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NIROP FRIDLEY
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DEPARTMENT OF THE NAVY
NORTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
PHILADELPHIA, PENNSYLVANIA 19112

RECEIVED
JUL 18 1983
MINN. POLLUTION
CONTROL AGENCY

(215) 755-4972

114/646/DRS

12 JUL 1983

Mr. Micheal Ayers
Regulatory Compliance Section
Solid and Hazardous Waste Division
Minnesota Pollution Control Agency
1935 West County Road B2
Roseville, MN 55113 - 2785

Re: Naval Industrial Reserve Ordnance Plant (NIROP) Fridley, MN

Dear Mr. Ayers:

As agreed during your 20 May 1983 meeting with the Corps of Engineers and the Navy, the Geophysical Survey Report for NIROP Fridley, MN is enclosed for your review and information. Dynamac Corporation has been directed to prepare plans and specifications for NIROP Site Cleanup, Fridley, MN based on the conclusion (Part III) of the enclosed Geophysical Survey Report. The plans and specification will be sent to your office, upon completion, for review and comment.

If there are any questions concerning the subject matter please contact Mr. David Smith, Environmental Engineer, Code 1142, Northern Division, Naval Facilities Engineering Command (NORTHNAVFACENGCOM) telephone (215) 755-4972/4712.

Sincerely

A. RHOADS
By direction

Copy to:
NAVSEASYSCOM (NAVSEA+56Y4 and NAVSEA-0705)
NAVPRO Fridley, MN
NAVFACENGCOM (1121B/PAP)

GEOPHYSICAL SURVEY REPORT
FOR
NAVAL INDUSTRIAL RESERVE ORDNANCE PLANT (NIROP)
FRIDLEY, MINNESOTA
5 JULY 1983

1. The initial Conductivity and Magnetometer Surveys were performed on 9 through 18 May 1983 in the area of the suspected waste dumping at the Naval Industrial Reserve Ordnance Plant in Fridley, Minnesota. These surveys were conducted by personnel of the Missouri River Division Laboratory, U.S. Army Corps of Engineers, Omaha, Nebraska. The results of the Conductivity Survey, dated 27 May 1983, and the Magnetometer Survey, dated 6 June 1983, were discussed in detail with representatives of the U.S. Navy and a specialist employed by the Hazardous Materials Technical Center of Rockville, Maryland. As a result of the detailed discussion, representatives of the Hazardous Materials Technical Center, using the Geophysical Reports, aerial photographs, and the initial NEESA Assessment Study, recommended areas for excavation and removal of known hazardous wastes and debris. The Hazardous Materials Technical Center Report is included as Part III of this Geophysical Survey Report. The sites to be excavated and materials removed are identified on the Conductivity Map, Figure 2, page 19, as the following:

High Priority Sites	Intermediate Priority Sites	Low Priority Sites
3, 5 and 18	7, 6 and 10	15, 17 and 19

2. In the Hazardous Waste Technical Center's analysis, an area was identified from aerial photograph pairs AA-12-26 and AA-12-27, dated 4-26-62, as being a possible location of buried waste beneath the railroad tracks near Site 15. This area is shown on Part III, page 39. Our analysis indicates this feature appears to be equipment or materials stored on the ground. HMTC included this in their report for information purposes. If the low priority sites, Nos. 15, 17 and 19 are found to contain hazardous wastes, then it will be necessary to re-evaluate other sites that are not scheduled to be excavated, particularly Site Nos. 8 and 9, which registered low conductivity during the initial survey.

Index to Geophysical Report

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PART II Magnetometer Survey.....pages 20 thru 33
PART III Hazardous Material Technical Center Analysis....pages 34 thru 39

PART I

CONDUCTIVITY SURVEY

27 MAY 1983

DEPARTMENT OF THE ARMY
MISSOURI RIVER DIVISION, CORPS OF ENGINEERS
DIVISION LABORATORY
OMAHA, NEBRASKA 68102

MRD Lab. No. 83/163

Sheet 1 of 7

27 MAY 1983

Subject: NIROP, Fridley, MN, Geophysical Survey to Locate Buried Waste Sites - Report Series No. 1

Project: NIROP, Fridley, MN

Intended Use:

Source of Material:

Submitted by: Chief, Engineering Division, Omaha District

Date Sampled: May 4 - May 18, 1983, Date Received:

Method of Test or Specification: Geophysical Survey by Conductivity Meter and Magnetometer

References: Letter Request dated 1 April 1983.

INTRODUCTION

1. Missouri River Division Laboratory representatives, Messrs. Mitchell and Baxter, traveled on May 3, 1983 to NIROP, Fridley, MN to comply with the letter request referenced above. The purpose of the trip was to conduct Electrical Conductivity and Proton Magnetometer surveys of a storage yard at the NIROP facility to locate and determine the extent of possible burial sites of waste materials.

EQUIPMENT

2. Two geophysical instruments were used with the intent of producing redundant information as verification of the site locations. The instruments consisted of a Conductivity Meter and a Proton Magnetometer.

3. The Conductivity Meter is an instrument transported approximately 3 feet above the ground surface by the operator. An electrical field is induced in the earth's surface beneath one end of the sensor boom by a coil. At 3.66 meters from the transmitting coil a sensing coil is located to measure the induced electrical field. A change in the constituency of the intervening earth is reflected by a change in the measurement of the induced electrical field. Thus sites of conductivity greater than or less than normal in the area investigated can be delineated.

4. The Proton Magnetometer is an instrument carried by the operator above the ground surface and is used to measure the earth's magnetic flux. Magnetic materials cause a distortion in the earth's magnetic flux pattern. By determining the locations of such anomalies, magnetic materials can be located.

MRD FORM 115 EDITION OF FEB 67 IS OBSOLETE

SURVEY AREA DESCRIPTION

5. The NIROP storage yard consists of 3 distinct areas. 1) A pie-shaped east area bordered on its north by a steel mesh fence, its west by a propane gas storage facility and access road, and on its south and east by curving railroad tracks. 2) A center area bordered on its east by the propane gas storage facility, its north by the steel mesh fence, its west by the main access road to the manufacturing area, and to its south by the railroad tracks. 3) A west area bordered on its east by the main access road, its north by the steel mesh fence, its west by the continuation of the uncleared storage yard designated by NIROP as sector 4, and its south by the railroad tracks.

6. In the center and west areas the north edge of the investigation was limited by the presence of steel tables, used to store steel armour plate, and footings of old buildings. These impediments are depicted in the base map of Figure 1.

7. In the east area an asphalt landing strip and a propane gas line are present and depicted in the base map of Figure 1.

8. An electrical system for the yard lights is present in all three areas and is depicted on the base map of Figure 1.

SURVEY PROCEDURE

9. Each area was investigated in the same manner. The data was collected systematically for each area by establishing a grid system of primary data points on 50 foot centers and then at secondary points on 25 foot centers. The primary points were physically determined by driving red flagged stakes for each point. The secondary points were taken at the mid-points between the primary points and at the intersection of the primary diagonals. The base lines for the east section were taken at the east edge of the asphalt of the propane storage facility and the fence on the north. The zero measuring point of the base line is the intersection of these two lines. For the center and west areas the baselines consisted of the west edge of the concrete of the propane storage area and the fence. The intersection of those two lines is the zero measuring point. The two baseline zero points are depicted on all the map figures and are to be used as the point of departure for all measurements. The red flagged grid system was left intact upon completion of the survey, May 18, 1983.

10. Upon completing the grid system for an area the electrical conductivity survey was performed. This consisted of establishing a reference point for checking the zero drift of the instrument. Point K-13 was used for the east and center areas, and point M-14 was used for the west area.

The equipment indicated no drift during the duration of the survey. Following the check of the instrument's zero, each primary and then each secondary data point was surveyed by taking four readings of the conductivity meter in mutually perpendicular directions to ascertain the high and low conductivity of the earth beneath the data point. An average earth conductivity was calculated for each data point. The readings and the calculated average earth conductivity are recorded in Tables 1, 2 and 3 for the east, center, and west areas. The data point conductivity values were then plotted on the conductivity contour map, Figure 2. Contours of equal conductivity value were drawn. The contours indicate areas of high and low conductivity which constitute possible waste burial sites. With the location of these interest areas the operators returned with the conductivity meter and attempted to define the limits of the interest areas. This was done by determining where the instrument readings indicate a significant and abrupt change. At this point a stake was driven and flagged with a contrasting pink or blue flag. Pink flagging was used in the center and east areas as the possible burial sites were separated widely enough to eliminate confusion as to what area was being defined. In the west area the possible burial sites are somewhat congested with nearly mutual borders leading to the use of blue flags for low conductivity and pink flags for high conductivity areas. Following the delineation of the possible burial sites with stakes in the field, the stake position grid coordinates were measured and their locations plotted on the grid contour map of Figure 1. The flagged stakes denoting the possible burial site perimeters were left in place upon completion of the survey. Each of the possible burial sites will be discussed further on in this report.

11. After gathering conductivity meter data in an area the proton magnetometer was taken, in the same manner as the conductivity meter, to each data gathering point. The proton magnetometer readings are subject to a diurnal shift which is time dependant. Thus a reading at the reference points was made before initiating and at the time of completing the survey. At each data point 4 magnetometer readings and a time reading were made. The readings were then averaged and corrected for the diurnal shift effect. The magnetometer data are included in Tables 4, 5 and 6. As with the conductivity meter data the magnetometer data was plotted and contoured on a contour map, Figure 3.

SURVEY LIMITATIONS

12. In discussing the interpretation of the conductivity meter and magnetometer data the presence of interference and limiting factors must be noted. These factors consist of conductive or magnetic materials that occur in, on and around the storage yard. All such factors and their location are noted on the base map, Figure 1. One factor not noted is the

western termination of the storage yard survey area. The western edge of the west area terminates in the active storage yard. At this juncture there are large pieces of equipment having considerable areal extent and great mass. Both the conductivity and magnetometer data are affected and thus there are no data for the western most survey points plotted on the 2 maps. Along the northern edge of the west area are steel tables for armour plate storage. The effect of these tables is to raise the conductivity values within 25 feet of the tables and to drastically distort the magnetometer data to a distance of 100 feet. Also along this border is a fence and footings for a building that affected the readings between the fence and the tables. Along the south edge of the west area is a buried electrical system that increases the conductivity data values to a distance of 75 feet on either side of it. The location of the electrical system is noted on the base map. In the center area there are steel tables in the northwest corner; a fence along the northern edge; propane tanks, an asphalt road and concrete pad along the east edge; the buried electrical system along the south edge; and an electrical switching box, a propane filling station, and propane pipes in the southeast corner. Thus there are no data for the northwest corner survey points and conductivity values are increased in the vicinity of the electrical system and pipelines. In the east area, interference is propagated by the fence on the north, the propane tanks on the west, the electrical system in the southwest corner, the intersection of the fence and railroad tracks in the northeast corner, and the propane pipeline through the center of the area. An asphalt airstrip also exists in the east area but exerts no detectable influence on the data readings. This would indicate that the asphalt is thin and of poor quality and exhibits electrical and magnetic properties nearly identical to the earth on which it was placed. Along all of the southern edges of the 3 areas are railroad tracks which considerably modify both the conductivity and magnetometer data. The magnetometer data appears to be so highly deranged by these factors that its credence is suspect. Thus the following discussion is based on conductivity data.

