearance, NASA Crows Landing Flight Facility, Crows Landing, California, Final Project Plans*, June 9.

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Acronyms and Abbreviations

Crows Landing	NASA Crows Landing Flight Facility
CTO	Contract Task Order
DGM	Digital Geophysical Mapping
EM	Electromagnetic
EM61-HH-MKII	Geonics, Inc. EM61HH Mark 2 Hand- Held Metal Detector
G858G	Geometrics, Inc. G858G magnetometer
GPS	Global Positioning System
Hz	Hertz
IRP	Installation Restoration Program
MAG	magnetometer
MEC	Munitions of Explosive Concern
MHz	MegaHertz
mm	millimeter
mS/m	milliSiemens/meter
mV	milliVolts
NAD	North American Datum
RF	radiofrequency
Shaw	Shaw Environmental, Inc.
Site B	Dredged Soil Berm Site B
TDEM	Time-Domain Electromagnetics

1.0 Introduction

This report presents the results of the geophysical investigation conducted in the dredged soil berm area at Site B (Site B), NASA Crows Landing Flight Facility (Crows Landing) in Stanislaus County, California. The survey was conducted on June 23 and 24, 2003.

This investigation was initiated due to the discovery of four 20-millimeter (mm) shells in soils removed from the berm in order to construct an adjacent sump on June 5, 2003 (Shaw Environmental, Inc. 2003a). Because of the 20-mm practice rounds, a high-resolution geophysical survey was conducted at both the sump and the berm covering approximately 0.7 acres.

1.1 Objectives

The purpose of the geophysical survey of the soil berm and the adjacent sump at Site B was to identify locations of any geophysical anomalies that may be indicative of the presence of 20-mm or similar practice ammunitions in the area. The survey area encompassing the soil berm and the sump is shown in Figure 1," Crows Landing Area Map with Survey Sites Posted." The survey is as a result of the discovery of 20-mm practice shells within the berm soils. Historical records indicate that a plane crashed into Little Salado Creek in the 1940's and there may be resultant scrap metal as well as Munitions and Explosives of Concern material at this site (Shaw Environmental, Inc. 2005).

A Shaw geophysicist did a site inspection at the dredged soil berm at Site B and determined the most applicable methods for conducting the geophysical survey. Due to the fact that 20-mm shells were encountered, the survey required detection of very small metal objects. Therefore a high-resolution survey was performed with the Geonics, Inc. EM61HH Mark 2 Hand-Held Metal Detector (EM61HH-MK2) all metals, time domain metal detector and a Geometrics, Inc. G858G magnetometer (G858G). These two instruments were used in conjunction with a Trimble ProXRS Pathfinder Global Positioning System (GPS) system to provide accurate, real-time locations for each data point.

The geophysical survey at this site was conducted in accordance with the proposed survey plan (Shaw Environmental, Inc. 2003b). Survey activities also conformed to the procedures described in the *Final Project Plans, Munitions and Explosives of Concern Verification and Clearance, NASA Crows Landing Flight Facility, California* (Shaw Environmental, Inc. 2005).

2.0 Technology and Approach

This section presents the theoretical background and rationale for using electromagnetic (EM) induction, magnetics, and GPS.

2.1 Time Domain Electromagnetics (EM61HH-MK2)

The EM61HH-MK2 (Geonics, Ltd., of Mississaugua, Ontario) is a unique type of EM metal detector. Most standard types of metal detectors are frequency domain electromagnetic tools or magnetometers of some simple type. The EM61HH-MK2 utilizes time domain theory to explore for both ferrous and non-ferrous buried metal objects. By using time domain theory, the EM61HH-MK2 is capable of discriminating between conductive earth materials and metallic targets such as buried metallic waste, underground storage tanks (USTs), and MEC material. It also has good resolution of small targets due to the reduced coil size.

The EM61HH-MK2 is the latest model of metal detection instrument from Geonics, Ltd. of Canada. The EM61HH-MK2 generates several EM pulses per second in a general square wave configuration. The system takes readings during the off time between square wave pulses. During each EM pulse, eddy currents, with associated secondary magnetic fields, are induced in earth materials and in any buried metallic objects that are present (Faraday's Law). The system measures the decay of secondary magnetic fields associated with the eddy currents using two coils mounted on a coil assembly.

By using time domain theory the EM61HH-MK2 is capable of discriminating between conductive earth materials and metallic targets. In general, the secondary magnetic field associated with the induced current dissipates much faster in earth materials than in buried metal objects. Between each pulse, the EM61HH-MK2 allows for the response from the earth materials to naturally dissipate and subsequently measures the prolonged buried metal response at four different time gates. By generally sensing only the buried metal response, the EM61HH-MK2 can be successful at distinguishing between conductive soils or rock and metal targets.

The EM61HH-MK2 system consists of a backpack, data logger, and a hand-held coil that is carried in front of the operator. The data logger, which is attached to the backpack, runs the entire system. The high sensitivity and ability to detect all metals make the EM61HH-MK2 a valuable tool for highly accurate detection of small subsurface metallic objects.

2.2 Magnetometer

The magnetic instrument used for the Site B soil berm geophysical survey was a Geometrics, Inc., G858G "walking mode" magnetometer/gradiometer, for acquiring geophysical survey data, and a G856AX magnetometer (MAG) for monitoring diurnal variations in the Earth's magnetic field. The MAG survey was conducted to assess possible significant metal objects in the center of the berm. The EM61HH-MK2 can detect smaller objects; however, it has a limited depth of investigation. MAG surveys were conducted to assess the deeper berm materials for detectable ferrometallic objects. Applications of the magnetic method include mapping MEC material and all buried ferrometallic debris.

The G858G is an optically pumped cesium vapor instrument that measures the intensity of the earth's magnetic field in gamma. During operation of the G858G magnetic a direct current is used to generate a polarized, monochromatic light. Absorption of the light occurs within the naturally precessing cesium atoms that are contained in the instrument's two vapor cells, or sensors. When absorption is complete, the precessing atoms become a transfer mechanism between light and a transverse radiofrequency (RF) field at a specific frequency known as the Larmor frequency. The light intensity is used to monitor the precession and adjusts the RF allowing for the determination of the magnetic field intensity.

Anomalies in the earth's magnetic field are caused by remnant or induced magnetism. Remnant magnetism is caused by naturally occurring magnetic materials. Induced magnetic anomalies are the result of inducing a secondary magnetic field from the earth's primary field. This typically occurs in ferromagnetic materials (ordnance/explosives, pipelines, drums, tanks, well casings, etc). The shape and amplitude of an induced magnetic anomaly over a ferromagnetic object depend on the geometry, size, depth, and magnetic susceptibility of the object and on the magnitude and inclination of the earth's magnetic field in the study area. Magnetic anomalies caused by buried metallic objects typically have dimensions much greater than the dimensions of the objects themselves.

