04-1

Site: Marnat Quarry
ID # MOD980685256
Break: 1.5
Other:
12-18-87

Final Report
Follow-up Site Investigation
Marnati Quarry Site
Frontenac, Missouri
TDD #F-07-8703-45 PAN #FM00128SB
Site #08L Project #001
December 18, 1987
Submitted to: Paul Doherty, Region VII RPO
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SECTION 1: INTRODUCTION

The Ecology and Environment Field Investigation Team (E&E/FIT) was tasked by the Region VII Office of the U.S. Environmental Protection Agency (USEPA) to perform a site investigation (SI) of the Marnati Quarry Site in Frontenac, Missouri (TDD #F-07-8611-64).

The objectives of this investigation were: 1) collect on-site soil from surface runoff pathways, quarry fill material (foundry sands), and sediment from seep areas; 2) collect surface water samples, and 3) to conduct a geophysical survey to determine the potential for the existence of approximately 200 drums allegedly buried in the abandoned quarry. The purpose of the efforts were to determine the extent of on-site contamination, if contaminants have migrated off-site, and to detect any subsurface anomalies by use of magnetometer and electromagnetic conductivity surveys.

The present Missouri contact is Mr. Gene Gunn of the U.S. EPA Superfund Branch, 726 Minnesota Avenue, Kansas City, Kansas 66101. His phone number is 913-236-2856. The current property owner of the Marnati Quarry Site is Mr. Ted Martin. His phone number is 314-991-5599.

SECTION 2: SITE DESCRIPTION

The Marnati Quarry site is an abandoned rock quarry located in Frontenac, Missouri, on German Blvd., approximately 0.2 miles west of Lindbergh Road. The location of the site is at approximately latitude 38° 38′ 35" North, longitude 90° 24′ 35" West. The legal description is 2 acres in the NW 1/4, SE 1/4, NW 1/4, Section 13, Township 45 North, Range 5 East, Creve Coeur Quadrangle, St. Louis County, Missouri (Figure 1).

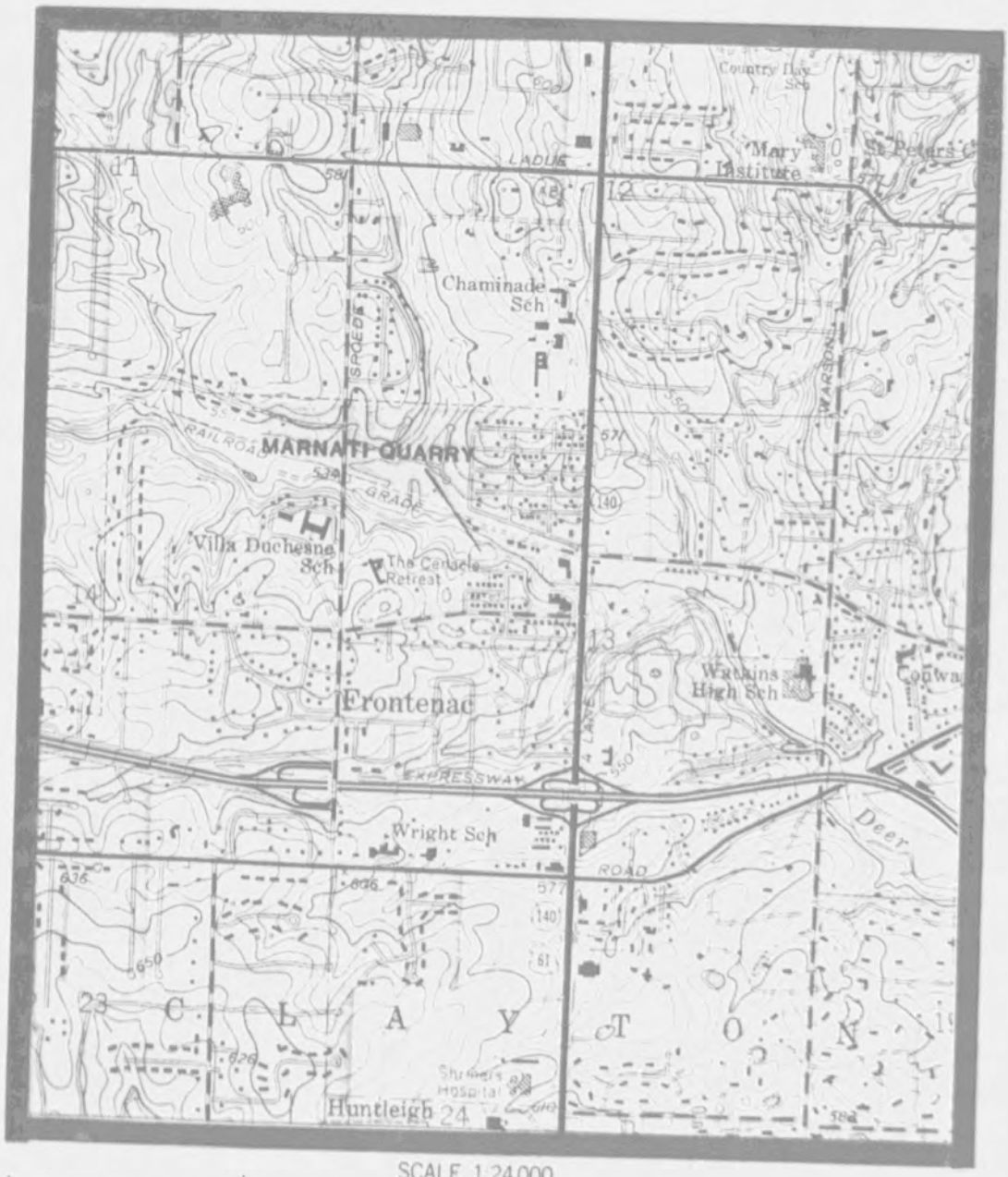
The site is presently owned by Mr. Ted Martin, who operates the Frontenac Racquetball Club, Inc. which is located on property adjacent to the Marnati Quarry site. The address of the Racquetball Club is 10455 German Blvd., Frontenac, MO 63131. The quarry is located on the south side of Deer Creek. Access to the quarry may be obtained by contacting Mr. Martin at the Frontenac Racquetball Club, Inc.