BURIAL SITE DISCUSSION

13. As stated previously, contouring of the conductivity data on the contour map of Figure 2 lead to the indication of areas having lower and higher conductivity than the surrounding area. Twenty such areas are delineated on the contour map. Each area is discussed in the next paragraphs.

A.1. This area centers around a data point that indicates an anomalous no value reading. The value of conductivity is lower than that recordable by the conductivity meter. The indication is of a perfect insulator. In delineating this area with blue flagged stakes it was found that a footing exists at the north end and an asphalt path extends from there to the southeast. The asphalt and footing are probably the only materials in this site.

A.2. Site 2 centers around an anomalous no value reading and is supported by a low reading immediately to the west. No materials were discovered to explain the low readings in this site. The probable cause of these readings is due to buried rubble and concrete which may also contain waste materials.

A.3. Site 3 was predicated on the distortion of the 20 millimho contour line and the high conductivity values around the distortion. In tracing the perimeter of the site it was found that an abrupt although small change in conductivity occurs. The area extends to the east and encompasses a known waste barrel find. The site also corresponds to a trench area described in the NEESA Report 13-029.

A.4. Site 4 centers around another anomalous no value reading. Within the perimeter of the site there is no reading on the conductivity meter. There are no surface or near surface indications of what is buried here. The supposition is that concrete or asphalt may be buried. The site is narrow with fairly straight sides possible indicating a covered asphalt path.

A.5. Site 5 was evidenced by high conductivity values nearly surrounded by lower values. Upon definition of the site a geometrically shaped area with very abrupt edges was delineated. The high conductivity values indicate metallic materials are probably buried and is a prime waste burial site.

A.6. Site 6 is evidenced by relatively high conductivity readings. In attempting to determine a perimeter for the site no edges could be located except at the west side. In the other 3 directions there is a gradual change in the readings and no definitive change can be ascertained. The buried electrical conduit is within 40 feet of these data points and is probably responsible for masking the edge effects. Since the area corresponds to a purported burial site it is delineated as a possible waste burial site.

A.7. Site 7 exhibits similarities to Site 6 having high conductivity values with indefinite edges. Again the site edge effects are probably masked by the buried electrical system as its proximity is closer than in the case of Site 6.

A.8. Site 8 is an area of relatively low conductivity and corresponds to a burial area near the west end described by an FMC employee as a rubble burial site. Because of the non-conductive nature of rubble some conductive materials may be present and their expression masked. This site perimeter was not determined.

A.9. Site 9 is similar to Site 8 and may correspond to an area located by MPCA personnel in air photos. It is quite non-conductive and probably contains only rubble. This site perimeter was not determined.

A.10. Site 10 is a high conductivity area whose perimeter was unsuccessfully delineated due to indistinct edge effects. The high conductivity values indicate a possible waste dump site.

A.11. Site 11 is a high conductivity area that is related to surface effects. It is in a topographic low area with high moisture content and foundry sand disposal. Both factors would tend to give high conductivity values. Also the nearness of the buried electrical system affects the measurements. This area is probably not a waste material burial site. The site perimeter was not determined.

A.12. Site 12 is related to the effect of the electrical system and the disposal of foundry sand. The area is of a high conductivity nature. Considerable foundry sand has been disposed of here and is not considered to be a waste burial area. The perimeter was not determined.

A.13. Site 13 is a high conductivity area. There is a large quantity of foundry sand, slag and furnace clinkers on the surface. The site conductivity is considered to be due to the surface disposal of these materials and is probably not a burial site. The perimeter of the site was not determined.

A.14. Site 14 is an area of very low conductivity with an anomalous no value reading near its center. This is probably a burial site of excess concrete and/or asphalt from the construction of the propane tank storage facility. The perimeter of the area is very abruptly defined by the instrument readings.

A.15. Site 15 was a very difficult area to delineate due to the proximity of the electrical system, the railroad tracks and the propane filling station. The site corresponds to a possible burial site indicated by MPCA studies of air photos. There are abrupt edges to the perimeter with the east edge probably due to the propane pipe and buried electrical conduit. Foundry sands are also present on this site.

A.16. Site 16 is within the area denoted by the 30 millimho contour lines. It conforms to the location of the propane pipeline that traverses the center of the east area. The trace of the pipeline was defined in the field by yellow flagged stakes located by using the conductivity meter. This delineation corresponds with the breather pipes at the railroad tracks and the emergence of the pipes in the propane storage facility.

A.17. Site 17 corresponds to an area of low conductivity. The perimeters of the site exhibit abrupt conductivity meter reading changes. Although the site exhibits low readings, according to testimony gathered by USN personnel from FMC employees barrels may be buried with the rubble, particularly in the east area.

A.18. Site 18 also corresponds to an area recorded in testimony as a burial site. This site exhibits 3 very straight edges and a fourth edge that is indistinct, which seems to correspond to a pit dug by a back hoe. It is also narrow, being slightly wider than a barrel's dimension when laid on its side. This is most probably a waste material burial site.

A.19. Site 19 corresponds to testimony describing a burial site near the railroad track fence gate. This site exhibits low conductivity values when compared to the surrounding area. Upon establishing the perimeter of the site the edges were easily distinguished by abrupt changes of the conductivity meter readings. Considering the low values, rubble is most probably buried at this site, however barrels of waste material may be included in the rubble.

A.20. Site 20 lies directly beneath the airstrip asphalt. The site exhibits high conductivity and a geometric shape that is similar to that of a creek or stream outfall. Prior to the construction of the airstrip a small ditch or stream existed in this area. This then may be a drainage related structure built with reinforced concrete and steel conduit. This most probably is not a waste material burial site.

CONCLUSION

14. The electrical conductivity meter has produced the most creditable results of the two methods used. Thus at this writing the conductivity meter data and interpretation is presented. The conductivity meter survey indicates that considerable burial activity has occurred in the east and west areas of the NIROP storage yard. The center area shows very little evidence of such activity, however there is an indication of considerable dumping of foundry sands and wastes on the earth's surface. In the west area Sites 3, 5, 6, and 7 seem to be the most likely waste material burial areas and Sites 8, 9. and 10 are possible burial areas. In the center area Site 15 occurs as the most likely burial area. In the east area Sites 17, 18 and 19 appear to be the most likely burial areas.

Submitted by:

R. K. SCHLENKER, P.E.
Director, MRD Laboratory

TABLE 1

NIROP · EAST AREA · CONDUCTIVITY

DATA NO.	SCALE	READING				AVE READING	MILLIMHOS
K-1	30	0.62	0.62	0.60	0.60	0.610	18.30
K-2	30	0.65	0.64	0.65	0.65	0.643	19.30
K-3	30	0.61	0.62	0.62	0.62	0.620	18.60
K-4	30	0.72	0.74	0.71	0.71	0.720	21.60
K-5	30	0.67	0.70	0.69	0.65	0.678	20.33
K-6	300	0.48	0.54	0.53	0.48	0.508	152.25
K-7	30	0.54	0.53	0.50	0.51	0.525	15.75
K-8	30	0.52	0.52	0.52	0.51	0.517	15.53
K-9	30	0.66	0.67	0.65	0.66	0.660	19.80
K-10	30	0.55	0.56	0.55	0.56	0.555	16.65
K-11	30	0.64	0.66	0.68	0.67	0.663	19.88
K-12	30	0.61	0.61	0.61	0.62	0.612	18.38
K-13	30	0.66	0.66	0.66	0.66	0.660	19.80
K-14	30	0.82	0.82	0.84	0.86	0.830	24.90
K-15	100	0.31	0.30	0.23	30x0.89		27.35
K-16	100	0.30	0.22	0.16	0.22	0.225	22.50
K-17	100	0.21	0.21	0.20	0.20	0.205	20.50
K-18	100	0.20	0.24	0.37	0.39	0.300	30.00
K-19	100	0.23	0.23	0.22	0.22	0.228	22.00
K-20	100	0.30	0.31	0.30	0.31	0.305	30.50
K-21	100	0.24	0.25	0.26	0.26	0.252	25.25
K-22	100	0.27	0.30	0.31	0.33	0.300	30.00
K-23	100	0.21	0.21	0.21	0.22	0.212	21.25
K-24	100	0.17	0.17	0.17	0.17	0.170	17.00
K-25	100	0.16	0.28	0.11	0.28	0.208	20.75
K-26	30	0.81	0.11	0.68	10x0.38		12.95
K-27	30	0.67	0.70	0.68	0.71	0.687	20.63
K-28	30	0.13	0.14	0.30	0.36	0.232	6.98
K-29	100	0.36	0:39	0.42	0.44	0.402	40.25
J-1	30	0.76	0.79	0.75	0.74	0.760	22.80
J-2	30	0.48	0.65	0.72	0.69	0.635	19.05
J-3	30	0.69	0.76	0.75	0.75	0.737	22.12
J-4	30	0.76	0.58	0.48	0.60	0.605	18.15
J-5	30	0.74	0.69	0.63	0.72	0.695	20.85
J-6	30	0.71	0.74	0.74	0.73	0.727	21.82
J-7	100	0.30	0.31	0.30	0.30	0.302	30.25
J-8	30	0.72	0.76	0.74	0.73	0.738	22.13
J-9	30	0.57	0.63	0.61	0.60	0.603	18.09
J-10	30	0.51	0.51	0.49	0.50	0.500	15.00
J-11	30	0.88	0.89	0.85	0.83	0.865	25.95
J-12	30	0.64	0.63	0.65	0.64	0.640	19.20
J-13	30	0.64	0.63	0.66	0.65	0.645	19.35
J-14	30	0.58	0.58	0.58	0.58	0.580	17.40
J-15	30	0.58	0.58	0.58	0.60	0.585	17.55
J-16	30	0.60	0.60	0.60	0.60	0.600	18.00
J-17	30	0.56	0.56	0.60	0.60	0.580	17.40
J-18	30	0.65	0.67	0.67	0.67	0.665	19.95

TABLE 1 (cont'd)