The magnetic field measured at any point on the earth's surface undergoes low frequency diurnal variation, called magnetic drift, associated with the earth's rotation. The source of magnetic drift is mainly within the ionosphere, and its magnitude is sometimes large enough to introduce artificial trends in survey data. The G856 base station magnetometer was used to record this drift for removal from the G858G survey data during processing.

2.3 Navigational Technology

Differential GPS technologies provide location data at approximately one and one-half foot, real time accuracy. Shaw utilized the single frequency, Trimble Pathfinder Pro XRS. The Pro XRS GPS system was used in conjunction with the EM61HH-MK2 and G858G systems to obtain

geophysical data. This assures that every data point has an associated northing and easting coordinate. Therefore, positional accuracy is tied into each geophysical map.

The availability of sufficient satellite coverage dictates the appropriate use of GPS. Two factors dictate sufficiency of satellite coverage: the view of the sky from the survey site, and the number and height of GPS satellites above the survey site. Tree coverage and proximity to buildings and topographic features such as cliffs and steep hills affect access to a clear view of the sky. GPS conditions at the Crows Landing facility are favorable. The orbits of the GPS satellites were reviewed through use of GPS planning software (Trimble's Quick Plan) prior to the field survey. By reviewing the satellite availability, optimal survey periods can be defined, and periods of poor satellite visibility coordinated with rest times, preventative maintenance, data downloading, and travel.

3.0 Field Procedures and Data Reduction

This section describes the geophysical field procedures used during this investigation and general data reduction and processing steps.

3.1 Field Survey

Prior to the geophysical surveys, a site walk was conducted to assess any visible surface metal or obstructions. The primary concern was a chain-link metal fence that paralleled the berm for approximately 500 feet as evident on Figures 2, "South Dredged Soil Berm Site B Field Area Map," and 3, "North Dredged Soil Berm Site B Field Area Map." Objects such as the chain link fence, concrete pad, water main, and scrap metal were noted as cultural interference and, subsequent to the geophysical surveys, were located with GPS to later overlay on geophysical maps. Existing stakes in and around the berm area were numbered in the field to provide additional reference points for the survey. These stakes were placed in about the same time prior to the survey to establish a site perimeter for the temporary metal fence to be installed around the soil berm and the sump. These additional features are also shown on Figures 2 and 3.

Both the EM61HH-MK2 and the G858G were utilized in conjunction with a Trimble Pro XRS Pathfinder GPS system (Pro XRS). Collecting both the geophysical and positional data sets concurrently ensures accurate locations for each geophysical data point.

Field survey methods for both of these instruments involved high-frequency data collection (5 readings per second) along lines spaced approximately 1-foot apart. Prior to geophysical data collection, a calibration was performed with both the EM61HH-MK2 and the G858G. The calibration consists of concurrently collecting geophysical sensor data and GPS data over a known anomaly. The geophysicist walked forward and then backward over the anomaly. This allowed Shaw proprietary software (ProData) to measure the time slew between the geophysical instrument data logger and the GPS data logger to determine a correction factor. The data is then subsequently corrected allowing the geophysical data to have the most accurate ground locations possible.

Data was collected along lines length-wise along the berm and across the sump. Each geophysical instrument was carried concurrently with the GPS system. Traverses were marked with marking paint in order to ensure consistent data density and line spacing.

The EM61HH-MK2 was carried approximately 6 inches above the ground surface. The G858G was collected in gradiometer configuration with the bottom sensor approximately 1.5 feet above ground surface. This configuration allows simultaneous data collection on two separate sensors that are spaced approximately 2.3 feet apart in a vertical sense. This allows the use of either

sensor alone, or a subtraction the bottom sensor minus the top sensor to estimate the vertical magnetic gradient. This configuration acts as a high pass filter and sometimes can furnish higher resolution.

3.2 Data Processing

Subsequent to the field survey, all geophysical and GPS data were downloaded to a laptop computer and scrutinized for data quality. Geophysical sensor data and GPS data were merged with proprietary Shaw software (ProData). ProData assists in determining the time slew between data loggers and calculates distance between GPS antenna and data sensor. The software applies a time shift to account for any data logger clock discrepancies and calculates the shift from GPS antenna to data sensor so that merged datasets have accurate ground locations.

ProData utilizes the results of the calibrations conducted on site to correct and accurately time merge the two data sets. This creates a xyz file, which ties every geophysical sensor data point to an accurate GPS coordinate. The data were then transformed into the North American Datum (NAD) 83, California State Central Coordinate system.

After generation of the xyz files the data were scrutinized and all necessary processing steps were conducted (leveling, gridding, filtering, target picking, etc) using Oasis Montaj™ (Geosoft, LTD). Maps of the geophysical data were then generated. Additionally, the MAG grid was run through a process within Oasis Montaj™ to create an analytic signal grid, which creates a monopolar signal from a dipolar signal. This is accomplished by taking the square root of the sum of the squares of the derivatives in the x, y, and z directions.

The UX Detect module of Oasis Montaj™ was utilized for the target picking process. This module is optimized for EM and MAG target picking for MEC applications. A threshold value was set for each of the two collection methods and the targets were then analyzed for viability in shape and size of the anomaly for targets that were selected. If it was decided that the module was not picking enough or was picking too many targets, the threshold value for the particular collection method would be slightly altered and the target picking process would be performed once again.

For EM targets the threshold was set at 6 milliVolts and for the MAG data the threshold was set at 30 gamma. Target maps for the EM61HH-MK2 data are depicted in Figures 4, "South Dredged Soil Berm Site B EM61HH MK2 Survey Results (mV)," and 5, "North Dredged Soil Berm Site B EM61HH MK2 Survey Results (mV)," and target maps of the G858G data are depicted in Figure 6, "South Dredged Soil Berm Site B Total Field Analytical Signal MAG Survey Results (gamma/ft)," and 7, "North Dredged Soil Berm Site B Total Field Analytical Signal MAG Survey (gamma/ft)." All of the GPS data were then superimposed over the geophysical maps. Targets related to cultural interference were demarcated from other

targets by separate symbols as reflected in the figures. Many of these targets related to cultural interference were due to the nearby metal fence and reinforced concrete pad at the southwestern side of the site.

4.0 Results

The results of the geophysical survey are presented in Figures 2 through 7. Figures 2 and 3 are South and North Location Maps for the MEC Site B Berm Area. Figures 4 and 5 are geophysical maps of the EM61HH-MK2 results. Figures 6 and 7 are geophysical maps of the total field analytic signal MAG (G858G) results.

Detection limits of the geophysical grids had to be set at low values in order to properly evaluate targets as small as 20-mm shells. Due to the undulating and unstable surface conditions on the berm, there may be some false positive target picks because of slight changes in sensor to ground surface distance.