J. D. Schlegel Landscape Company is currently leasing the Marnati Quarry site and using the site for temporary storage of collected leaves and tree branches (Figure 2). Owner Dave Schlegel may be contacted at 716 Trogan Street, St. Louis, MO 63141. His phone number is 314-872-3203. The site is presently fenced and an access gate is locked daily by Schlegel Landscape personnel.

The quarry was originally excavated to a depth of 200 feet over an area of approximately 2 acres (Ref. 4). Mr. Marnati filled the quarry with foundry sands from 1975 to 1982 to a thickness of approximately 170 feet (Ref. 4). The exposed quarry wall is currently about 30 feet high (Figure 3). The quarry lies partly in the flood plain of Deer Creek and partly in the lower side slope of the southern valley wall. Slopes in

CREVE COEUR QUADRANGLE
MISSOURI – ST. LOUIS CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
PHOTOGRAPH REVISED 1968

QUADRANGLE LOCATION



SCALE 1:24000

1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 KILOMETER

CONTOUR INTERVAL 10 FEET

FIGURE 1 LOCATION MAP OF MARNATI QUARRY SITE

COMPILED BY JIM ALLDRITT

DECEMBER 1986

FIGURE 2: WESTERN HALF OF MARNATI QUARRY, PARTIALLY COVERED WITH LANDSCAPING DEBRIS.

(DECEMBER, 1986)