NIROP • EAST AREA • CONDUCTIVITY

DATA NO.	SCALE	READING				AVE READING	MILLIMHOS
J-19	30	0.56	0.56	0.56	0.58	0.565	16.95
J-20	30	0.57	0.58	0.58	0.56	0.572	17.18
J-21	30	0.78	0.76	0.73	0.72	0.747	22.42
J-22	30	0.70	0.72	0.67	0.68	0.713	21.52
J-23	30	0.82	0.81	0.85	0.84	0.830	24.90
J-24	30	0.72	0.70	0.79	0.76	0.743	22.30
J-25	30	0.63	0.62	0.64	0.64	0.633	18.98
J-26	30	0.72	0.70	0.73	0.72	0.717	21.52
J-27	30	0.63	0.63	0.63	0.62	0.625	18.75
J-28	30	0.70	0.70	0.69	0.69	0.695	20.85
J-29	100	0.34	0.36	0.34	0.35	0.348	34.75
J-30	100	0.37	0.44	0.44	30x0.61		29.92
J-31	100	0.39	0.40	0.41	0.40	0.400	40.00
J-32	100	0.45	0.30	0.13	0.13	0.252	25.25
J-33	100	0.36	0.35	0.37	0.35	0.358	35.75
J-34	30	0.33	0.36	0.32	0.33	0.335	10.05
J-35	30	0.91	0.80	0.83	100x0.35		30.20
J-36	30	0.61	0.64	0.63	0.64	0.630	18.90
J-37	30	0.64	0.67	0.66	0.65	0.660	19.80
J-38	30	0.66	0.51	0.91	100x0.32		26.40
J-39	30	0.85	0.83	0.83	0.83	0.835	25.05
J-40	30	0.83	0.83	0.80	0.79	0.813	24.38
J-41	30	0.64	0.62	0.64	0.62	0.630	18.90
J-42	30	0.89	0.86	0.38	0.14	0.568	17.02
J-43	30	0.70	0.72	0.90	100x0.29		26.10

TABLE 2

NIROP · CENTER AREA · CONDUCTIVITY

DATA NO.	SCALE	READING				AVE READING	MILLIMHOS
M-1	30	0.62	0.67	0.62	0.62	0.633	18.98
M-2	30	0.57	0.57	0.55	0.56	0.563	16.88
M-3	30	0.58	0.58	0.60	0.60	0.590	17.70
M-4	30	0.69	0.70	0.63	0.64	0.665	19.95
M-7	30	0.55	0.52	0.57	0.55	0.548	16.43
M-8	30	0.61	0.61	0.59	0.61	0.605	18.15
M-9	30	0.72	0.72	0.72	0.72	0.720	21.60
M-10	30	0.66	0.66	0.67	0.64	0.658	19.72
M-11	30	0.64	0.64	0.66	0.66	0.650	19.50
M-12	30	0.58	0.56	0.61	0.62	0.592	17.78
M-13	30	0.58	0.58	0.59	0.59	0.585	17.55
M-14	30	0.66	0.67	0.65	0.65	0.658	19.72
M-15	30	0.59	0.60	0.67	0.67	0.635	19.05
M-16	30	0.91	0.88	0.88	0.88	0.390	26.70
M-17	30	0.73	0.73	0.74	0.76	0.737	22.12
M-18	30	0.76	0.75	0.75	0.76	0.755	22.65
M-19	100	0.36	0.33	0.34	0.33	0.340	34.00
M-20	100	0.31	0.31	0.34	0.32	0.330	32.00
M-21	100	0.34	0.36	0.33	0.34	0.342	34.25
M-22	100	0.34	0.33	0.35	0.35	0.342	34.20
M-23	100	0.39	0.35	0.37	0.38	0.372	37.25
M-24	100	0.30	0.31	0.29	0.30	0.298	29.75
M-25	100	0.40	0.38	0.37	0.34	0.372	37.25
M-26	100	0.75	0.77	0.74	0.74	0.750	75.00
M-27	100	0.36	0.35	0.37	0.35	0.358	35.75
M-28	100	0.29	0.33	0.28	0.32	0.305	30.50
M-29	100	0.34	0.33	0.36	0.35	0.345	34.50
M-30	100	0.33	0.33	0.40	0.39	0.328	38.75
M-31	100	0.33	0.31	0.34	0.33	0.328	32.75
M-32	100	0.35	0.34	0.36	0.35	0.350	35.00
M-33	100	0.35	0.34	0.34	0.36	0.348	34.75
N-1	30	0.46	0.34	0.36	0.41	0.392	11.77
N-2	30	0.50	0.50	0.50	0.51	0.502	15.07
N-3	30	0.62	0.60	0.64	0.64	0.625	18.75
N-4	30	0.60	0.60	0.60	0.60	0.600	18.00
N-5	30	0.62	0.61	0.61	0.59	0.608	8.22
N-6	30	0.70	0.68	0.72	0.71	0.702	21.08
N-7	30	0.78	0.77	0.82	0.83	0.800	24.00
N-12	100	0.40	0.24	0.19	0.17	0.252	25.25
N-13	100	0.20	0.20	0.34	0.43	0.285	28.50
N-14	30	0.67	0.66	0.69	0.70	0.680	20.40
N-15	30	0.55	0.56	0.58	0.59	0.568	17.02
N-16	30	0.61	0.61	0.66	0.66	0.635	19.05
N-17	30	0.53	0.53	0.54	0.54	0.535	16.05
N-18	30	0.59	0.59	0.59	0.60	0.592	17.78
N-19	30	0.61	0.61	0.60	0.59	0.602	18.07
N-20	30	0.66	0.64	0.64	0.63	0.642	19.27

TABLE 2 (Cont'd.)

NIROP · CENTER AREA · CONDUCTIVITY

DATA NO.	SCALE	READING				AVE READING	MILLIMHOS
N-21	30	0.67	0.66	0.67	0.66	0.665	19.95
N-22	30	0.72	0.72	0.73	0.74	0.727	21.82
N-23	30	0.75	0.75	0.72	0.72	0.735	22.05
N-24	30	0.66	0.61			0.635	19.05
N-25	30	0.62	0.64	0.87	0.73	0.715	21.45
N-26	30	0.54	0.57	0.50	0.48	0.527	15.68
N-27	30	0.60	0.68	0.53	0.56	0.592	17.78
N-28	30	0.55	0.56	0.53	0.54	0.545	16.35
N-29	30	0.70	0.70	0.72	0.72	0.710	21.30
N-30	30	0.68	0.69	0.64	0.63	0.662	19.88
N-31	30	0.70	0.70	0.70	0.71	0.702	21.08
N-32	30	0.65	0.64	0.67	0.68	0.660	19.80
N-33	30	0.57	0.55	0.55	0.55	0.560	16.80
N-34	30	0.66	0.65	0.66	0.64	0.652	19.58
N-35	30	0.68	0.68	0.68	0.67	0.678	20.32
N-36	30	0.71	0.69	0.67	0.68	0.688	20.62
N-37	30	0.69	0.65	0.72	0.63	0.672	20.18
N-38	30	0.63	0.66	0.67	0.69	0.662	19.88
N-39	30	0.78	0.80	0.73	0.70	0.752	22.58
N-40	30	0.67	0.64	0.65	0.69	0.662	19.88
N-41	30	0.65	0.67	0.64	0.68	0.668	20.02
N-42	30	0.58	0.57	0.62	0.64	0.602	18.08
N-43	30	0.62	0.69	0.68	0.68	0.668	20.02
N-44	30	0.63	0.65	0.65	0.65	0.645	19.35
N-45	100	0.31	0.33	0.32	30x0.98		31.35
N-46	30	0.66	0.66	0.59	0.62	0.632	18.98
N-47	30	0.71	0.73	0.74	0.74	0.730	21.90
N-48	30	0.68	0.66	0.66	0.65	0.662	19.82
N-49	30	0.63	0.64	0.58	0.59	0.610	18.35
N-50	30	0.63	0.63	0.66	0.66	0.645	19.35
N-51	30	0.66	0.67	0.70	0.69	0.680	20.40
N-52	30	0.75	0.77	0.81	0.80	0.782	23.48
N-53	30	0.75	0.70	0.80	0.79	0.760	22.80
N-54	30	0.75	0.76	0.78	0.78	0.768	23.02
N-55	30	0.86	0.86	0.92	0.92	0.890	26.70
N-56	30	0.89	0.92	0.93	0.93	0.918	27.52
N-57	30	0.76	0.74	0.77	0.77	0.760	22.80
N-58	30	0.67	0.68	0.69	0.69	0.682	20.48
N-59	30	0.71	0.70	0.72	0.69	0.705	21.15
N-60	100	0.33	0.32	0.34	0.31	0.325	32.50
N-61	100	0.32	0.32	0.32	0.34	0.325	32.50
N-62	100	0.35	0.36	0.33	0.33	0.342	34.25
N-63	100	0.30	0.32	0.31	0.32	0.312	31.25
N-64	100	0.24	0.23	0.32	0.32	0.278	27.75
N-65A	100	0.24	0.23	0.23	0.23	0.232	23.25
N-67	100	0.44	0.40	0.44	0.41	0.422	42.25
N-68	30	0.88	0.93	0.84	0.86	0.878	26.32

TABLE 2 (Cont'd)

NIROP • CENTER AREA • CONTUCTIVITY

DATA NO.	SCALE	READING				AVE. READING	MILLIMHOS
N-69	30	0.79	0.79	0.79	0.79	0.788	23.65
N-70	30	0.84	0.86	0.85	0.84	0.848	25.42
N-71	30	0.98	0.99	0.98	100x0.32		30.75
N-72	30	0.94	0.99	0.91	0.91	0.938	28.12
N-73	100	0.31	0.33	0.32	0.32	0.320	32.00
N-74	100	0.32	0.35	0.33	0.33	0.332	33.25
N-75	100	0.41	0.44	0.39	0.39	0.408	40.75
N-76	100	0.48	0.52	0.48	0.50	0.495	49.50
N-77	100	0.48	0.52	0.53	0.53	0.515	51.50
N-78	100	0.47	0.50	0.53	0.50	0.500	50.00
N-79	100	0.47	0.50	0.55	0.59	0.523	52.75
N-80	100	0.38	0.42	0.40	0.41	0.402	40.25
N-81	100	0.30	0.32	0.32	0.33	0.318	31.75
N-82	100	0.33	0.35	0.36	0.37	0.352	35.25
N-83	100	0.36	0.37	0.36	0.37	0.365	36.50
N-84	100	0.41	0.40	0.35	0.36	0.380	38.00
N-85	100	0.30	0.31	0.31	0.33	0.312	31.25
N-86	100	0.32	0.32	0.34	0.35	0.332	33.25
N-87	100	0.42	0.42	0.42	0.42	0.420	42.00
N-88	100	0.34	0.37	0.35	0.32	0.345	34.50
N-89	30	0.56	0.53	0.61	0.60	0.575	17.25
N-90	30	0.65	0.64	0.67	0.66	0.655	19.65
N-91	30	0.62	0.61	0.62	0.62	0.617	18.52
N-92	30	0.59	0.57	0.61	0.62	0.607	18.22