4.1 EM Survey

There are a total of 76 targets that were picked by the UX Detect Module in Oasis Montaj™. Of these, 10 targets were removed due to cultural interference features. These targets are displayed on Figures 4 and 5. Grid values for these anomalies range from approximately 7 mV to 12,000 mV. The majority of these targets are small anomalies that are virtually undetectable on the color grid map. This is due to the very low threshold value chosen to detect very small targets, such as a 20-mm practice round. In some cases the target location symbol is larger than the anomaly and disguises its expression in the map. Eleven of these targets have high anomalous readings greater than 1000 mV. The locations and anomaly values of each target are presented in Appendix A, Table 1.

4.2 MAG Survey

There are a total of 202 targets that were picked by the UX Detect Module in Oasis Montaj™. Of these, 168 targets were removed due to cultural interference features. Most of these were removed due to the nearby fence, which affects the G858G more than the EM61HH-MK2 due to the sensitivity to surrounding objects of the G858G compared to the EM61HH-MK2.

Anomalies for the MAG survey were picked on the analytic signal grid created in Oasis Montaj™. Most of the targets have low grid values and are virtually undetectable on the color grid map (Figures 6 and 7). This is due to the very low threshold value chosen to detect very small targets, such as a 20-mm practice round. In some cases the target location symbol is larger than the anomaly and disguises its expression in the map. Seven of these targets have high anomalous readings greater than 500 gamma. The locations and anomaly values of each target are presented in Appendix A, Table 2.

Total field response consists of only the bottom magnetic sensor. The gradiometer consists of an upper sensor that is subtracted from a lower sensor. Both sensors are utilized during field data collection but either top or bottom sensor or a combination of both can be used to for interpretation. The rationale for using the gradiometer configuration is to only measure changes in the vertical direction and filter out any affects from surrounding metal objects. It was desired that this method might filter out the affects of the nearby metal fence that paralleled most of the length of the site. The fence was evident within the data so only the total field signal was utilized for target picking.

5.0 Discussion

It must be noted that very low geophysical thresholds were utilized for detection of possible MEC items. These values are near the background noise limit for geophysical measurements. In addition, the physical nature of the disturbed soil within the berms is expected to generate low magnitude variations in measured geophysical values due to the heterogeneous nature of the disturbed soil and surface conditions during data acquisition (false positives). Therefore, ground truth data during excavation activities should be considered for adjusting the threshold value regarding excavation considerations.

6.0 References

Shaw Environmental, 2003a, *"Geophysical Survey of the Berm Area Near IRP Site 18 South (Live Ammunition Area), NASA Crows Landing Flight Facility,"* October 9.

Shaw Environmental, Inc., 2003b, *"Proposed Geophysical Survey Near IRP Site 18 South, NASA Crows Landing Flight Facility, California", Transmittal No. 010 under CTO 0086,* June 18.

Shaw Environmental, Inc., 2005, *Final Project Plans, Munitions and Explosives of Concern Verification and Clearance, NASA Crows Landing Flight Facility, California,* June 9.

Figures

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Crows Landing Flight Facility
Figure 1 - Crows Landing Area Map with Survey Sites Posted
NAD83, California Zone 3, US Feet

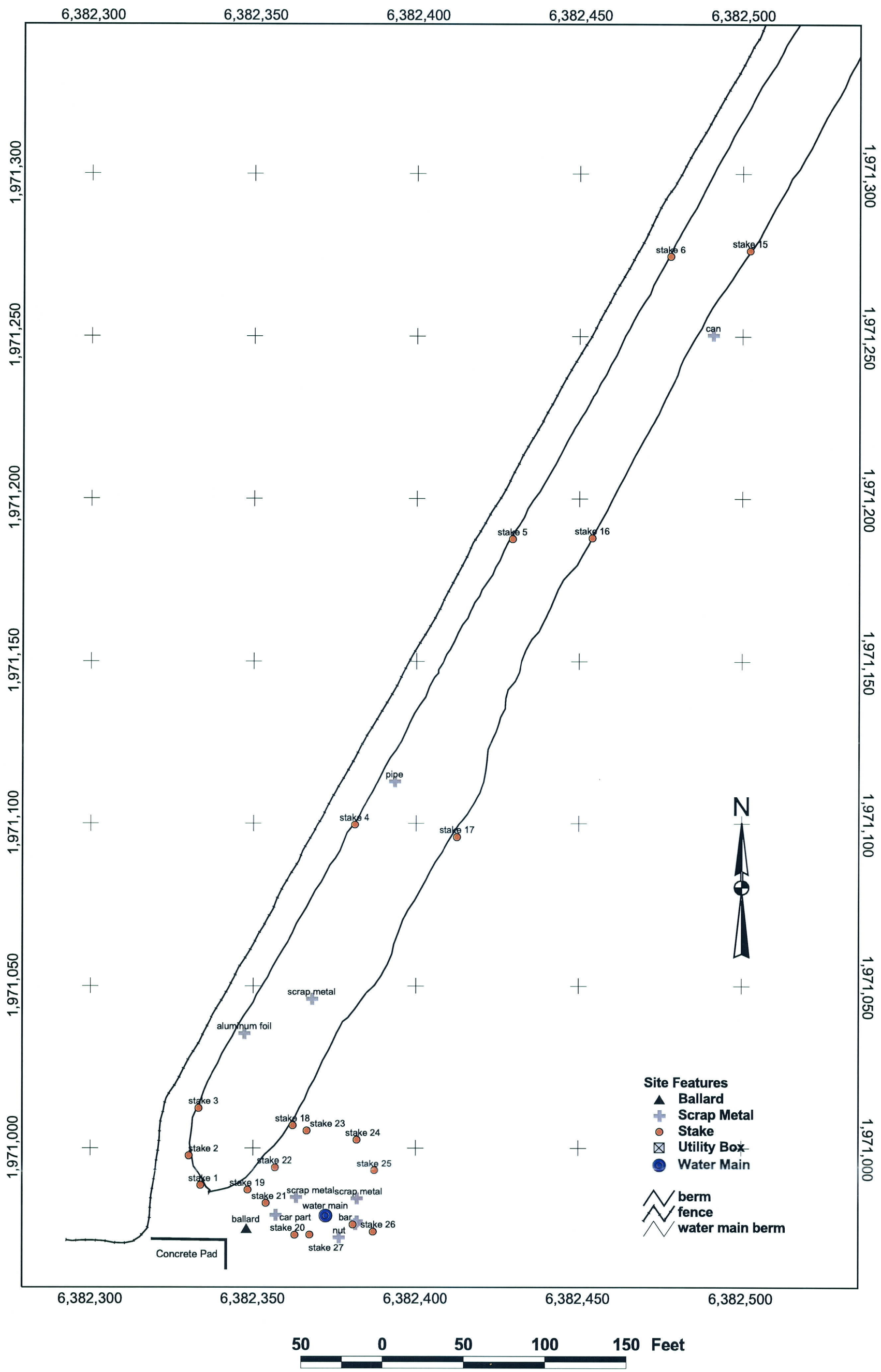

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Figure 2 - South Dredged Soil Berm Site B
Field Area Map