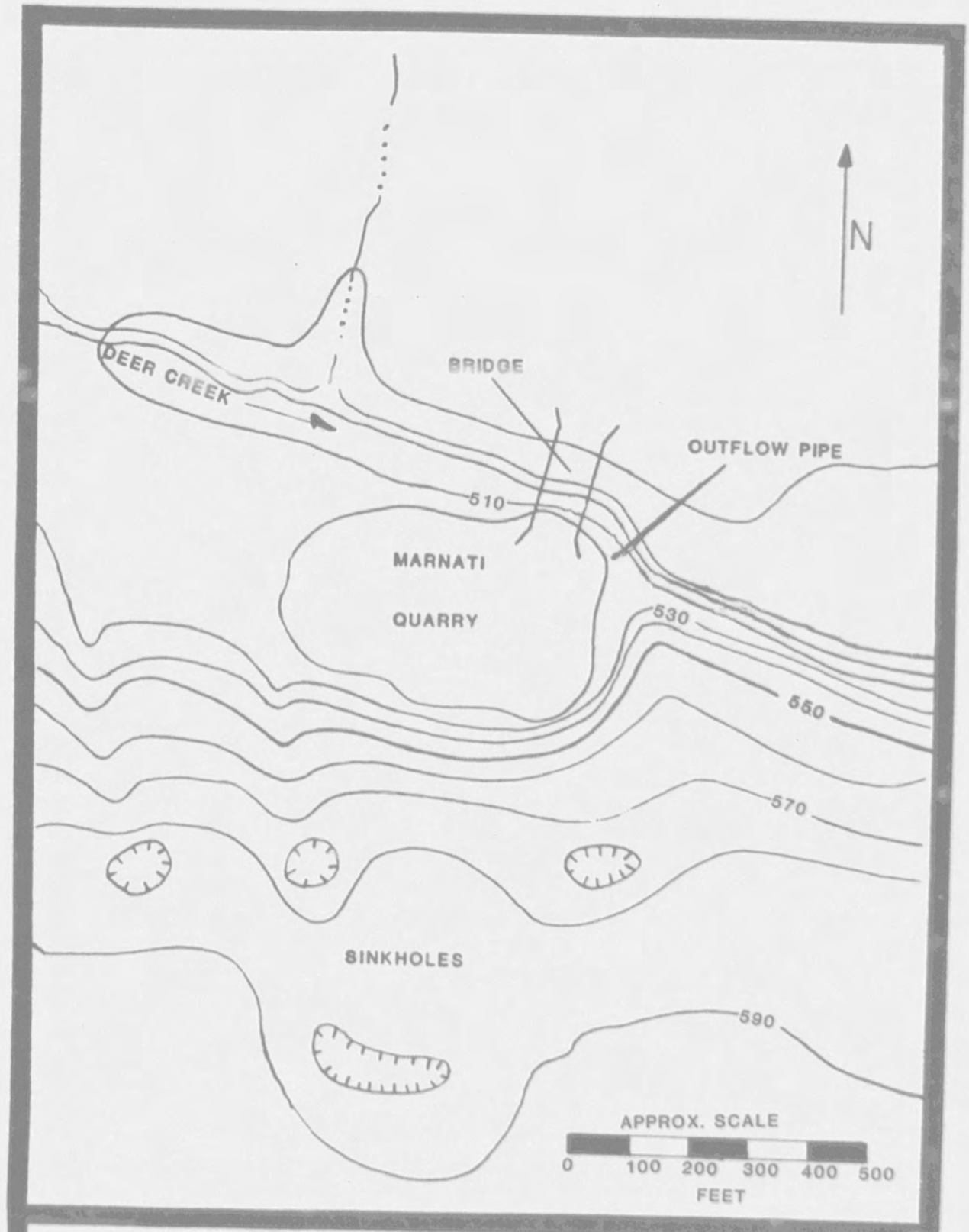


FIGURE 3 SITE SKETCH MARNATI QUARRY CONTOUR INTERVAL 10 FEET

COMPILED BY JIM ALLDRITT
SOURCE:USGS 7.5' SERIES-CREVE COEUR QUAD, 1968 DECEMBER 1986

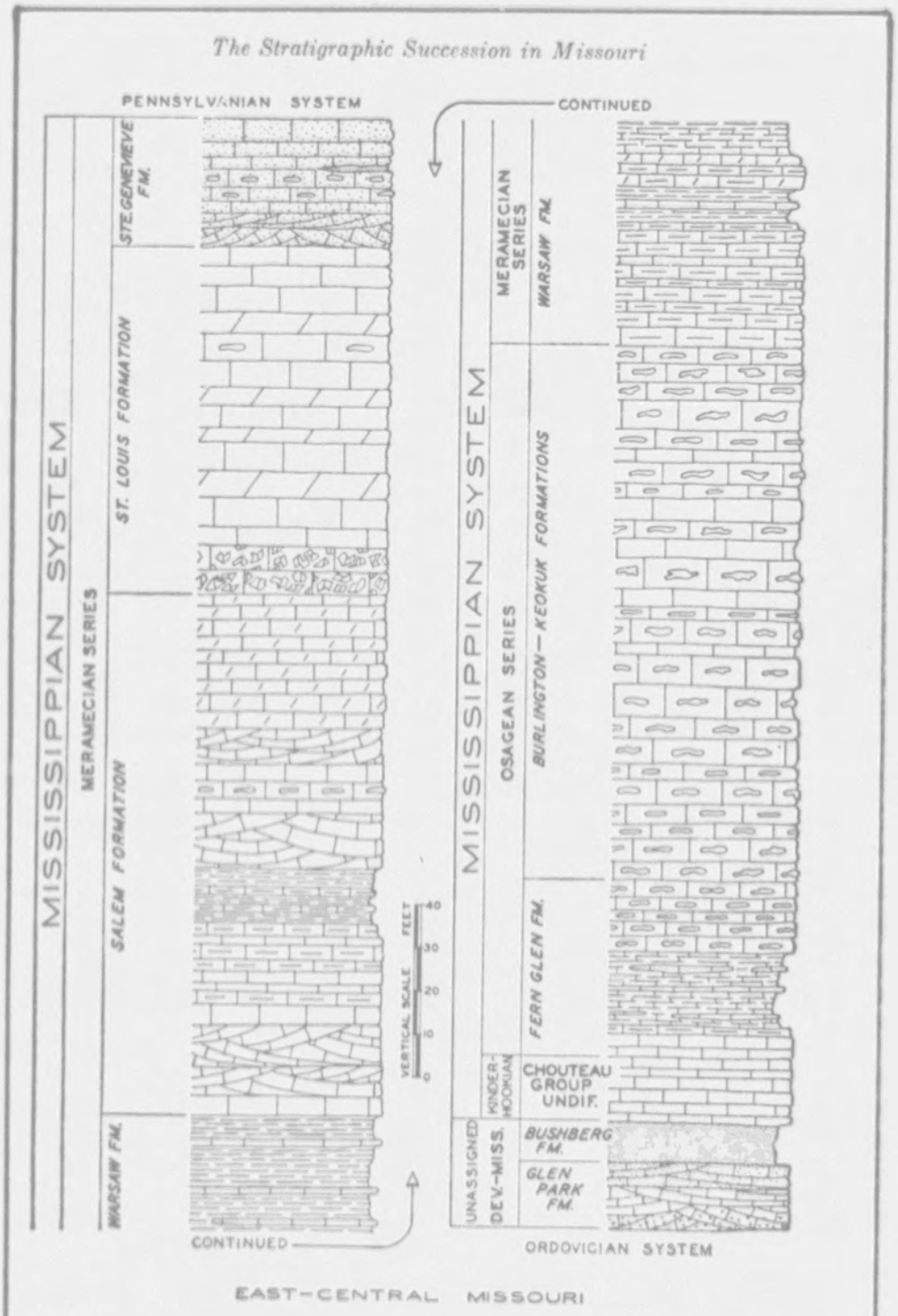
the area range from nearly flat on the filled surface to nearly vertical where the quarry walls are exposed, along the south side of the site. The site drains northeast into Deer Creek. Numerous sinkholes in the area suggest subsurface solutional weathering of bedrock by ground water.

The soil survey of St. Louis County and the City of St. Louis identifies the soils adjacent to the site as belonging to the Urban Land-Harvester complex and the Menfro silt loam. Both types represent soils formed in loess and found in upland areas. Harvester soils are moderately well drained and exhibit moderately slow permeability (0.2 to 0.6 inches per hour). These soils are slightly acidic. Menfro soils are well drained, have moderate permeability (0.6 to 2.0 inches per hour), and are slightly acidic. Harvester and Menfro soils are moderately susceptible to sheet and rill erosion. The northeastern edge of the Marnati site is being eroded by Deer Creek and the western edge of the site is channelized by a intermittent stream flowing north into Deer Creek (Ref. 1).

No soil was observed over most of the site surface. Refinery waste, sand, and glass fill the quarry, and contain very fine sand to silt sized particles. Permeability of the foundry sands is suspected to be relatively high (> 2 inches per hour).

Rocks of the St. Louis formation (Figure 4) are exposed at the quarry walls. The lithology of the St. Louis formation is an argillaceous to arenaceous limestone of Mississippian age. It is gray, finely crystalline, medium to massively bedded and over 100 feet thick in its type area in St. Louis County (Ref. 2).

The site lies in a karst region as indicated by numerous sinkholes in the area. The water table level is typically higher at the site than the bottom of Deer Creek. Hence, Deer Creek is usually a gaining stream with water flowing through the quarry fill and into Deer Creek. The



Mississippian System; Osagean and Meramecian Series, and unassigned Devonian-Mississippian formations in east-central Missouri.

FIGURE 4 : THE ST. LOUIS FORMATION AND ADJACENT UNITS.

FROM: MO. GEOL. SURVEY AND WATER RESOURCES (REF. 2)

channel is defined by shaley dolomites and limestones of the Salem formation (See Figure 4). These rocks are light gray to white, fragmently fossiliferous and argillaceous. The presence of sinkholes indicates that solution activity has enlarged joints and bedding planes in the underlying bedrock. The hydraulic conductivity of these rock units may reach 2,000 gpd/ft^2 (Ref. 3).