TABLE 3

NIROP · WEST AREA · CONDUCTIVITY

DATA NO.	SCALE	READING				AVE READING	MILLIMHOS
P-1	30	0.56	0.60	0.52	0.52	0.550	16.50
P-2	30	0.61	0.64	0.33	0.33	0.487	14.62
P-3	30	0.68	0.80	0.48	0.52	0.620	18.60
P-4	30	0.56	0.53	0.51	0.50	0.525	15.75
P-5	30	0.72	0.80	0.53	0.52	0.662	19.88
P-6	100	0.34	0.40	0.30	0.30	0.330	33.00
P-7	30	0.88	0.69	0.79	100x0.48		35.80
P-8	100	0.59	0.41	0.20	0.22	0.355	35.50
P-11	30	0.57	0.58	0.53	0.55	0.557	16.72
P-12	3	0.00	0.38	0.10	10x0.62		3.82
P-13	30	0.53	0.51	0.50	0.51	0.513	15.38
P-14	30	0.57	0.56	0.59	0.58	0.575	17.25
P-15	30	0.49	0.49	0.51	0.51	0.500	15.00
P-16	30	0.49	0.47	0.47	0.48	0.477	14.32
P-17	30	0.59	0.58	0.59	0.57	0.583	17.48
P-18	30	0.53	0.53	0.52	0.52	0.525	15.75
P-19	30	0.73	0.73	0.72	0.73	0.730	21.90
P-20	30	0.63	0.64	0.64	0.64	0.640	19.20
P-21	30	0.67	0.65	0.63	0.63	0.645	19.35
P-22	30	0.57	0.58	0.58	0.59	0.580	17.40
P-23	30	0.69	0.69	0.69	0.68	0.685	20.55
P-24	30	0.62	0.61	0.58	0.57	0.595	17.85
P-25	30	0.50	0.49	0.51	0.51	0.503	15.08
P-26	30	0.56	0.57	0.57	0.57	0.567	17.02
P-29	100	0.34	0.32	0.31	0.31	0.320	32.00
P-30	100	0.37	0.40	0.35	0.36	0.370	37.00
P-31	100	0.65	0.65	0.64	0.65	0.650	65.00
P-32	100	0.37	0.37	0.35	0.36	0.360	36.00
P-33	100	0.34	0.36	0.39	0.41	0.375	37.50
P-34	100	0.40	0.43	0.39	0.41	0.408	40.75
P-35	100	0.40	0.43	0.38	0.40	0.402	40.25
P-36	100	0.37	0.40	0.36	0.38	0.378	37.75
P-37	100	0.36	0.34	0.34	0.34	0.345	34.50
P-38	100	0.35	0.33	0.34	0.34	0.340	34.00
P-39	100	0.34	0.34	0.34	0.34	0.340	34.00
P-40	100	0.40	0.40	0.40	0.39	0.398	39.75
P-41	100	0.48	0.45	0.37	0.41	0.430	43.00
P-42	100	0.27	0.26	0.36	0.36	0.312	31.25
P-43	100	0.27	0.25	0.24	0.23	0.248	24.75
P-44	100	0.27	0.25	0.24	0.25	0.252	25.25
S-1	30	0.70	0.72	0.70	0.70	0.705	21.15
S-2	30	0.77	0.76	0.75	0.75	0.757	22.72
S-3	30	0.76	0.80	0.77	0.78	0.777	23.32
S-4	30	0.71	0.68	0.78	0.78	0.737	22.12
S-5	30	0.83	0.82	0.84	0.84	0.833	24.98
S-6	30	0.82	0.81	0.80	0.80	0.807	24.22
S-7	30	0.79	0.79	0.80	0.81	0.797	23.92

TABLE 3 (Cont'd)

NIROP • WEST AREA • CONDUCTIVITY

DATA NO.	SCALE	READING				AVE READING	MILLIMHOS
S-8A	30	0.83	0.83	0.81	0.82	0.823	24.68
S-8B	30	0.81	0.79	0.83	0.83	0.815	24.45
S-9	30	0.75	0.74	0.78	0.79	0.765	22.95
S-10	30	0.68	0.68	0.70	0.70	0.690	20.70
S-11	30	0.66	0.66	0.67	0.67	0.665	19.95
S-12	30	0.69	0.69	0.70	0.70	0.695	20.85
S-13	30	0.83	0.82	0.81	0.81	0.817	24.52
S-14	10	0.32	0.40	0.00	3X0.80		3.00
S-15	30	0.65	0.64	0.68	0.68	0.663	19.90
S-16	30	0.56	0.56	0.59	0.59	0.575	17.25
S-17	30	0.66	0.69	0.52	0.48	0.587	17.62
S-18	30	0.92	0.94	0.63	0.63	0.780	23.40
S-19	30	0.93	0.64	0.64	100X0.34		28.05
S-20	30	0.85	0.62	0.63	100X0.33		27.00
S-21	100	0.38	0.37	30X0.69	30X0.72		29.32
S-22	30	0.75	0.68	0.53	0.53	0.623	18.68
S-23	30	0.86	0.75	0.61	0.58	0.700	21.00
S-24	30	0.40	0.40	0.36	0.43	0.397	11.92
S-25	30	0.63	0.62	0.63	0.61	0.623	18.68
S-26	30	0.56	0.56	0.54	0.54	0.550	16.50
S-27	30	0.62	0.63	0.58	0.58	0.603	18.09
S-28	30	0.50	0.53	0.53	0.53	0.520	15.60
S-29	30	0.44	0.48	0.41	0.42	0.437	13.12
S-30	30	0.53	0.56	0.51	0.52	0.530	15.90
S-31	30	0.60	0.60	0.60	0.61	0.603	18.09
S-32	30	0.58	0.57	0.56	0.55	0.565	16.95
S-33	30	0.62	0.62	0.60	0.60	0.610	18.30
S-34	30	0.55	0.55	0.56	0.56	0.555	16.65
S-35	30	0.51	0.51	0.51	0.51	0.510	15.30
S-36	30	0.49	0.50	0.50	0.51	0.500	15.00
S-37	30	0.69	0.69	0.67	0.67	0.680	20.40
S-38	30	0.64	0.66	0.68	0.68	0.667	20.02
S-39	30	0.55	0.55	0.56	0.57	0.557	16.72
S-40	30	0.50	0.50	0.50	0.50	0.500	15.00
S-42	30	0.50	0.51	0.50	0.50	0.503	15.08
S-43	30	0.61	0.59	0.60	0.60	0.600	18.00
S-44	30	0.55	0.55	0.52	0.52	0.535	16.05
S-45	30	0.60	0.59	0.64	0.64	0.617	18.52
S-46	30	0.52	0.52	0.52	0.53	0.523	15.68
S-47	30	0.43	0.48	0.42	0.49	0.455	13.65
S-48	30	0.53	0.52	0.45	0.44	0.485	14.55
S-49	30	0.50	0.48	0.56	0.54	0.520	15.60
S-50	30	0.60	0.60	0.55	0.55	0.575	17.25
S-51	30	0.56	0.58	0.60	0.59	0.582	17.48
S-52	30	0.61	0.60	0.62	0.62	0.613	18.38
S-53	30	0.60	0.63	0.59	0.58	0.600	18.00
S-54	30	0.53	0.54	0.51	0.53	0.527	15.82

TABLE 3 (cont'd)

NIROP · WEST AREA · CONDUCTIVITY

DATA NO.	SCALE	READING				AVE READING	MILLIMHOS
S-55	30	0.62	0.62	0.60	0.60	0.610	18.30
S-56	30	0.52	0.52	0.55	0.55	0.535	16.05
S-57	30	0.64	0.63	0.65	0.65	0.643	19.28
S-58	30	0.62	0.64	0.68	0.69	0.657	19.72
S-59	10	0.47	0.00	0.00	3X0.21		5.33
S-60	30	0.45	0.33	0.64	0.63	0.513	15.38
S-61	30	0.67	0.65	0.70	0.65	0.668	20.03
S-62	30	0.60	0.61	0.61	0.62	0.610	18.30
S-63	30	0.50	0.51	0.50	0.48	0.498	14.93
S-64	30	0.57	0.58	0.57	0.56	0.570	17.10
S-65	30	0.56	0.55	0.53	0.55	0.548	16.42
S-67	30	0.55	0.55	0.55	0.55	0.550	16.50
S-68	30	0.46	0.46	0.48	0.48	0.470	14.10
S-69	30	0.50	0.49	0.50	0.51	0.500	15.00
S-70	30	0.64	0.66	0.68	0.69	0.688	20.03
S-71	30	0.64	0.64	0.65	0.65	0.645	11.35
S-72	30	0.60	0.60	0.58	0.60	0.595	17.85
S-73	30	0.63	0.63	0.64	0.64	0.635	19.05
S-74	30	0.47	0.48	0.48	0.47	0.425	14.25
S-75	30	0.73	0.73	0.72	0.73	0.728	21.82
S-76	30	0.71	0.71	0.71	0.71	0.710	21.30
S-77	30	0.71	0.71	0.72	0.72	0.715	21.45
S-78	30	0.70	0.70	0.70	0.70	0.700	21.00
S-79	30	0.70	0.70	0.71	0.71	0.705	21.15
S-80	30	0.69	0.69	0.69	0.69	0.690	20.70
S-81	30	0.68	0.67	0.68	0.67	0.675	20.25
S-82	30	0.74	0.74	0.74	0.74	0.740	22.20
S-83	30	0.74	0.72	0.74	0.75	0.738	22.13
S-84	30	0.81	0.80	0.85	0.53	0.823	24.68
S-85		0.00	0.00	0.35x3	0.26x10	0.913	0.91
S-86	30	0.60	0.60	0.65	0.65	0.625	18.75
S-87	30	0.55	0.55	0.55	0.55	0.550	16.50
S-88	30	0.55	0.55	0.55	0.55	0.550	16.50
S-89	30	0.60	0.60	0.60	0.60	0.600	18.00
S-90	30	0.56	0.58	0.61	0.60	0.588	17.63
S-91	30	0.70	0.69	0.69	0.68	0.690	20.70
S-92	30	0.96	1.00	0.93	0.94	0.963	28.88
S-93	100	0.33	0.35	0.32	0.32	0.330	33.00
S-94	100	0.42	0.41	0.46	0.42	0.428	42.75
S-95	100	0.46	0.51	0.48	0.49	0.485	48.50
S-96	30	0.64	0.64	0.68	0.71	0.668	20.03
S-97	100	0.39	0.40	0.43	0.41	0.408	40.75
S-98	100	0.38	0.41	0.38	0.38	0.388	38.75
S-99	100	0.36	0.39	0.36	0.36	0.368	36.75
S-100	100	0.38	0.35	0.36	0.36	0.363	36.25
S-101	100	0.44	0.48	0.47	0.42	0.453	45.25
S-102	100	0.51	0.54	0.62	0.58	0.563	56.25