NAD83, California Zone 3, Feet

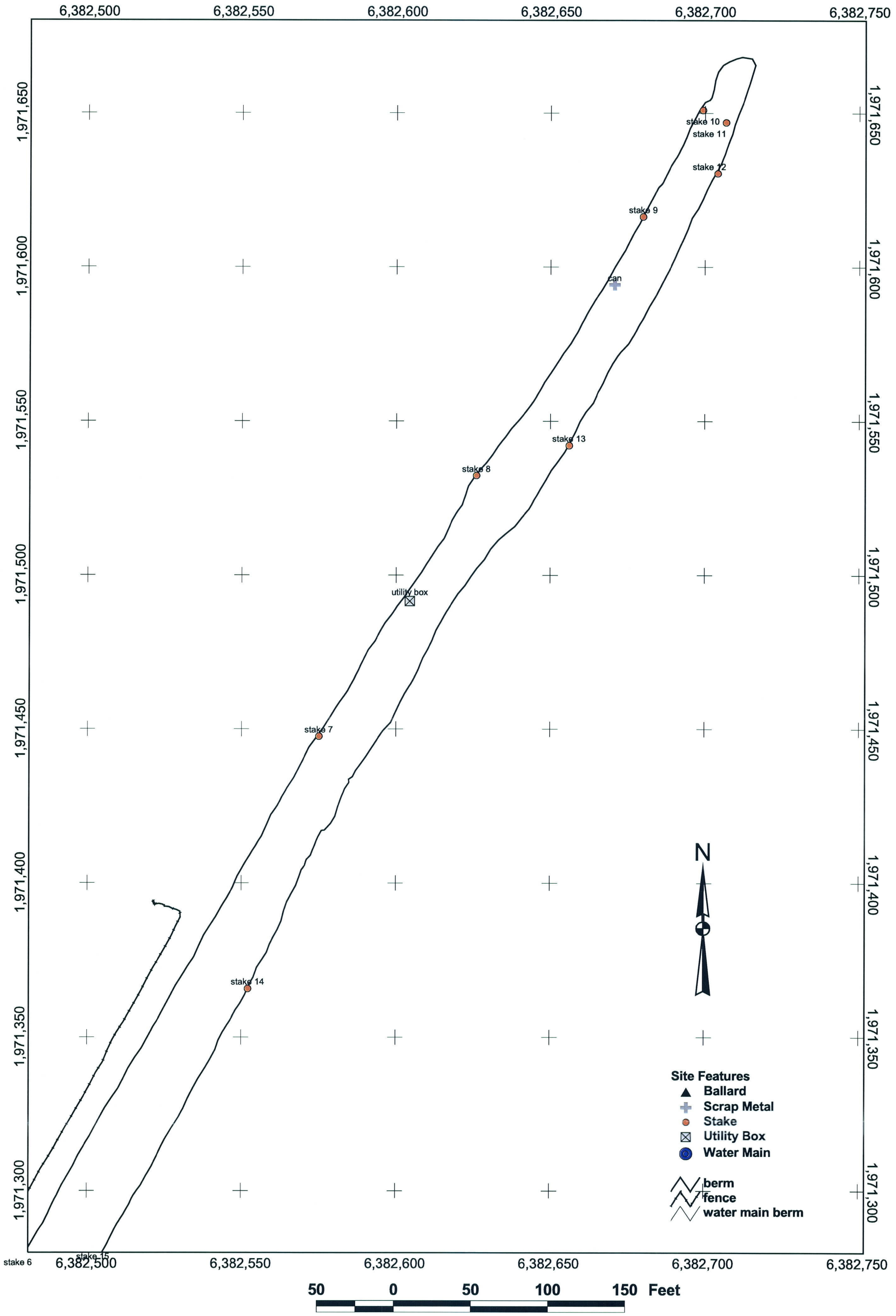

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Figure 3 - North Dredged Soil Berm Site B
Field Area Map