Deer Creek flows through the cities of Frontenac, Ladue, Brentwood, and Maplewood before entering the Des Peres River approximately 5.5 miles downstream. The total population of these cities is approximately 50,000 people. However, these communities water supplies are provided by the City of St. Louis and no intakes are located on Deer Creek.

SECTION 3: SITE HISTORY

The Marnati Quarry was first investigated by the Industrial Pollution Control Group of the City of Frontenac in June of 1976. Investigators observed an overflow and associated seepage from the quarry, discharging into Deer Creek. A sample was collected and analyzed by the city's Industrial Waste Laboratory. The sample was found to contain a high chemical oxygen demand and dissolved solids content, phenols, sulfides, heavy metals, and traces of benzene, toluene, xylene and motor oil (Ref. 4).

Mr. Marnati was informed that the discharge from the quarry was in direct violation of city and state regulations and requested to take immediate action to prevent any future discharge of contaminated water from the quarry to Deer Creek.

A field inspection was performed at the site by the EPA in October of 1979. Reportedly, approximately one million gallons of quarry water had been pumped directly from the quarry to the sewer via a manhole. This was apparently Mr. Marnati's response to the city's request for compliance with city and state regulations (Ref. 4).

The report of the October investigation included data from one quarry water sample. The analyses showed low concentrations of several acid, base/neutral compounds. The investigators walked upstream and downstream on Deer Creek and observed no evidence of leachate. Based on these results, the Marnati Quarry was not considered to be an immediate hazard to the environment. A Potential Hazardous Waste Site Tentative Disposition Form 2070-5 was filed on March 16, 1982 for the site and indicated that no action was needed. The rationale for this determination was the lab analyses of foundry sand and the fact that the quarry had been dewatered. Additional funds to the state under the 3012 grant, a CERCLA grant to finance a preliminary assessment, prompted reactivation of the Marnati Quarry in December 1983 (Ref. 4).

In June 1984, the E&E/FIT was tasked under TDD #R-07-8406-01 to collect samples for analysis of TCDD. Sediment samples were collected from two leachate seep areas near the quarry. Subsequent analyses showed that no TCDD contamination was present in the leachate samples (Ref. 5).

The Missouri Department of Natural Resources (MDNR) investigated the site in February of 1985. The MDNR report of the investigation reveals that the material filling the quarry are foundry sands from Banner Iron Works, Abex Corporation and Scullin Steel Company and that filling operations ceased around 1982. The St. Louis Regional office of the MDNR filed a summary prepared by a former MDNR employee relating an interview with Henry Marnati on April 11, 1977 in which Mr. Marnati stated that 200 barrels had been placed in the quarry "a couple of years ago." The content of the barrels is not known (Ref. 4).

Based on the information gathered, MDNR recommended that the possibility of buried drums containing unknown materials be further investigated.

SECTION 4: FIELD ACTIVITIES

Field work was designed to achieve two primary objectives. Surface soil, sediment, and surface water samples were collected to determine if contamination is present and if there is currently off-site migration. The second objective was to investigate the alleged burial of approximately 200 drums using geophysical survey techniques. Soil, sediment, and foundry sand (fill) samples were composites of five aliquots each. Aliquots were collected within an approximate 6 foot radius of a sample node. Surface water samples were collected as discrete samples.

The field effort was conducted by E&E/FIT personnel, Team Leader Jim Alldritt, Geologist Ted Faile, and Soil Scientist Eric Hess. The samples were collected on December 17, 1986 and the geophysical reconnaissance was performed on December 16 and 17, 1986.

4.1 SAMPLING/CHARACTERIZATION OF THE SITE

The detection of contamination migrating via surface runoff required sampling at various locations of three different types of matrixes (Figure 5 and Table 1). One foundry sand sample (I098L002) was collected to characterize the components of the fill material. Three surface soil samples were collected downgradient of the site (I098L003, -005, and -006). Surface soil sample #I098L005 was collected at the base of a 10-inch diameter outlet drainage pipe, which was designed to direct subsurface flow from the quarry into Deer Creek. Four sediment samples were collected, three were associated with seeps emitting from the quarry (I098L001, -004, and -007), and one sediment sample served as