TABLE 3 (Cont'd)

NIROP • WEST AREA • CONDUCTIVITY

DATA NO.	SCALE	READING				AVE READING	MILLIMHOS
S-103	100	0.46	0.49	0.49	0.46	0.475	47.50
S-104	100	0.37	0.40	0.36	0.35	0.370	37.00
S-105	100	0.46	0.49	0.50	0.49	0.455	48.50
S-106	100	0.35	0.37	0.36	0.35	0.379	35.75
S-107	100	0.21	0.32	0.30	0.19	0.255	25.50
S-108	100	0.43	0.42	0.45	0.41	0.425	42.75
S-109	100	0.36	0.28	0.27	0.24	0.288	28.75
S-110	100	0.40	0.42	0.39	0.38	0.375	39.75
S-111	100	0.39	0.42	0.38	0.36	0.388	38.75
S-112	100	0.67	0.25	0.25	0.25	0.255	25.50
S-113	100	0.28	0.31	0.28	0.29	0.290	29.00
S-114	100	0.31	0.34	0.32	0.33	0.325	32.50
S-116	100	0.32	0.31	0.37	0.37	0.343	34.25
S-117	100	0.26	0.29	0.27	0.27	0.278	27.75
S-118	100	0.26	0.28	0.26	0.26	0.265	26.50
S-119	100	0.33	0.31	0.30	0.30	0.310	31.00
S-120	100	0.44	0.44	0.47	0.45	0.450	45.00
S-121	100	0.36	0.37	0.34	0.33	0.350	35.00
S-122	100	0.40	0.42	0.40	0.41	0.408	40.75
S-123	100	0.33	0.37	0.35	0.34	0.348	34.75
S-124	100	0.34	0.37	0.34	0.34	0.348	34.75

PART II

MAGNETOMETER SURVEY

6 JUNE 1983

DEPARTMENT OF THE ARMY
MISSOURI RIVER DIVISION, CORPS OF ENGINEERS
DIVISION LABORATORY
OMAHA, NEBRASKA 68102

MRD Lab. No. 83/163

Sheet 1 of 3

6 JUN 1983

Subject: NIROP, Fridley, MN Geophysical Survey to Locate Buried Waste Sites Report Series No. 2 (FINAL)

Project: NIROP Fridley, MN

Intended Use:

Source of Material:

Submitted by: Chief, Engineering Division, Omaha District

Date Sampled: May 4 - 18, 1983, Date Received:

Method of Test or Specification: Geophysical Survey by Conductivity Meter and Magnetometer

References: (A) Letter Request dated 1 April 1983
(B) MRD Lab No. 83/163, Report Series No. 1

INTRODUCTION

1. This report series concludes the discussion begun in Report Series No. 1, of the geophysical survey methods used in attempting to define buried waste sites at NIROP, Fridley, MN. The use of the proton magnetometer is discussed in this report. Report Series No. 1 must be referred to for a discussion of the equipment and survey methods used in the magnetometer survey.

BURIAL SITE DISCUSSION

2. Magnetometer data is presented in Tables 4, 5, and 6 and on the contour map of Figure 3. It is noted in the Tables that the readings are displayed as five digit numbers and the corrected readings and contour map data points as three digit numbers. It was expedient to establish 58,000 gammas as a zero level to eliminate the clutter of numbers at the data points and along the contour lines. Magnetic force values less than 58,000 gamma are designated with a negative value and are equal to the subtraction of the average reading from 58,000, after correction for the diurnal shift effect. Magnetic force values greater than 58,000 gamma are positive values equal to the average reading minus 58,000 after correction for the diurnal shift effect. The contour levels range from 0 to 1000 in value. Thus all values less than 0 fall within a 0 contour and all values greater than 1000 fall within a 1000 contour. This allows the contour map to use a contour interval that is most applicable to the greatest portion of the data and to eliminate contour intervals that are too gross to allow the development of significant areas.

3. The contour map of Figure 3 indicates that considerable derangement of the magnetic force lines has taken place. Note particularly the North-South trend of the contours at the west edge of the survey area, the

general east-west trend of the contours along the railroad tracks of all three areas, the east-west trend near the fence of the east area, and the east-west trend along the metal tables of the center and west areas. In the west area are numerous small zero value contours at regular intervals. These correspond to steel sign posts used to delineate the FMC storage sectors. Apart from all the interference factors there are areas delineated by the magnetometer survey that roughly correspond to interest areas delineated by the conductivity survey. Eleven such areas are indicated on the contour map and each is discussed in the succeeding paragraphs.

A.1. This area roughly corresponds to Area 3 of the Conductivity survey. Unfortunately there is a steel post exerting influence on the shape of the area, but it seems to be roughly parallel to the east-west trend of a puported burial site.

A.2. This area roughly corresponds to Area 10 of the conductivity survey. Again, though, there is a strong influence by the electrical system pole and a steel sign post.

A.3. Area 3 of the magnetic survey encompasses a portion of the eastern end of the barrel trench delineated by Area 3 of the conductivity survey. However, it extends much further to the north than does the area of the conductivity survey. This lends support to the lack of confidence in the magnetometer survey.

A.4. The occurence of this area is probably due to the steel sign post located near the negative data point. However, the area also occurs near the well defined Area 5 of the conductivity survey.

A.5. This area also agrees roughly with the conductivity Area 5 and probably is more indicative of the buried material already delineated.

A.6. This area has a rough counterpart in the conductivity survey Area 9. However, the conductivity survey indicates this to be an area of low not high conductivity that would be expected of a magnetic area.

A.7. This area corresponds directly to a foundry sand area delineated by the conductivity survey (Area 13).

A.8. This area corresponds to Area 12 of the conductivity survey and is an area of foundry sand disposal.

A.9. This area corresponds to conductivity survey Area 17 which is a low conductivity area. Most likely the pipeline that traverses this area is most responsible for the magnetic survey results.

A.10. This area tends to indicate the presence of the pipeline that traverses the east area and also the effect of the railroad tracks.

A.11. This area is not delineated by the contour interval, however an 800 contour would envelope it and thus delineate an area corresponding to Area 20 of the conductivity survey.

4. At the west edge of the center area is an area without data. At the time of making the magnetic survey of the center area, there was considerable activity at the east edge of the west area and along the main road separating the two areas. It was not possible to obtain repeatable readings. The next opportunity to take readings at these data points was two days later. It was felt that over such a long interval the effect of the diurnal shift would be too great to compensate for and would tend to distort the readings, hence no data was collected.

CONCLUSION

5. Although it is quiet easy to gather magnetometer data it is not easily and reliably interpreted in these circumstances. This area is too small and crowded with interference that distorts the data readings. In literature describing the operation of the magnetometer it is recommended that readings within 200 feet of known interference not be used. Thus the entire area is not a good subject for a magnetometer survey. Despite this the survey was performed with the result that in a gross manner there is some agreement with the findings of the conductivity survey. These findings can not be used alone as definitive. If the circumstances could be altered where there is no interference present the magnetometer may provide definitive results.

6. The electrical conductivity meter provides definitive results in this confined area. Some interference is experienced with the conductivity meter, but to a considerably less degree than the magnetometer. Location of possible and likely waste burial sites are best delineated by the conductivity meter.

Submitted by:

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TABLE 4

NIROP • WEST AREA • MAGNETOMETER

DATA NO	READING				AVE. READING	TIME	CORRECTED READING
ZERO	58 696	58 698	58 698	58 698	58 698	1217	
P-1	55 721	55 772	55 719	55 729	55 735	1219	- 2265
P-2	58 673	58 673	58 672	58 666	58 671	1220	671
P-3	63 015	63 102	63 123	63 170	63 102	1221	+ 5102
P-4	58 973	59 001	59 006	59 004	58 996	1222	996
P-5	58 269	58 267	58 270	58 271	58 269	1223	268
P-6	62 428	62 426	62 080	62 485	62 405	1224	+ 4404
P-7	60 643	60 067	60 217	60 114	60 260	1333	+ 2259
P-8	62 096	62 015	62 585	61 758	62 114	1334	+ 2111
P-11	58 454	58 446	58 439	58 435	58 444	1335	440
P-12	58 551	58 560	58 561	58 560	58 558	1336	553
P-13	58 837	58 837	58 837	58 839	58 838	1225	837
P-14	58 818	58 824	58 820	58 821	58 821	1226	820
P-15	58 896	58 897	58 898	58 897	58 897	1227	896
P-16	57 591	57 593	57 597	57 587	57 592	1228	- 409
P-17	56 601	57 027	56 801	56 608	56 759	1229	- 1242
P-18	59 371	59 366	59 355	59 346	59 360	1231	+ 1359
P-19	57 379	57 386	57 374	57 404	57 386	1232	- 616
P-20	58 699	58 699	58 699	58 698	58 699	1233	697
P-21	57 159	57 151	57 145	57 165	57 155	1234	- 847
P-22	59 028	59 019	59 005	59 018	59 018	1235	+ 1016
P-23	56 686	56 677	57 161	57 081	56 901	1236	- 1101
P-24	59 264	59 266	59 261	59 263	59 264	1239	+ 1262
P-25	57 197	57 212	57 252	57 246	57 227	1337	221
P-26	58 751	58 753	58 754	58 755	58 753	1338	746
P-29	58 728	58 727	58 729	58 729	58 728	1339	720
P-30	58 676	58 679	58 680	58 680	58 679	1340	670
P-31	58 687	58 688	58 687	58 687	58 687	1242	684
P-32	58 022	58 025	58 021	58 012	58 020	1243	017
P-33	58 584	58 581	58 582	58 580	58 582	1244	579
P-34	58 573	58 567	58 569	58 570	58 570	1248	567
P-35	58 642	58 641	58 642	58 643	58 642	1249	639
P-36	58 485	58 488	58 489	58 488	58 488	1250	484
P-37	58 233	58 231	58 230	58 233	58 232	1302	227
P-38	58 233	58 236	58 239	58 236	58 236	1303	231
P-39	58 166	58 166	58 167	58 167	58 166	1305	161
P-40	58 950	58 946	58 944	58 941	58 945	1306	940
P-41	58 522	58 521	58 522	58 522	58 522	1307	517
P-42	58 595	58 594	58 596	58 596	58 595	1308	589
P-43	58 527	58 928	58 929	58 930	58 928	1341	918
P-44	58 454	58 455	58 455	58 456	58 455	1342	444
SECONDARY	CENTERS						
S-1	58 423	58 426	58 426	58 425	58 425	1318	418
S-2	58 931	58 929	58 937	58 937	58 934	1319	927
S-3	58 889	58 888	58 888	58 887	58 888	1320	881
S-4	58 776	58 772	58 778	58 782	58 777	1321	770
S-5	58 920	58 920	58 919	58 919	58 920	1322	913