NAD83, California Zone 3, Feet

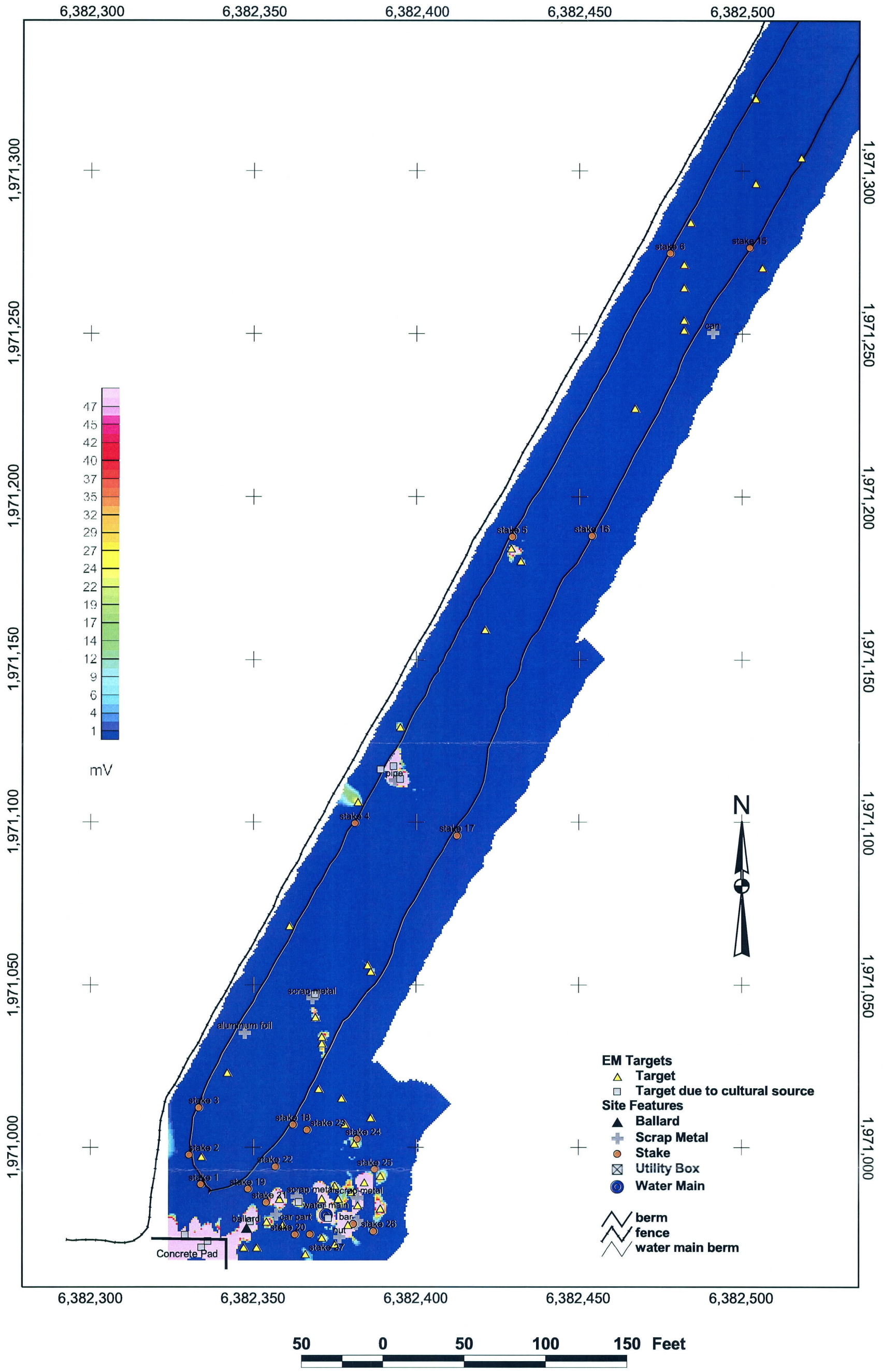

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Figure 4 - South Dredged Soil Berm Site B
EM61HH MK2 Survey Results (mV)

NAD83, California Zone 3, Feet

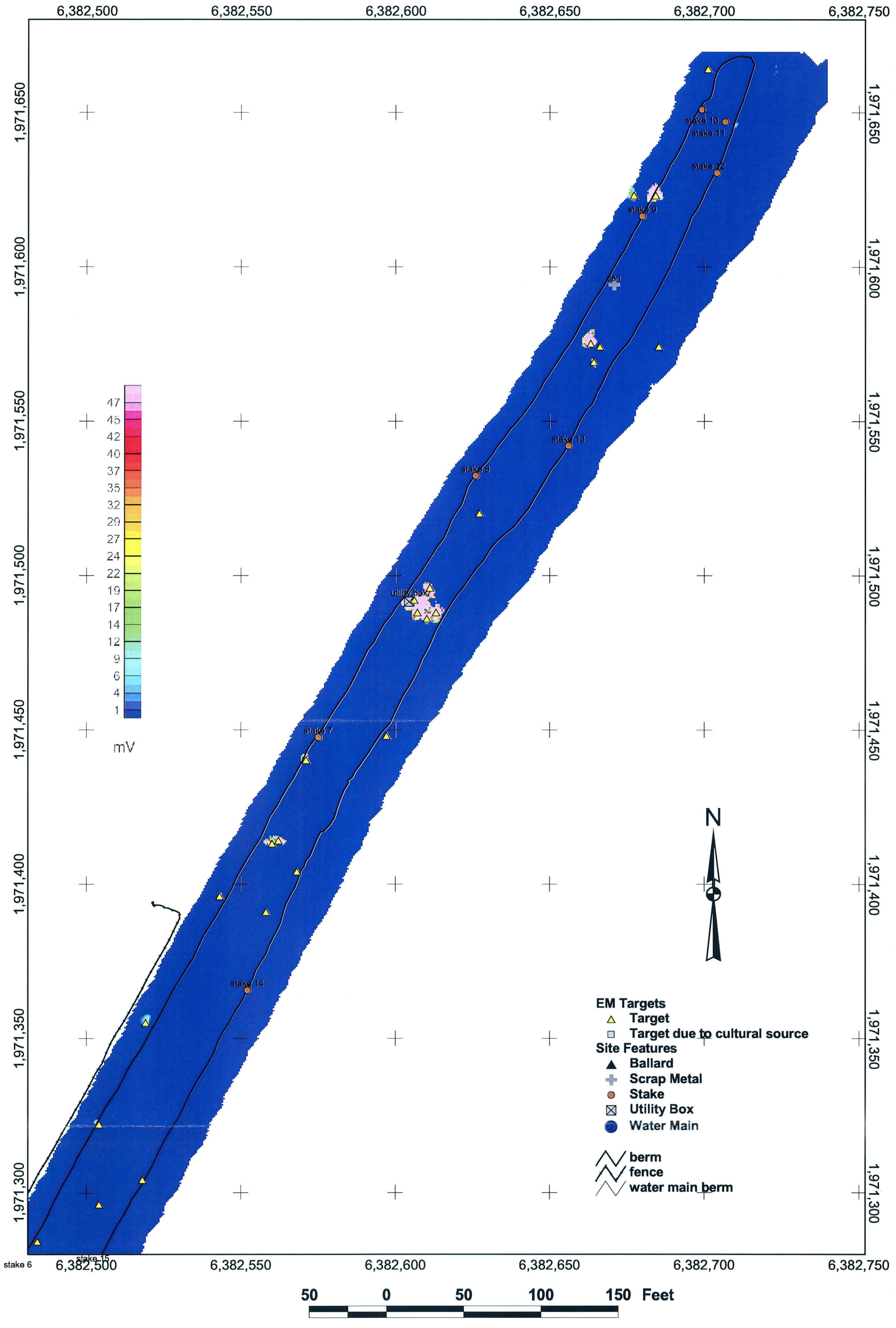

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Figure 5 - North Dredged Soil Berm Site B
EM61HH MK2 Survey Results (mV)