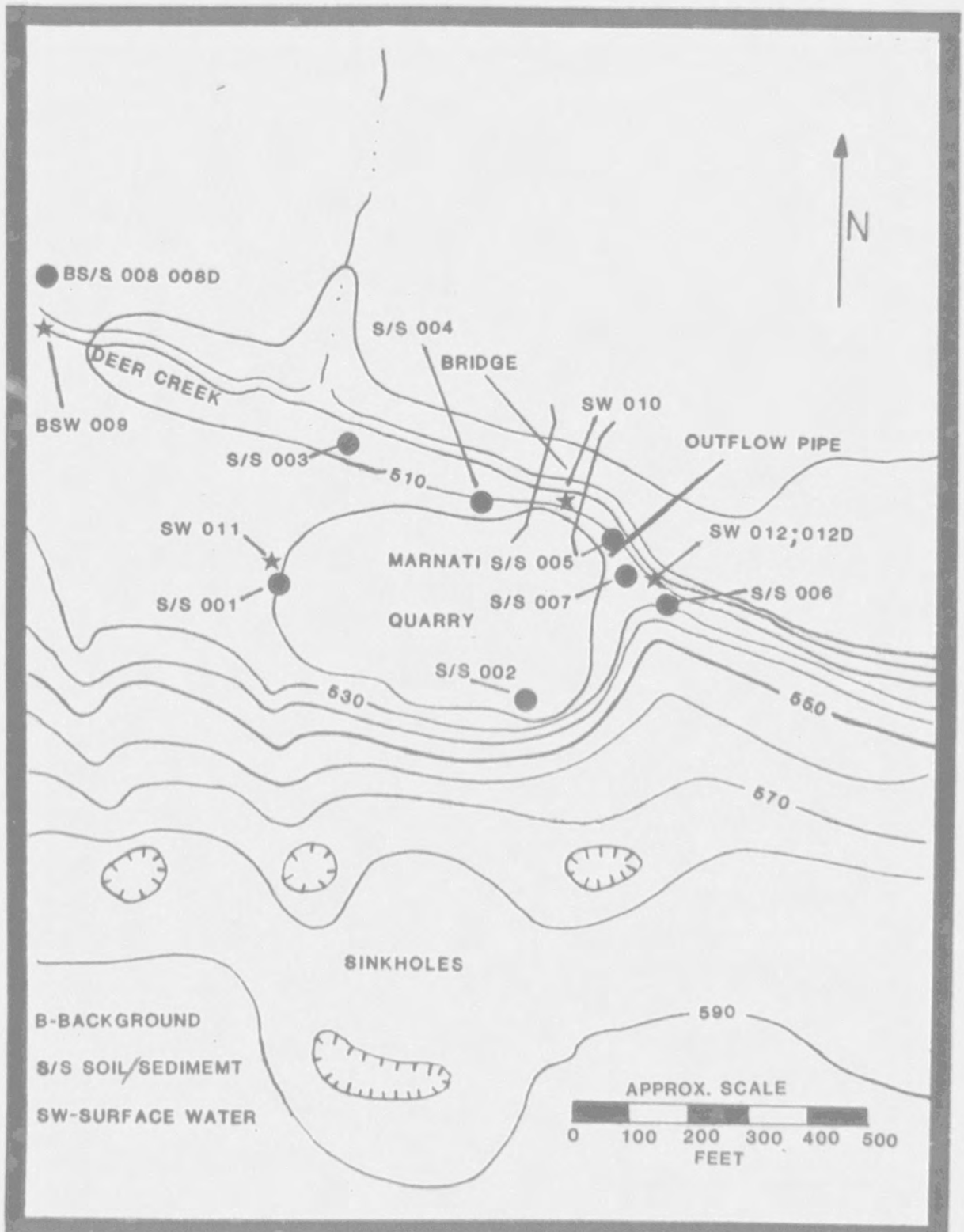


FIGURE 5 SAMPLE LOCATIONS MARNATI QUARRY CONTOUR INTERVAL 10 FEET

SAMPLE LOCATIONS: ● SOIL/SEDIMENT S/S ★ SURFACE WATER SW

SOURCE:USGS 7.5' SERIES CREVE COEUR QUAD. 1968 DECEMBER 1986

Table 1
Sample Summary
Marnati Quarry Site
December 17, 1986
TDD #F-07-8611-64

Sample #	Description	Location (See Figure 5)
I098L001	Sediment/Seep Sample	West edge of quarry
I098L002	Surface quarry fill sample	Approx. 20 ft. from wall at SE corner of site
I098L003	Surface soil sample, north of quarry	Approx. 50 ft. from NW corner of quarry on south side of Deer Creek
I098L004	Sediment/seep sample	20 ft. W of bridge at of edge of quarry
I098L005	Surface soil sample below quarry outlet pipe	Approx. 75 ft. east of bridge at edge of quarry
I098L006	Surface soil sample	NE corner of site on bank of Deer Creek
I098L007	Sediment/seep sample	Approx. 15 ft. southeast of sample I098L005
I098L008	Background sediment sample from channel of Deer Creek	Approx. 2,000 ft. upstream
I098L008D	Duplicate of I098L008	Same as I098L008
I098L009	Background surface water sample	Approx. 2,000' upstream from site; same location as I098L008
I098L010	Surface water sample	Downstream from seep sample I098L004; under bridge
I098L011	Surface water sample	From seep on western edge of site
I098L012	Surface water sample	Deer Creek sample collected downstream from outlet pipe
I098L012D	Duplicate of I098L012	Same as I098L012
I099L013F	Field Blank	- - - - - -

Note: All samples were analyzed for: Total metals, acid/base/neutrals, pesticides, and volatile organics.

a background sample (I098L008). All nine samples (eight locations and one duplicate) were composed of five aliquots and collected as surface samples, 0 to 2 inches deep. The samples were collected with solvent-rinsed stainless steel spoons and placed into disposable aluminum pans for homogenization before placing in sample jars.

The close proximity of Deer Creek to the site makes it susceptible to potential contamination migrating from the quarry. Four locations were selected for sampling of surface water. One served as a background sample and was collected approximately 1,000 feet upstream from the site (I098L009). One sample was collected from a seep on the west end of the site (I098L011) and the remaining two samples were collected downgradient, under and east of the bridge, from Deer Creek (I098L010 and -012). Surface water samples #I098L012 and its duplicate were collected approximately 10 feet downstream from the location of the outlet drainage pipe. One field blank and one duplicate were included to combine a final total of six water samples. All the water samples were collected directly into the sample containers. Temperature, pH, and conductivity were measured and recorded in the field.

Because of the possible unknown content of the drums allegedly buried at the site, an analysis of all samples included the compounds of the entire Hazardous Substance List (HSL). The analysis involved the following analytical fractions: total and dissolved metals, acid/base/neutrals, pesticides, and volatile organics.

4.2 GEOPHYSICAL SURVEYS

The geophysical reconnaissance was performed on December 16 and 17, 1986. At that time, much of the quarry surface was cluttered with piles of leaves and brush which, to some extent, disrupted the continuity of the survey. Despite this impediment, the E&E/FIT conducted an effective survey.

The geophysical study included surveillance of the magnetic field using an EG&G Model G-856 Proton Precession Magnetometer. A grid pattern of ten lines, running north to south, set 50 feet apart was designed to efficiently cover the entire quarry area. Readings were recorded at 25 foot intervals along each line to a maximum distance of 350 feet. Cultural interferences, along with the general geometry of the quarry, dictated the necessity for lines of unequal length. In localized areas of interest, smaller intervals (between readings) were used along each line. In some cases, an intermediate line segment was created, in order to better define these area. Background values were recorded at several stations off-site (see Appendix D) to provide a quick comparison with measurements within the quarry.