TABLE 4 (cont'd)

NIROP • WEST AREA • MAGNETOMETER

DATA No	READING				AVE. READING	TIME	CORRECTED READING
S-6	58 929	58 926	58 921	58 924	58 925	1323	918
S-7	58 825	58826	58 825	58 826	58 826	1324	813
S-8A	58 641	58 640	58 640	58 638	58 640	1325	632
S-8B	58 596	58598	58597	58597	58 597	1325	589
S-9	58 518	58518	58519	58518	58 518	1326	510
S-10	58 574	58571	58570	58570	58 571	1327	563
S-11	58 749	58749	58 747	58 748	58 748	1328	740
S-12	58 612	58 612	58 611	58 611	58 612	1329	604
S-13	58 551	58 558	58 556	58 561	58 557	1346	542
S-14	58 613	58 615	58 619	58 621	58 617	1347	601
S-15	58 749	58759	58 761	58 758	58 758	1348	741
S-16	58 320	58 323	58 325	58 326	58 324	1348	307
S-17	59 840	59880	59 910	59 865	59 874	1351	+1854
S-18	57 835	57 652	57 786	57 785	57 764	1352	- 257
S-19	55 930	55763	55905	56060	55 914	1333	-2094
S-20	64 056	63 939	63 865	63 838	63 924	1334	+5915
S-21	63 330	63276	63352	63231	63 297	1335	+ 5289
S-22	59 380	59361	59 363	59 382	59 372	1336	+1363
S-23	63 908	63473	63276	63 637	63 574	1337	+5565
S-24	63 035	63024	63 044	62 996	63 025	1338	+5016
S-25	58 026	58 026	58 023	58 024	58 025	1339	016
S-26	58 991	58 982	58 986	58 982	58 985	1340	976
S-27	59 345	59 346	59 340	59 331	59 340	1341	+1331
S-28	58 593	58 580	58 574	58 569	58 579	1342	570
S-29	59 398	59105	58 998	59281	59 196	1343	+1186
S-30	59 121	59126	59 113	59110	59 118	1344	+1108
S-31	59 140	59140	59 142	59 141	59 141	1344	+1131
S-32	58 531	58 531	58 533	58 531	58 532	1345	+ 522
S-33	57 225	57214	57227	57234	57225	1346	- 775
S-34	58 545	58 540	58 539	58 544	58 542	1347	532
S-35	58 611	58 605	58 606	58 605	58 607	1348	597
S-36	57 657	57656	57675	57677	57 666	1349	- 344
S-37	57 891	57 864	57 870	57 884	57 877	1354	- 146
S-38	59 325	59 322	59 321	59 320	59 322	1354	+1299
S-39	58 942	58 953	58 952	58 950	58 949	1355	925
S-40	58 466	58 470	58 467	58 464	58 467	1356	442
S-42	57 923	57926	57 928	57 929	57 926	1357	- 100
S-43	59 038	59040	59 040	59 037	59 039	1358	+ 1012
S-44	58 363	58362	58 363	58 363	58 363	1350	353
S-45	59 357	59368	59 352	59 363	59 360	1351	+1350
S-46	59 480	59 469	59 466	59 475	59 472	1352	+ 1461
S-47	57 726	57741	57 734	57 736	57 731	1353	- 280
S-48	57 737	57729	57 735	57 726	57 732	1354	- 281
S-49	57 431	57438	57435	57 436	57 435	1355	- 676
S-50	58 216	58 208	58-210	58 206	58 210	1356	199
S-51	58 534	58 532	58 533	58 536	58 534	1357	523
S-52	58 706	58 706	58 706	58 704	58 706	1358	695

TABLE 4 (cont'd)

NIROP • WEST AREA • MAGNETOMETER

DATA No	READING				AVE. READING	TIME	CORRECTED READING
S-53	58 749	58 746	58 747	58 750	58 748	1359	737
S-54	58 579	58 569	58 568	58 568	58 571	1400	560
S-55	58 919	58 919	58 919	58 917	58 918	1401	906
S-56	59 771	59 766	59 768	59 764	59 767	1402	+1755
S-57	59 174	59 174	59 174	59 175	59 174	1403	+1162
S-58	58 296	58 296	58 298	58 301	58 298	1404	286
S-59	58 763	58 763	58 762	58 758	58 762	1405	750
S-60	58 492	58 503	58 499	58 496	58 498	1405	486
S-61	58 088	58 086	58 086	58 087	58 087	1406	075
S-62	58 410	58 406	58 404	58 398	58 404	1407	368
S-63	58 562	58 562	58 560	58 561	58 561	1408	524
S-64	59 141	59 140	59 139	59 144	59 141	1409	+1103
S-65	57 368	57 383	57 388	57 387	57 382	1410	- 657
S-67	57 985	57 980	57 977	57 981	57 981	1411	- 059
S-68	58 545	58 533	58 526	58 528	58 533	1411	493
S-69	58 795	58 798	58 799	58 800	58 798	1407	786
S-70	58 412	58 413	58 410	58 412	58 412	1408	400
S-71	58 685	58 691	58 691	58 685	58 688	1409	675
S-72	58 925	58 923	58 930	58 928	58 926	1410	914
S-73	58 674	58 673	58 675	58 675	58 674	1412	661
S-74	58 716	58 716	58 715	58 715	58 716	1413	703
S-75	58 705	58 704	58 705	58 705	58 705	1414	682
S-76	58 776	58 775	58 776	58 776	58 776	1415	763
S-77	58 762	58 762	58 763	58 762	58 762	1416	749
S-78	58 738	58 738	58 737	58 738	58 738	1417	725
S-79	58 724	58 725	58 726	58 726	58 725	1417	712
S-80	58 746	58 746	58 746	58 746	58 746	1418	733
S-81	58 753	58 753	58 753	58 752	58 753	1419	740
S-82	58 693	58 689	58 688	58 689	58 690	1420	676
S-83	58 636	58 640	58 642	58 638	58 639	1421	625
S-84	58 636	58 636	58 635	58 636	58 636	1421	622
S-85	58 804	58 804	58 805	58 805	58 804	1422	790
S-86	58 574	58 571	58 569	58 571	58 571	1423	557
S-87	58 790	58 790	58 790	58 789	58 790	1412	749
S-88	58 806	58 807	58 806	58 805	58 806	1413	764
S-89	58 733	58 730	58 730	58 731	58 731	1414	688
S-90	58 390	58 402	58 403	58 402	58 399	1415	355
S-92	58 573	58 570	58 570	58 571	58 571	1415	527
S-93	58 784	58 784	58 786	58 787	58 785	1416	740
S-94	58 595	58 596	58 598	58 596	58 596	1425	582
S-95	58 645	58 644	58 642	58 643	58 644	1426	630
S-96	57 964	57 960	57 961	57 959	57 961	1427	947
S-97	58 691	58 692	58 692	58 692	58 692	1428	678
S-98	58 650	58 649	58 650	58 651	58 650	1429	636
S-99	58 607	58 609	58 609	58 608	58 608	1430	784
S-100	57 069	56 916	56 837	56 851	56 918	1432	-1197
S-101	58 609	58 606	58 607	58 605	58 607	1432	582

TABLE 4 (cont'd)

NIROP · WEST AREA · MAGNETOMETER

DATA No	READING				AVE. READING	TIME	CORRECTED READING
S-102	58 721	58 716	58 719	58 717	58 718	1433	703
S-103	58 669	58 674	58 672	58 670	58 671	1434	656
S-104	57 165	57 316	57 329	57 335	57 286	1435	- 729
S-105	58 661	58 659	58 661	58 662	58 661	1436	646
S-106	58 508	58 506	58 509	58 507	58 508	1437	492
S-107	57 525	57 550	57 543	57 547	57 541	1438	- 475
S-108	56 864	56 820	56 834	56 817	56 834	1439	- 1182
S-109	58 534	58 541	58 540	58 540	58 539	1439	523
S-110	58 737	58 737	58 738	58 736	58 737	1440	721
S-111	58 414	58 418	58 418	58 416	58 416	1441	400
S-112	57 854	57 851	58 852	58 871	57 857	1417	- 189
S-113	58 721	58 720	58 720	58 720	58 720	1418	673
S-114	58 510	58 511	58 511	58 512	58 511	1419	463
S-115	58 346	58 346	58 343	58 345	58 345	1419	297
S-117	58 315	58 318	58 317	58 322	58 318	1420	269
S-118	58 676	58 675	58 675	58 675	58 675	1421	625
S-119	58 378	58 375	58 376	58 372	58 375	1443	359
S-120	58 625	58 625	58 625	58 624	58 625	1443	609
S-121	58 542	58 543	58 544	58 542	58 543	1444	527
S-122	58 775	58 776	58 773	58 772	58 774	1445	757
S-123	58 292	58 291	58 292	58 293	58 292	1446	275
S-124	58 203	58 195	58 201	58 203	58 200	1448	183
ZERO	58 755	58 756	58 758	58 759	58 757	1423	