NAD83, California Zone 3, Feet

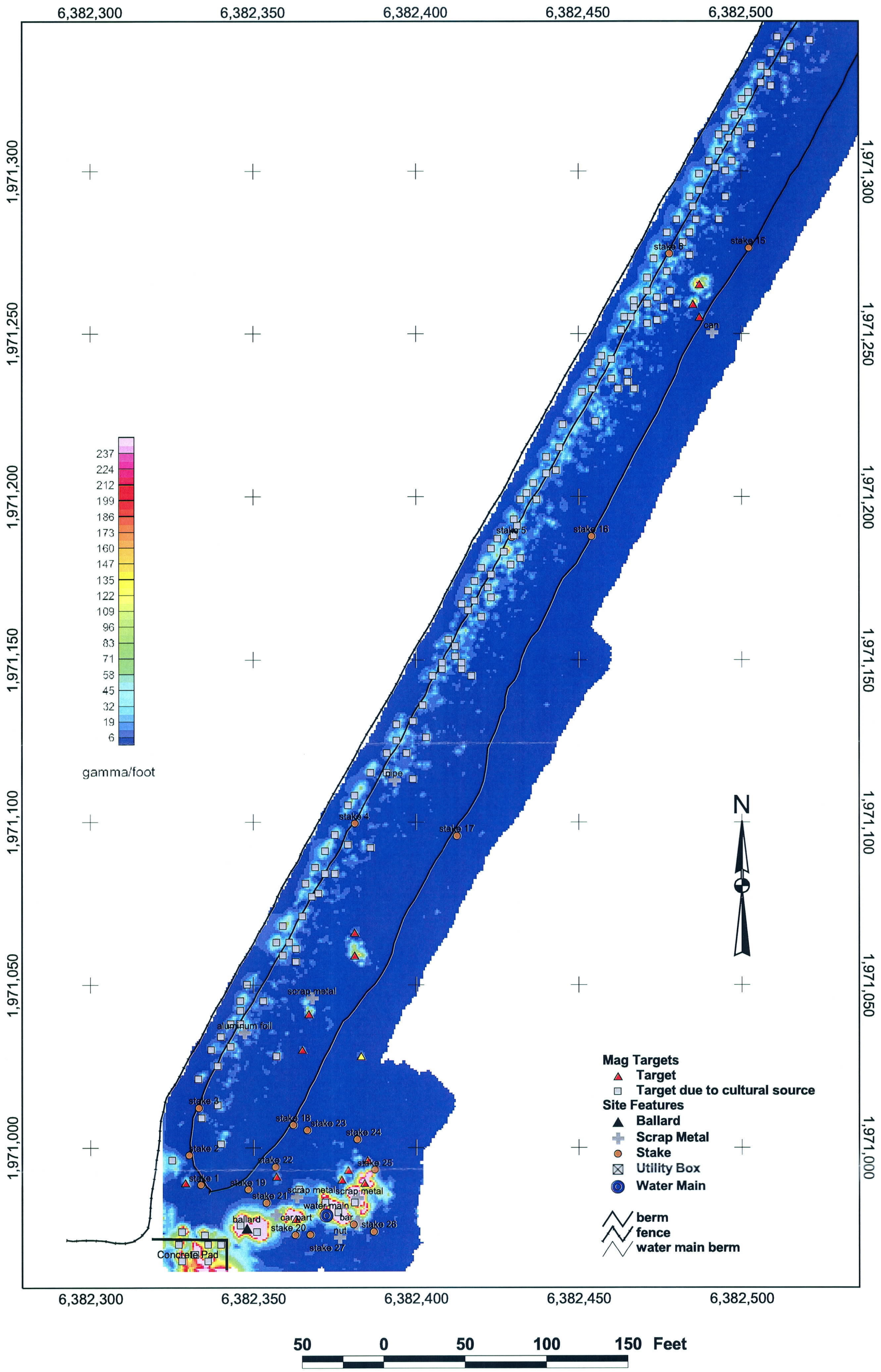

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Figure 6 - South Dredged Soil Berm Site B Total Field Analytic Signal MAG Survey Results (gamma/ft)

NAD83, California Zone 3, Feet

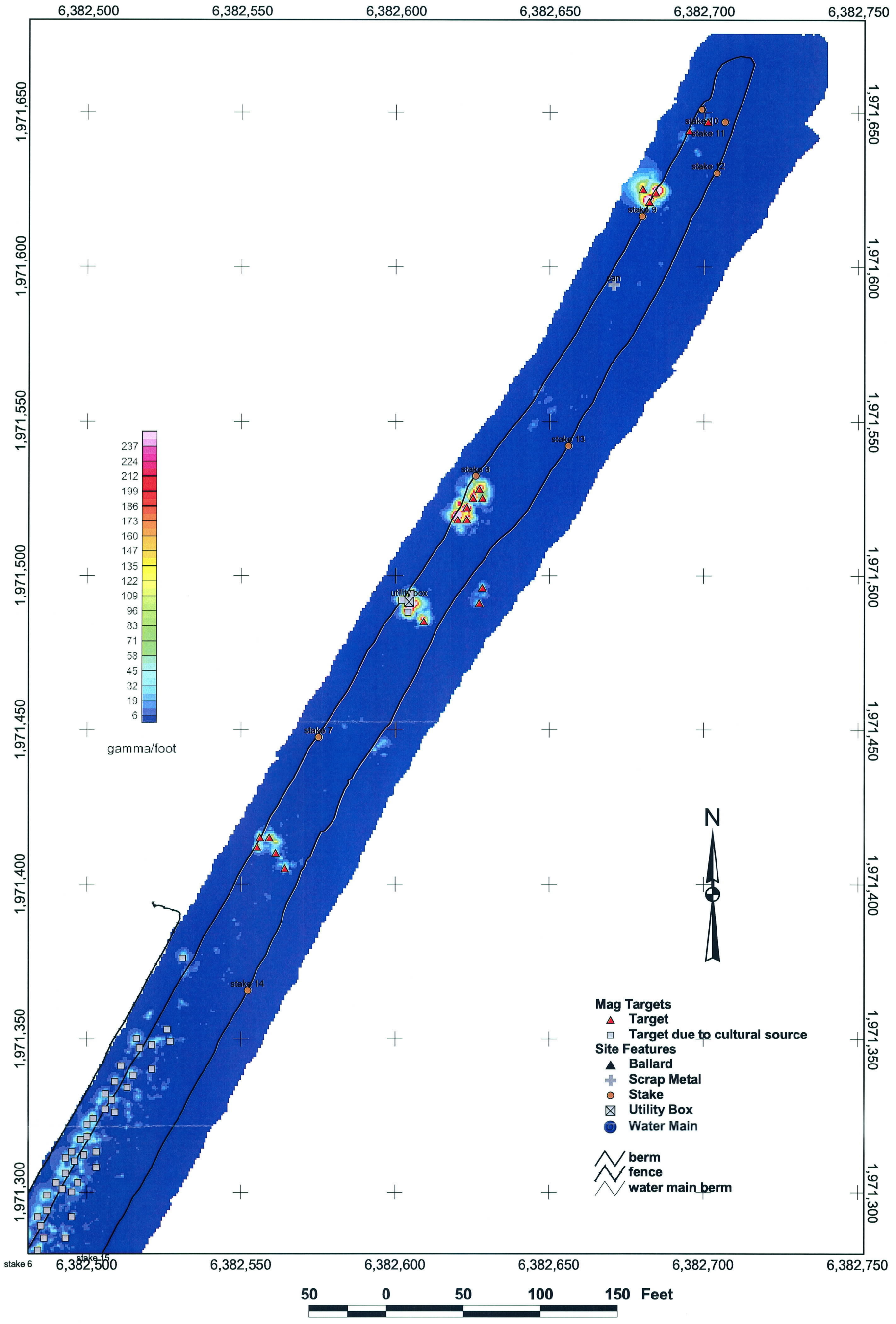

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Figure 7 - North Dredged Soil Berm Site B Total Field Analytic Signal MAG Survey Results (gamma/ft)