The magnetometer survey was performed in conjunction with an electromagnetic (EM) survey, the latter with effective investigation depths of approximately 7.5 meters (m), 15m, and 30m. A Geonics Model EM 34-3 Terrain Conductivity Meter was employed for this multi-depth investigation. The EM lines were run along the same lines used for the magnetometer survey (north to south) throughout the uncovered areas. In the debris area the lines were run wherever space permitted, regardless of their orientation. A total of seven lines were recorded in this manner, ranging in length from 20m to 80m.

4.3 STANDARD FIELD PROCEDURES

The entire gathering of data and samples was conducted utilizing Level D protection. Rubber boots, tyveks, and gloves were worn during the collection of soil, sediment, and water samples. Decontamination on-site was limited to decontaminating the washable components of the geophysical equipment and boots. Sampling apparatus and protective clothing were disposable and were placed in a large plastic bag after each day's use and returned, double bagged, to Kansas City for proper disposal. Decontamination wash and rinse water were disposed on-site.

The entire sampling activity was thoroughly documented to provide a record of the sample collection procedures, sampling locations, chain-of-custody records, field log book, and photographs.

1. Field sheets were used to document the sample collection process to include the specific sample number, the date and time of collection of sample, the individual that collected the sample(s) and any observations or identifiers made in conjunction with the collection of each individual sample.

2. The sample tags, containing the specific sample number, date and time of sampling, site name, and sampling location were affixed to each discrete sample collected. The tags were secured with transparent tape.

3. Chain-of-custody was recorded and initiated for each set of samples to provide a record of sample custody. To simplify the methodology, team leader Jim Alldritt assumed custody of all 15 samples, including two duplicates and one field blank.

SECTION 5: ANALYTICAL RESULTS

5.1 DATA RESULTS

Tables 2 through 7 indicate levels of semi-volatile, volatile organic, pesticide, and total metal compounds detected in samples collected during the site investigation. All contaminant levels are reported at ug/l or ppb levels; with the exception of the total metals analysis for the soil/sediment samples, which are in mg/kg or ppm. The sample set includes two duplicates (I098L008D, for soil and I098L012D, for water) and one field blank sample to comprise the field prepared quality control samples. The field blank sample data were qualified by the "blank" rules. An extensive number of tentatively identified compounds, detected in sediment samples, are listed in the Data Transmittal. The concentrations of these tentatively identified compounds are crude estimates based on response relative to an internal standard. An authentic standard was not run for these compounds.

Because the quarry fill is primarily foundry waste, metals contamination is the primary focus. Other parameters (volatile organics, semi-volatiles, and pesticides) were selected for analysis due to the alleged drum-burial and due to the length of time that the quarry served as a landfill.

5.2 DATA EVALUATION

Tables 6 and 7 list the detected concentrations of total metal compounds for soil/sediment and surface water respectfully. Sample I098L008 serves as a background sediment sample; and sample I098L009 as a background surface water sample. The data results from these two background samples indicate that the metal compounds detected in all samples may very well be naturally occurring, as on-site concentrations

Table 2
Concentrations of Semivolatile
Compound Detected in Soil/Sediment
at Marnati Quarry Site, Frontenac, Missouri
December 1986

Compound (ug/kg or PPB)	West Seep Area 001	Foundry Sand 002	Soil, NW of Quarry 003	North Seep Area 004	Soil, Pipe Outlet Area 005	Soil, NE of Quarry 006	NE Seep Area 007	Background Sediment 008	008D
4-Methylphenol	---	---	---	20M	---	---	---	---	---
Hexachloroethane	---	---	---	74M	---	---	---	---	---
Benzoic Acid	---	250M	---	---	---	---	---	---	---
2-Chloronapthalene	36M	30M	30M	32M	---	30M	22M	19M	---
Acenaphthylene	---	18M	---	19M	690M	---	16M	---	---
Acenapthene	---	16M	94M	---	180M	---	---	---	---
Dibenzofuran	---	12M	---	---	480	---	---	---	---
Diethylphthalate	52M	---	---	19M	---	---	---	---	---
Fluorene	---	24M	130M	---	880	---	---	30M	---
Phenanthrene	67M	210M	---	44M	10,000	---	620	390M	350M
Anthracene	---	4M	51M	---	170M	---	27M	22M	10M
Di-N-Butylphthalate	54M	26M	29M	32M	---	---	---	27M	---
Fluoranthene	200M	110M	2600	43M	18,000	---	950M	630	550
Pyrene	220M	180M	2400J	47M	18,000	---	1000	820	520
Benzo(A)Anthracene	130M	---	1100	---	11,000	---	520	290M	230M
Chrysene	130M	110M	1200	---	9,100	---	500	260M	250M
Benzo(B)Fluoranthene	---	---	1100	---	6,700	---	---	240M	170M
Benzo(A)Pyrene	---	---	940	---	6,000	---	---	220M	240M
Indeno(1,2,3-CD) Pyrene	---	---	650M	---	2,600	---	---	---	130M
Napthalene	---	---	---	---	380M	---	---	---	---
2-Chlorophenol	---	---	---	---	---	---	---	---	29M
2,4,5-Trichlorophenol	---	---	---	44M	---	---	---	---	---
Benzo(K)Fluoranthene	---	---	---	---	---	---	---	140M	250M
Benzo(G,H,I)Perylene	---	---	---	---	---	---	---	---	160M

J = Compound was qualitatively identified; however, compound failed to meet all QA criteria and is only an estimated value.

M = Compound was qualitatively identified; however, quantitative value is less than contract required detection limits.

Note: Only detected levels reported. Sample series # is I098L. See Figure 5 for sample locations and Appendix B for complete analytical results.

Table 3
Concentrations of Semivolatile
Compounds Detected in Water (ug/l or PPB)
at Marnati Quarry Site, Frontenac, Missouri
December 1986

	Sample Numbers (I098L...)	
Compound Name	011 (West Seep)	013F (Field Blank)
2-Chlorophenol	0.8M	----
Diethylphthalate	----	0.8M
Bis(2-Ethylhexyl) Phthalate	----	17.0

J = Compound was qualitatively identified; however, compound failed to meet all QA criteria and is only an estimated value.