TABLE 5

NITROP • CENTER AREA • MAGNETOMETER

DATA No	READING				AVE. READING	TIME	CORRECTED READING
ZERO	58 750	58 754	58 750	58 750	58 751	0725	
M-1	58 317	58 320	58 322	58 317	58 319	0730	319
M-2	58 983	58 982	58 984	58 981	58 982	0731	982
M-3	58 893	58 893	58 891	58 889	58 892	0732	892
M-4	58 433	58 430	58 429	58 429	58 430	0734	429
M-8	57 817	57 792	57 822	57 814	57 811	0735	-190
M-9	58 705	58 705	58 703	58 704	58 704	0736	703
M-10	58 665	58 663	58 664	58 664	58 664	0737	662
M-11	58 864	58 865	58 866	58 866	58 865	0738	863
M-12	58 608	58 607	58 608	58 608	58 608	0740	606
M-13	58 777	58 776	58 774	58 776	58 776	0741	773
M-14	58 713	58 713	58 712	58 712	58 712	0742	709
M-15	58 597	58 595	58 597	58 601	58 598	0743	595
M-16	58 559	58 563	58 562	58 563	58 562	0744	559
M-17	58 434	58 427	58 435	58 429	58 431	0745	427
M-20	58 869	58 869	58 869	58 868	58 869	0747	865
M-21	58 488	58 489	58 488	58 488	58 488	0748	484
M-22	57 921	57 936	57 931	57 927	57 929	0749	-76
M-23	58 632	58 624	58 621	58 623	58 625	0750	620
M-24	58 706	58 705	58 705	58 706	58 706	0751	701
M-25	58 685	58 685	58 685	58 685	58 685	0752	680
M-26	57 432	57 438	57 438	57 443	57 438	0753	-568
M-27	58 494	58 497	58 495	58 494	58 495	0754	489
M-28	57 612	57 600	57 601	57 605	57 604	0755	-402
M-29	58 147	58 148	58 147	58 149	58 148	0756	142
M-30	58 602	58 603	58 602	58 603	58 602	0757	596
M-31	58 958	58 958	58 955	58 953	58 956	0758	949
M-32	57 771	57 778	57 780	57 777	57 776	0759	-231
SECONDARY	CENTERS						
N-1	57 627	57 622	57 629	57 630	57 627	0803	-381
N-2	58 432	58 447	58 493	58 465	58 459	0804	451
N-3	58 967	58 969	58 970	58 968	58 968	0805	960
N-4	58 500	58 499	58 503	58 504	58 502	0806	493
N-5	59 153	59 152	59 153	59 154	59 153	0807	1144
N-6	59 118	59 121	59 121	59 121	59 120	0808	1111
N-7	59 283	59 276	59 276	59 279	59 278	0809	1269
N-14	58 790	58 788	58 791	58 790	58 790	0812	780
N-15	58 635	58 639	58 641	58 637	58 638	0813	628
N-16	64 665	64 567	64 678	64 830	64 685	0815	6674
N-17	58 532	58 531	58 532	58 532	58 532	0816	521
N-18	58 931	58 929	58 928	58 928	58 929	0817	918
N-19	58 841	58 839	58 841	58 840	58 840	0818	828
N-20	58 782	58 780	58 780	58 779	58 780	0819	768
N-21	58 694	58 695	58 697	58 696	58 696	0820	684
N-22	59 077	59 077	59 077	59 077	59 077	0821	1065
N-23	59 160	59 160	59 160	59 162	59 160	0821	1148
N-24	64 418	64 372	64 389	64 415	64 398	0823	6385

TABLE 5 (CONT'D)

NIROP · CENTER AREA · MAGNETOMETER

DATA No	READING				AVE. READING	TIME	CORRECTED READING
N-25	56 680	56 728	56 785	56 710	56 726	0824	-1287
N-26	62 156	62 511	62 366	62 697	62 432	0825	4419
N-27	58 858	58 859	58 860	58 863	58 860	0826	846
N-28	57 853	57 821	57 855	57 864	57848	0827	-166
N-29	59 199	59 202	59 202	59 201	59 201	0828	1187
N-30	58 436	58 436	58 436	58 436	58 436	0830	422
N-31	58 785	58 786	58 785	58 786	58 786	0831	771
N-32	58 747	58 747	58 747	58 747	58 747	0832	732
N-33	58 763	58 765	58 764	58 764	58 764	0833	749
N-34	58 803	58 803	58 802	58 804	58 803	0834	788
N-35	58 475	58 476	58 476	58 475	58 476	0835	460
N-36	58 819	58 818	58 816	58 815	58 817	0835	801
N-37	58 836	58 836	58 834	58 835	58 835	0836	819
N-38	58 732	58 735	58 733	58 731	58 733	0838	717
N-39	58 535	58 537	58 539	58 539	58 538	0839	521
N-40	58 469	58 465	58 470	58 468	58 468	0857	447
N-41	58 435	58 436	58 439	58 443	58 438	0858	416
N-45	59 187	59 180	59 186	59 189	59 186	0901	1163
N-46	58 735	58 735	58 737	58 736	58 736	0902	713
N-47	58 904	58 909	58 908	58 907	58 907	0903	884
N-48	58 757	58 757	58 758	58 759	58 758	0904	734
N-49	58 822	58 823	58 822	58 820	58 822	0905	798
N-50	58 591	58 590	58 590	58 589	58 590	0906	566
N-51	58 554	58 552	58 553	58 553	58 553	0906	529
N-52	58 404	58 404	58 402	58 403	58 403	0907	379
N-53	58 902	58 900	58 902	58 900	58 901	0908	876
N-54	58 715	58 714	58 711	58 711	58 713	0909	688
N-55	59 439	59 440	59 431	59 432	59 436	0910	1411
N-56	59 786	59 791	59 795	59 798	59 792	0911	1767
N-57	58 616	58 618	58 619	58 618	58 618	0912	383
N-61	58 468	58 476	58 475	58 474	58 473	0912	447
N-62	58 375	58 376	58 376	58 379	58 376	0913	350
N-63	58 306	58 299	58 296	58 296	58 299	0918	272
N-64	59 287	59 275	59 278	59 270	59 278	0919	1251
N-65 A	58 707	58 708	58 707	58 706	58 707	0920	680
N-66	58 700	58 711	58 706	58 713	58 708	0922	681
N-67	58 595	58 594	58 594	58 594	58 594	0924	566
N-65 B	58 413	58 411	58 412	58 412	58 412	0921	385
N-68	58 715	58 716	58 715	58 715	58 715	0924	687
N-69	58 953	58 952	58 951	58 949	58 951	0925	923
N-70	59 030	59 029	59 032	59 021	59 028	0927	999
N-71	58 723	58 725	58 724	58 714	58 722	0930	693
N-72	58 914	58 912	58 914	58 915	58 914	0931	884
N-73	58 165	58 160	58 164	58 159	58 162	0932	132
N-74	58 036	58 028	58 036	58 039	58 035	0932	5
N-75	58 947	58 952	58 950	58 948	58 949	0933	919
N-76	58 834	58 833	58 832	58 832	58 833	0934	802

NIROP • TABLE 5 (CONT'D.) CENTER AREA • MAGNETOMETER

DATA No	READING				AVE. READING	TIME	CORRECTED READING
N-77	58 779	58 780	58 782	58 781	58 780	0936	749
N-78	58 637	58 638	58 636	58 635	58 636	0938	605
N-82	58 570	58 565	58 561	58 561	58 564	0940	532
N-83	58 859	58 856	58 855	58 853	58 856	0941	824
N-84	58 373	58 366	58 367	58 365	58 368	0942	336
N-85	57 862	57 871	57 850	57 862	57 869	0944	-164
N-86	58 409	58 416	58 411	58 406	58 410	0945	377
N-87	58 055	58 061	58 059	58 059	58 058	0946	25
N-88	57 628	57 634	57 644	57 636	57 636	0948	-398
ZERO	58 788	58 787	58 786	58 787	58 787	0950	

TABLE 6

NIROP • EAST AREA • MAGNETOMETER

DATA No	READING				AVE. READING	TIME	CORRECTED READING
ZERO	58 778	58 780	58 781	58 780	58 780	0731	780
K-1	58 795	58 794	58 794	58 793	58 794	0732	794
K-2	59 208	59 207	59 206	59 203	59 206	0733	1206
K-3	58 812	58 812	58 813	58 812	58 812	0735	812
K-4	58 823	58 823	58 822	58 823	58 823	0736	823
K-5	58 367	58 365	58 368	58 367	58 367	0737	367
K-6	58 743	58 855	58 039	57 565	58 300	0738	300
K-7	58 482	58 477	58 477	58 479	58 479	0739	479
K-8	58 596	58 594	58 594	58 593	58 594	0740	594
K-9	56 617	56 592	56 579	56 618	56 602	0741	-1399
K-10	58 313	58 314	58 313	58 311	58 313	0742	312
K-11	58 840	58 840	58 840	58 840	58 840	0743	839
K-12	58 828	58 825	58 827	58 827	58 827	0744	826
K-13	58 779	58 778	58 777	58 777	58 778	0745	777
K-14	58 625	58 624	58 622	58 623	58 624	0746	623
K-15	58 630	58 628	58 628	58 628	58 628	0747	627
K-16	59 166	59 169	59 167	59 172	59 168	0748	1167
K-17	58 729	58 729	58 729	58 728	58 729	0749	728
K-18	58 763	58 762	58 763	58 763	58 763	0751	762
K-19	58 835	58 834	58 836	58 836	58 835	0752	834
K-20	58 642	58 641	58 641	58 641	58 641	0752	640
K-21	57 997	58 012	58 008	58 005	58 006	0756	005
K-22	57 918	57 923	57 923	57 918	57 920	0757	-081
K-23	57 387	57 381	57 385	57 393	57 386	0758	-615
K-24	58 524	58 524	58 523	58 524	58 524	0759	523
K-25	58 373	58 373	58 372	58 373	58 373	0801	371
K-26	57 927	57 933	57 930	57 909	57 925	0802	-077
K-27	58 440	58 441	58 441	58 441	58 441	0803	439
K-28	56 844	56 853	56 862	56 892	56 858	0804	-1144
SECONDARY CENTERS							
J-1	58 703	58 702	58 702	58 702	58 702	0808	700
J-2	58 884	58 883	58 882	58 882	58 883	0809	881
J-3	58 788	58 788	58 787	58 787	58 788	0810	786
J-4	58 272	58 276	58 278	58 290	58 279	0811	277
J-5	58 718	58 595	58 493	58 666	58 670	0813	668
J-6	58 627	58 627	58 626	58 626	58 626	0814	624
J-7	58 648	58 647	58 650	58 649	58 648	0828	645
J-8	58 894	58 894	58 894	58 895	58 894	0830	891
J-9	58 525	58 526	58 526	58 529	58 526	0831	523
J-10	58 700	58 701	58 701	58 700	58 700	0832	697
J-11	58 770	58 771	58 772	58 772	58 771	0833	768
J-12	60 245	60 238	60 256	60 231	60 242	0834	2239
J-13	58 933	58 935	58 935	58 935	58 934	0835	931
J-14	58 742	58 743	58 743	58 744	58 743	0836	740
J-15	58 603	58 605	58 604	58 604	58 604	0837	601
J-16	58 767	58 768	58 768	58 766	58 767	0838	764
J-17	58 918	58 918	58 918	58 918	58 918	0839	915