NAD83, California Zone 3, Feet

Appendix A
Target List

Table 1
EM Targets

Target ID	X (easting)	Y (northing)	Grid Value (mV)	Classification
1	6382366	1970967	18	Target
2	6382334	1970969	1666	Target due to cultural source
3	6382347	1970969	21	Target
4	6382351	1970969	12	Target
5	6382375	1970970	11	Target
6	6382336	1970971	3789	Target due to cultural source
7	6382371	1970972	48	Target
8	6382329	1970973	81	Target due to cultural source
9	6382379	1970976	11956	Target
10	6382359	1970976	7	Target
11	6382349	1970977	9084	Target due to cultural source
12	6382354	1970977	119	Target
13	6382373	1970978	1156	Target due to cultural source
14	6382389	1970981	52	Target
15	6382382	1970982	9213	Target
16	6382364	1970983	86	Target due to cultural source
17	6382358	1970984	831	Target
18	6382371	1970984	4014	Target
19	6382376	1970984	9	Target
20	6382380	1970986	14	Target
21	6382375	1970988	92	Target
22	6382384	1970989	3507	Target
23	6382389	1970991	23	Target
24	6382334	1970997	20	Target
25	6382381	1971001	41	Target
26	6382378	1971007	51	Target
27	6382386	1971009	7	Target
28	6382377	1971015	24	Target
29	6382370	1971018	9	Target
30	6382342	1971023	7	Target
31	6382371	1971032	10	Target
32	6382371	1971034	14	Target
33	6382369	1971040	63	Target
34	6382369	1971047	7	Target due to cultural source
35	6382386	1971054	20	Target
36	6382385	1971056	23	Target
37	6382361	1971068	8	Target
38	6382382	1971106	35	Target
39	6382395	1971113	570	Target due to cultural source
40	6382389	1971116	20	Target due to cultural source
41	6382393	1971117	7375	Target due to cultural source
42	6382395	1971129	42	Target
43	6382421	1971159	8	Target
44	6382432	1971180	21	Target
45	6382429	1971184	77	Target
46	6382467	1971227	18	Target
47	6382482	1971251	9	Target
48	6382482	1971254	10	Target
49	6382482	1971264	7	Target
50	6382506	1971270	11	Target
51	6382482	1971271	8	Target

Table 1
EM Targets

Target ID	X (easting)	Y (northing)	Grid Value (mV)	Classification
52	6382484	1971284	8	Target
53	6382504	1971296	8	Target
54	6382518	1971304	8	Target
55	6382504	1971322	40	Target
56	6382519	1971355	13	Target
57	6382558	1971391	8	Target
58	6382543	1971396	22	Target
59	6382568	1971404	17	Target
60	6382560	1971413	176	Target
61	6382562	1971414	94	Target
62	6382571	1971440	146	Target
63	6382597	1971448	15	Target
64	6382610	1971486	132	Target
65	6382607	1971488	228	Target
66	6382613	1971488	166	Target
67	6382606	1971492	2523	Target
68	6382611	1971496	98	Target
69	6382627	1971520	7	Target
70	6382664	1971569	116	Target
71	6382666	1971574	39	Target
72	6382685	1971574	10	Target
73	6382663	1971575	710	Target
74	6382684	1971623	2520	Target
75	6382677	1971623	42	Target
76	6382701	1971664	10	Target

Table 2
Mag Targets

Target ID	X (easting)	Y (northing)	Grid Value (gamma)	Classification
1	6382336	1970965	786	Target due to cultural source
2	6382328	1970965	592	Target due to cultural source
3	6382332	1970967	819	Target due to cultural source
4	6382336	1970970	302	Target due to cultural source
5	6382340	1970970	431	Target due to cultural source
6	6382327	1970970	483	Target due to cultural source
7	6382335	1970973	281	Target due to cultural source
8	6382328	1970974	377	Target due to cultural source
9	6382351	1970974	6534	Target due to cultural source
10	6382346	1970976	2444	Target due to cultural source
11	6382363	1970978	1371	Target
12	6382376	1970980	2675	Target due to cultural source
13	6382372	1970983	1267	Target due to cultural source
14	6382381	1970983	4283	Target due to cultural source
15	6382364	1970987	162	Target due to cultural source
16	6382329	1970989	46	Target
17	6382384	1970989	1056	Target
18	6382377	1970990	170	Target
19	6382357	1970991	40	Target
20	6382379	1970993	72	Target
21	6382325	1970996	101	Target due to cultural source
22	6382385	1970996	41	Target
23	6382340	1971001	86	Target due to cultural source
24	6382334	1971009	43	Target due to cultural source
25	6382339	1971013	61	Target due to cultural source
26	6382333	1971021	60	Target due to cultural source
27	6382339	1971025	35	Target due to cultural source
28	6382357	1971028	44	Target due to cultural source
29	6382383	1971028	37	Target
30	6382337	1971030	47	Target due to cultural source
31	6382365	1971030	35	Target
32	6382343	1971031	62	Target due to cultural source
33	6382340	1971034	52	Target due to cultural source
34	6382343	1971038	62	Target due to cultural source
35	6382346	1971038	30	Target due to cultural source
36	6382367	1971041	166	Target
37	6382346	1971042	64	Target due to cultural source
38	6382346	1971045	102	Target due to cultural source
39	6382353	1971045	40	Target due to cultural source
40	6382348	1971050	48	Target due to cultural source
41	6382363	1971057	37	Target due to cultural source
42	6382359	1971059	66	Target due to cultural source
43	6382381	1971059	98	Target
44	6382363	1971061	99	Target due to cultural source
45	6382357	1971063	128	Target due to cultural source
46	6382361	1971063	41	Target due to cultural source
47	6382381	1971066	35	Target
48	6382359	1971068	97	Target due to cultural source
49	6382365	1971071	88	Target due to cultural source
50	6382368	1971077	55	Target due to cultural source
51	6382370	1971078	56	Target due to cultural source