M = Compound was qualitatively identified; however, quantitative value is less than contract required detection limits.

Note: Only detected levels reported. See Figure 4 For sample locations and Appendix B for complete analytical results.

Table 4
Concentrations of Volatile Organic Compounds
Detected in Soil/Sediments*
Marnati Quarry Site
Frontenac, Missouri
December, 1986

Compound (ug/kg)	Foundry Sand 002	Soil, NW of Quarry 003	North Seep Area 004	Soil, Pipe Outlet Area 005	Soil, NE of Quarry 006	NE Seep Area 007	Background Sediment 008	008D
Methylene Chloride	57	10	20	---	---	4M	---	---
Acetone	---	---	91J	---	---	---	---	---
Benzene	---	---	3M	---	---	---	---	1M
Toluene	---	---	5M	1M	2M	1M	1M	---
Total Xylenes	---	---	13	---	---	---	---	---
1,1,1 Tichlorethane	---	---	---	---	---	4M	---	5M

* Methylene Chloride detected in only two water samples (I098L009 = 55 PPB and I098L012D = 46 PPB). No other volatile organic compounds detected in any of the water samples.

J = Compound was qualitatively idontified; however, compound failed to meet all QA criteria and is only an estimated value.

M = Compound was qualitatively identified; however, quantitative value is less than contract required detection limits.

Note: Only detected levels reported. Sample series # is I098L. See Figure 5 for sample locations and Appendix B for complete analytical results.

Table 5
Concentrations of Pesticide Compounds
Detected in Soil/Sediment*
At Marnati Quarry Site, Frontenac, Missouri
December 1986

Compound (ug/kg or PPB)	West Seep Area 001	Foundry Sand 002	Soil, NW of Quarry 003	Soil, Pipe Outlet Area 005	NE Seep Area 007	Background Sediment 008
Alpha - BHC	----	9.4	----	----	----	----
Chlordane	2.1M	13M	35M	17M	2.2M	----
Arochlor - 1254	----	----	390	----	----	----
Arochlor - 1260	43M	----	----	----	----	----
Methoxychlor	----	----	----	----	----	55M

* No pesticide compounds were detected in any of the water samples (#I098L009 through I098L013F).

M = Compound was qualitatively identified; however, quantitative value is less than contract required detection limits.

Note: Only detected levels reported. Sampe series # is I098L. See Figure 5 for sample locations and Appendix B for complete analytical results.

Table 6
Concentrations of Total Metals
Detected in Soil/Sediment
at the Marnati Quarry Site, Frontenac, Missouri
December 1986

Compound (mg/kg or PPM)	West Seep Area 001	Foundry Sand 002	Soil, NW of Quarry 003	North Seep Area 004	Soil, Pipe Outlet Area 005	Soil, NE of Quarry 006	NE Seep Area 007	Background Sediment 008	008D
Aluminum	4,200	400	3,300	15,000	6,600	11,000	4,800	7,700	8,300
Arsenic	----	2M	----	----	10J	I	----	56J	47J
Barium	180J	43M	110J	180J	170J	130J	120J	670J	810J
Beryllium	----	----	----	----	----	----	.6M	2.8M	3.2M
Cadmium	----	2M	----	----	----	----	----	3M	4
Calcium	5,100J	780M	3,300J	21,000J	6,800J	14,000J	6,600J	11,000J	15,000J
Chromium	15	200	9	34	21	23	17	----	74
Cobalt	17M	17M	8M	12M	18M	11M	15M	91	100
Copper	33	27	10M	17M	21	21	14M	28	71
Iron	18,000	18,000	9,600	33,000	32,000	24,000	19,000	100,000	110,000
Lead	70J	65J	44J	23J	71J	41J	44J	110J	110J
Manganese	7,300	3,800	820	2,700	1,110	850	730	9,000	10,000
Nickel	19M	170	9M	39	24M	28	17M	67	78
Potassium	340	290M	420M	1,800M	970M	680M	510M	610J	----
Sodium	----	----	----	2,500M	2,000M	----	----	----	----
Vanadium	18M	----	17M	51	34	40	28M	150	150
Zinc	160J	36J	38J	87J	86J	76J	67J	160J	190J
Magnesium	1,700M	16,000	1,400	9,400	3,400	7,900	2,300	3,300	3,200M
Mercury	I	I	I	I	----	I	0.4J	0.1J	0.1J

J = Compound was qualitatively identified; however, compound failed to meet all QA criteria and is only an estimated value.

M = Compound was qualitatively identified; however, quantitative value is less than contract required detection limits.

I = Analysis attempted, but no results can be reported.

Note: Only detected levels reported. Sample series # is I098L. See Figure 5 for sample locations and Appendix b for complete analytical data.

Table 7
Concentrations of Total Metals
Detected in Surface Water
Marnati Quarry Site, Frontenac, Missouri
December 1986

Compound (ug/l or PPB	Creek, Back-ground 009	Creek, Under Bridge 010	West Seep 011	(Deer) Creek Pipe Outlet Area 012	012D	Field Blank 013F
Barium	76M	70M	96M	75M	80M	----
Calcium	68,000	62,000	120,000	68,000	71,000	----
Copper	61	16M	----	24M	----	----
Magnesium	18,000	17,000	23,000	18,000	18,000	----
Potassium	----	3,700M	1,600M	3,300M	3,600M	----
Sodium	74,000	68,000	35,000	69,000	70,000	----
Zinc	----	14M	15M	----	----	----
Iron	----	----	----	2,600J	----	310J
Mercury	----	----	----	----	----	.2J
Lead	----	----	----	----	----	5
Manganese	110	230	100	310	310	----

J = Compound was qualitatively identified; however, compound failed to meet all QA criteria and is only an estimated value.

M = Compound was qualiltatively identified; however, quantitative value is less than contract required detection limits.