NIROP • EAST AREA • MAGNETOMETER

DATA No	READING				AVE. READING	TIME	CORRECTED READING
J-18	58 899	58 898	58 897	58 897	58 898	0840	895
J-19	58 951	58 951	58 950	58 951	58 951	0841 -	947
J-20	58 847	58 847	58 847	58 847	58 847	0842	843
J-21	58 791	58 791	58 791	58 792	58 791	0843	787
J-22	58 795	58 794	58 793	58 794	58 794	0844	790
J-23	58 584	58 587	58 587	58 587	58 586	0846	582
J-24	58 611	58 609	58 611	58 611	58 610	0847	606
J-25	58 918	58 918	58 917	58 917	58 918	0847	914
J-26	58 827	58 826	58 825	58 825	58 826	0849	822
J-27	58 820	58 819	58 820	58 819	58 820	0850	816
J-28	58 781	58 780	58 780	58 780	58 780	0851	776
J-29	58 627	58 626	58 626	58 624	58 626	0852	622
J-30	58 159	58 158	58 159	58 161	58 159	0853	155
J-31	58 351	58 353	58 353	58 356	58 353	0854	349
J-32	58 171	58 170	58 170	58 171	58 170	0855	166
J-33	58 514	58 513	58 513	58 512	58 513	0856	509
J-34	58 993	58 995	58 995	58 997	58 995	0856	991
J-35	58 573	58 573	58 574	58 573	58 573	0858	569
J-36	58 648	58 647	58 649	58 648	58 648	0859	642
J-37	58 668	58 667	58 667	58 669	58 668	0900	664
J-38	58 448	58 457	58 454	58 446	58 451	0901 -	446
J-39	58 445	58 444	58 445	58 445	58 445	0902	440
J-40	58 260	58 257	58 256	58 258	58 258	0903	253
J-41	58 687	58 687	58 686	58 686	58 686	0904	681
J-42	58 200	58 177	58 176	58 174	58 182	0905	177
J-43	57 370	57 807	57 438	57 820	57 609	0906	-396
ZERO	58 786	58 785	58 784	58 783	58 784	0908	779

PART III

HAZARDOUS MATERIAL TECHNICAL CENTER ANALYSIS

13 JUNE 1983

Hazardous Materials Technical Center

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Rockville, MD 20856-8168

(800) 638-8958
In Maryland call collect
(301) 468-8858
FTS No. (202) 468-8858

Date: June 13, 1983

Subject: NIROP, Fridley, MN, Buried Waste Sites Recommended for Excavation

Project: NIROP, Fridley, MN

Reference Material:
1. NEESA report 13-029
2. MRD, Corps of Engineers Geophysical Survey Report dated 5/27/83
3. Air-photo analyses performed by the Dynamac Corporation hydrogeological staff and the Minnesota Pollution Control Agency (MPCA)

1.0 INTRODUCTION

1.1 This report identifies nine (9) potential waste disposal sites at NIROP which, herein, are being recommended for further investigation by excavation. These nine sites have been selected by thoroughly reviewing and cross-referencing several sources of information regarding potential waste disposal sites at NIROP. These information sources include:

1.1.1 Verbal communications with NIROP plant personnel as summarized in NEESA report 13-029.

1.1.2 Geophysical Survey Report dated 5/27/83 which was provided by Missouri River Division Laboratory, Corps of Engineers.

1.1.3 Air-photo analyses performed by the Hazardous Materials Technical Center (HMTC) hydrogeological staff and MPCA.

Because this report considers several information sources pertinent to site selection, its conclusions may be more reliable than previous reports which do not consider all of the above information sources.

Operated by the Dynamac Corporation 11140 Rockville Pike Rockville, MD 20852 for the Defense Logistics Agency

2.0 SUMMARY OF EXISTING INFORMATION

2.1 Figure 1 is from the NEESA report. This figure identifies the approximate locations of two waste disposal pits (site 2 in Figure 1) and two waste disposal trenches (site 1 in Figure 1), as determined by verbal communications with NIROP personnel. In Figure 2 these correspond to sites 3, 6, 18, and 19. In order to better-delineate these potential waste disposal areas, two geophysical surveys were conducted.

2.2 The results of the magnitometer survey were inconclusive due to interference from numerous large metallic objects near the sites. However, the results of the conductivity survey were useful in further defining the locations of the potential waste sites. Figure 2 summarizes the major conductivity anomalies. As indicated in the original conductivity report produced by the Corps, areas with anomalously low or zero conductivity values are more likely due to buried low conductivity materials such as rubble and concrete rather than metallic waste drums. The conductivity survey indicates that such sites include 1, 2, 4, 8, 9, 14, and 17. High conductivity areas suggest buried high-conductivity materials such as scrap metal or waste drums. These higher priority areas (3, 5, 6, 7, 10, 15) are identified with vertical lines in Figure 2. Several sites were identified as high-conductivity anomalies but are not presented here as waste disposal sites to be excavated because it was reported (conductivity report) that the anomalously high-conductivity readings were probably due to non-hazardous waste materials. These sites are: 11, 12, 13, 16, and 20. The waste-site locations indicated in the NEESA report (Figure 1) have been transferred to their approximate locations in Figure 2 (slanted shading). Overlap of the areas denoting potential waste sites identified by the NEESA report and the conductivity survey indicates those areas which have a greater probability of being hazardous waste disposal sites.

2.3 The final sources of information regarding potential hazardous waste sites on the NIROP property are the air-photo analyses performed by HMTC and MPCA. Information from the air-photos is considered least reliable because in no case were actual waste drums observed in the photographs. Also, some of the land-surface blemishes visable on the photographs can be produced by any number of non-waste disposal activities related to the operation of NIROP, such as dumping of foundry sand, movement of stored yard materials, grading, etc. Nevertheless, all potential waste disposal sites identified on aerial photographs of the NIROP plant are also incorporated into Figure 2 (stippling).

3.0 CONCLUSION

3.1 On the basis of the degree of overlap of the potential waste disposal sites identified by the aforementioned information sources and the reliability of the original information source, the following potential waste disposal sites are recommended for excavation in the order of the indicated priority:

HIGH PRIORITY SITES	INTERMEDIATE PRIORITY SITES	LOW PRIORITY SITES
3,5,18	7,6,10	15,17,19

3.2 Four of these sites warrant special consideration:

Site 15: This site was identified as a potential waste disposal site by MPCA. Also, it is a high conductivity anomaly. However, it is approximately coincident with subsurface electrical and propane gas lines, therefore, extreme caution should be exercised during excavation.

Site 10: The northern portion of site 10 is also coincident with subsurface electrical utilities; therefore, appropriate caution should be exercised when excavating this site.

Sites 18 and 19: These sites are separated by a portion of the NN-W trending asphalt runway. During excavation, special consideration should be given to the possibility that any waste materials discovered at these sites may extend under the asphalt runway. If this occurs, it will be necessary to remove the asphalt and excavate the additional waste material.

3.3 If the low priority sites identified above (15, 17, 19) are found to contain hazardous wastes, it will be necessary to re-evaluate some of the sites not included in section 3.1.

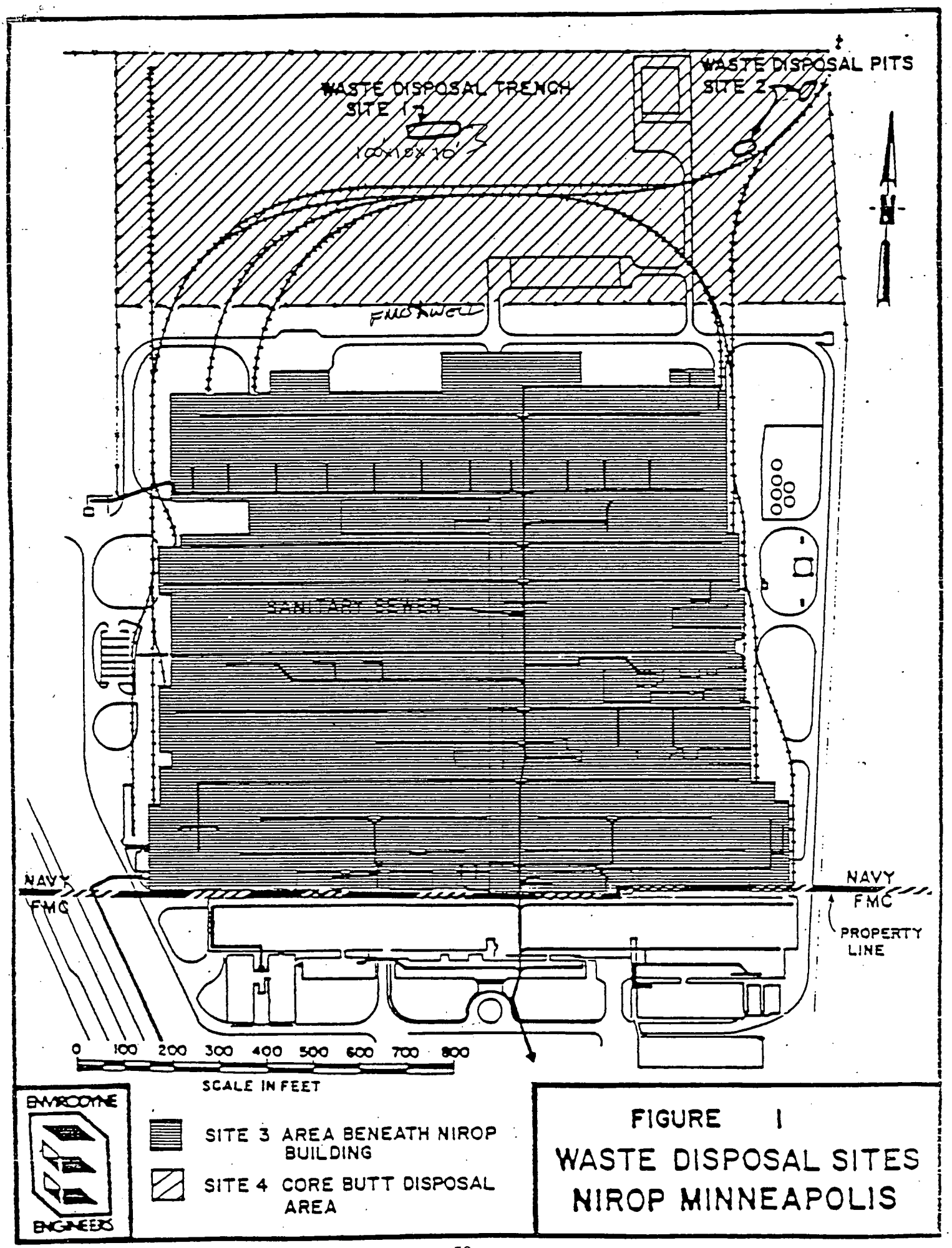

FIGURE 1
WASTE DISPOSAL SITES
NIROP MINNEAPOLIS