Table 2
Mag Targets

Target ID	X (easting)	Y (northing)	Grid Value (gamma)	Classification
52	6382366	1971081	77	Target due to cultural source
53	6382372	1971084	91	Target due to cultural source
54	6382375	1971084	40	Target due to cultural source
55	6382369	1971086	41	Target due to cultural source
56	6382372	1971091	89	Target due to cultural source
57	6382386	1971092	55	Target due to cultural source
58	6382379	1971093	50	Target due to cultural source
59	6382375	1971096	67	Target due to cultural source
60	6382379	1971105	101	Target due to cultural source
61	6382381	1971108	98	Target due to cultural source
62	6382399	1971113	32	Target due to cultural source
63	6382386	1971115	83	Target due to cultural source
64	6382391	1971115	53	Target due to cultural source
65	6382391	1971121	53	Target due to cultural source
66	6382397	1971121	58	Target due to cultural source
67	6382394	1971125	111	Target due to cultural source
68	6382403	1971126	36	Target due to cultural source
69	6382394	1971130	43	Target due to cultural source
70	6382399	1971131	33	Target due to cultural source
71	6382402	1971136	50	Target due to cultural source
72	6382417	1971145	30	Target due to cultural source
73	6382405	1971145	66	Target due to cultural source
74	6382408	1971147	63	Target due to cultural source
75	6382414	1971147	54	Target due to cultural source
76	6382408	1971149	36	Target due to cultural source
77	6382414	1971149	36	Target due to cultural source
78	6382412	1971151	36	Target due to cultural source
79	6382412	1971154	61	Target due to cultural source
80	6382410	1971156	34	Target due to cultural source
81	6382420	1971163	62	Target due to cultural source
82	6382416	1971165	43	Target due to cultural source
83	6382414	1971167	54	Target due to cultural source
84	6382418	1971168	42	Target due to cultural source
85	6382423	1971169	82	Target due to cultural source
86	6382416	1971171	51	Target due to cultural source
87	6382422	1971172	96	Target due to cultural source
88	6382418	1971174	69	Target due to cultural source
89	6382423	1971176	49	Target due to cultural source
90	6382420	1971178	70	Target due to cultural source
91	6382429	1971179	268	Target due to cultural source
92	6382432	1971181	61	Target due to cultural source
93	6382427	1971183	628	Target due to cultural source
94	6382423	1971184	77	Target due to cultural source
95	6382425	1971187	95	Target due to cultural source
96	6382430	1971188	73	Target due to cultural source
97	6382431	1971191	65	Target due to cultural source
98	6382430	1971193	66	Target due to cultural source
99	6382432	1971199	69	Target due to cultural source
100	6382437	1971199	87	Target due to cultural source
101	6382434	1971201	62	Target due to cultural source
102	6382436	1971204	71	Target due to cultural source

Table 2
Mag Targets

Target ID	X (easting)	Y (northing)	Grid Value (gamma)	Classification
103	6382440	1971207	48	Target due to cultural source
104	6382443	1971208	33	Target due to cultural source
105	6382440	1971212	57	Target due to cultural source
106	6382444	1971215	73	Target due to cultural source
107	6382445	1971222	54	Target due to cultural source
108	6382455	1971223	39	Target due to cultural source
109	6382451	1971232	61	Target due to cultural source
110	6382454	1971233	56	Target due to cultural source
111	6382462	1971233	35	Target due to cultural source
112	6382467	1971233	37	Target due to cultural source
113	6382465	1971235	32	Target due to cultural source
114	6382460	1971236	91	Target due to cultural source
115	6382454	1971238	50	Target due to cultural source
116	6382465	1971238	35	Target due to cultural source
117	6382456	1971241	76	Target due to cultural source
118	6382460	1971242	64	Target due to cultural source
119	6382457	1971243	62	Target due to cultural source
120	6382463	1971251	31	Target due to cultural source
121	6382471	1971253	39	Target due to cultural source
122	6382474	1971254	50	Target due to cultural source
123	6382466	1971255	41	Target due to cultural source
124	6382487	1971255	32	Target
125	6382464	1971255	41	Target due to cultural source
126	6382467	1971258	84	Target due to cultural source
127	6382476	1971258	42	Target due to cultural source
128	6382471	1971259	38	Target due to cultural source
129	6382480	1971259	32	Target due to cultural source
130	6382485	1971259	167	Target
131	6382467	1971260	62	Target due to cultural source
132	6382474	1971261	37	Target due to cultural source
133	6382471	1971263	84	Target due to cultural source
134	6382478	1971263	40	Target due to cultural source
135	6382487	1971265	377	Target
136	6382471	1971267	90	Target due to cultural source
137	6382477	1971269	71	Target due to cultural source
138	6382473	1971273	113	Target due to cultural source
139	6382484	1971274	34	Target due to cultural source
140	6382482	1971278	60	Target due to cultural source
141	6382477	1971281	41	Target due to cultural source
142	6382484	1971281	100	Target due to cultural source
143	6382486	1971285	34	Target due to cultural source
144	6382480	1971285	52	Target due to cultural source
145	6382493	1971285	41	Target due to cultural source
146	6382485	1971289	46	Target due to cultural source
147	6382484	1971292	66	Target due to cultural source
148	6382495	1971292	34	Target due to cultural source
149	6382487	1971294	54	Target due to cultural source
150	6382487	1971299	77	Target due to cultural source
151	6382495	1971300	35	Target due to cultural source
152	6382492	1971301	36	Target due to cultural source
153	6382490	1971303	60	Target due to cultural source

Table 2
Mag Targets

Target ID	X (easting)	Y (northing)	Grid Value (gamma)	Classification
154	6382497	1971303	104	Target due to cultural source
155	6382493	1971306	40	Target due to cultural source
156	6382503	1971308	44	Target due to cultural source
157	6382496	1971310	41	Target due to cultural source
158	6382493	1971311	48	Target due to cultural source
159	6382499	1971312	83	Target due to cultural source
160	6382495	1971313	47	Target due to cultural source
161	6382503	1971313	45	Target due to cultural source
162	6382498	1971317	71	Target due to cultural source
163	6382500	1971318	98	Target due to cultural source
164	6382500	1971322	87	Target due to cultural source
165	6382502	1971324	79	Target due to cultural source
166	6382509	1971326	30	Target due to cultural source
167	6382506	1971327	39	Target due to cultural source
168	6382508	1971330	59	Target due to cultural source
169	6382506	1971332	87	Target due to cultural source
170	6382513	1971334	32	Target due to cultural source
171	6382509	1971336	41	Target due to cultural source
172	6382515	1971338	102	Target due to cultural source
173	6382521	1971340	37	Target due to cultural source
174	6382511	1971341	33	Target due to cultural source
175	6382517	1971347	44	Target due to cultural source
176	6382521	1971348	64	Target due to cultural source
177	6382527	1971349	35	Target due to cultural source
178	6382516	1971350	80	Target due to cultural source
179	6382526	1971353	31	Target due to cultural source
180	6382531	1971376	52	Target due to cultural source
181	6382564	1971405	100	Target
182	6382561	1971410	115	Target
183	6382555	1971412	114	Target
184	6382559	1971415	250	Target
185	6382556	1971415	108	Target
186	6382609	1971485	483	Target
187	6382604	1971488	783	Target due to cultural source
188	6382627	1971491	33	Target
189	6382602	1971492	116	Target due to cultural source
190	6382605	1971494	194	Target due to cultural source
191	6382628	1971496	46	Target
192	6382620	1971518	1011	Target
193	6382623	1971518	495	Target
194	6382623	1971522	1099	Target
195	6382628	1971525	262	Target
196	6382625	1971525	521	Target
197	6382627	1971528	432	Target
198	6382682	1971621	563	Target
199	6382684	1971624	1287	Target
200	6382680	1971625	215	Target
201	6382695	1971644	33	Target
202	6382701	1971647	31	Target