Note: Only detected levels reported. Sample series # is I098L. See Figure 5 for sample locations and Appendix B for complete analytical data.

are similar to those of the background samples. Although slightly elevated levels of metals were detected in some soil samples, it appears these metals are not being leached out into Deer Creek as indicated by the three downstream water samples (I098L010, I098L011, and I098L012). The hardness of local water sources is reflected by the high calcium, magnesium, potassium, and sodium content detected in the water samples (Table 7).

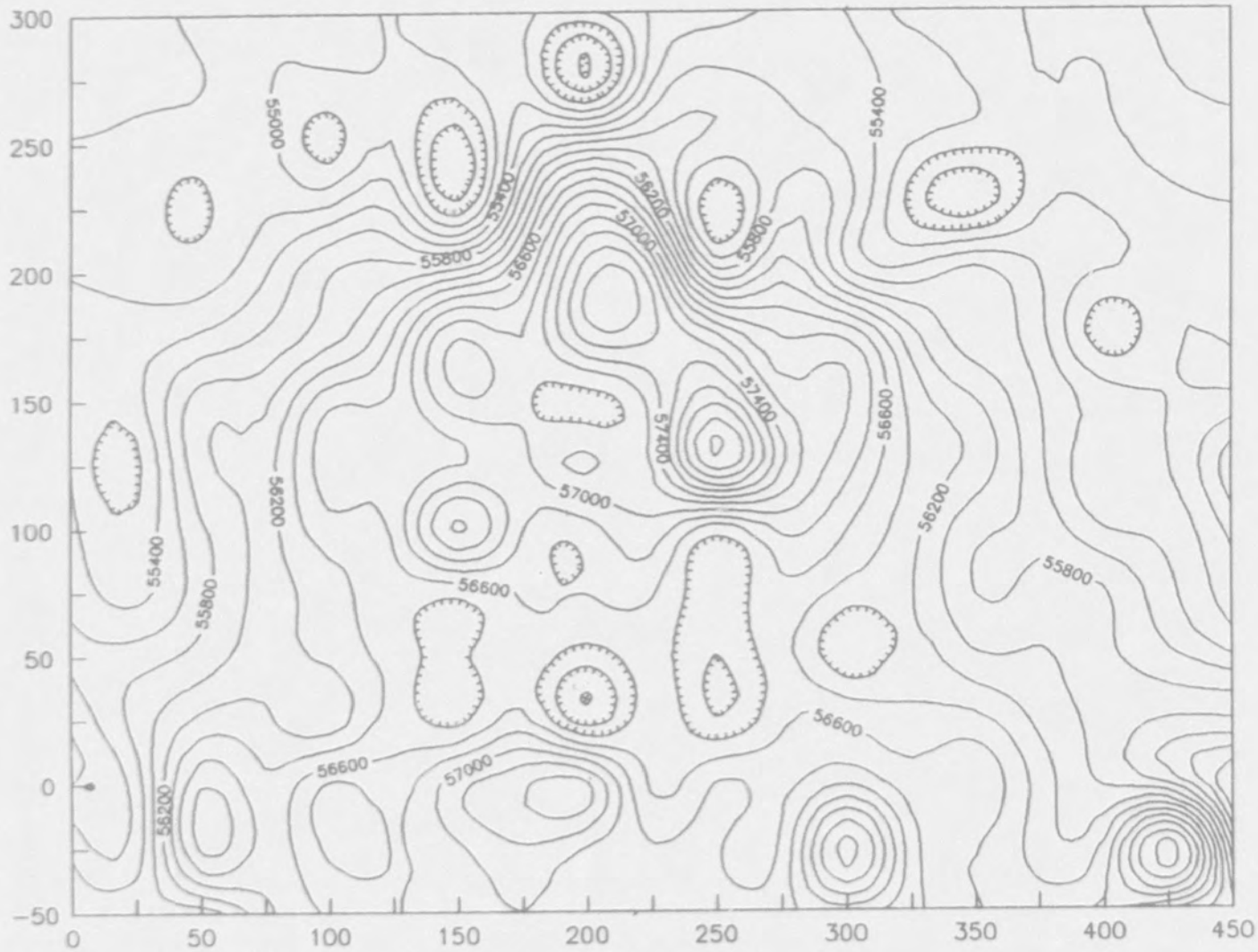
Tables 2 and 3 show detected levels of semi-volatile and volatile compounds within soil/sediment samples, respectfully. The data indicates low levels of several semi-volatile compounds were detected; detected levels are not believed to be at environmentally harmful levels nor did they significantly differ from background samples, except for the soil sample collected near the drain pipe outlet. The north seep sample indicated the most (and highest concentrations) volatiles contamination of any sample: acetone, 91 ppb; benzene, 3 ppb; toluene, 5 ppb; and total xylenes, 13 ppb. The water samples did not show significant levels of volatile, semi-volatile, or pesticide compounds. The pesticide compounds detected in the soil/sediment samples (Table 5) were very low. The data indicates that although the quarry fill has elevated levels of metals and slightly elevated levels of semi-volatiles, these compounds are not being leached out of the quarry into Deer Creek as indicated by lack of contamination in the water samples (see Tables 3 and 7).

SECTION 6: GEOPHYSICAL DATA

On December 16 and 17, 1986 geophysical surveys were conducted at the quarry in order to gather information which might support or refute the allegation that drums were buried on-site. It was anticipated that an anomaly in the electromagnetic and magnetic field caused by such a burial could be defined using the appropriate geophysical techniques. The data from the surveys was plotted and contoured using the Golden Software contouring package. Figure 6A is a magnetic field contour plot and Figure 6B is a profile along magnetometer line 300. Figures 7 through 10 are electromagnetic contour maps (in mmhos/meter) for the three different depth penetrations. The contours of both data sets indicate there is variability in the fill materials, with respect to magnetic and electromagnetic properties.

Magnetic anomalies along the south wall of the quarry partially reflect the debris scattered along the slope of this wall. Several pieces of scrap metal, including an empty 55-gallon drum was observed amid the debris. However, the magnitude of these anomalies indicates buried ferrous materials are also present in these areas.

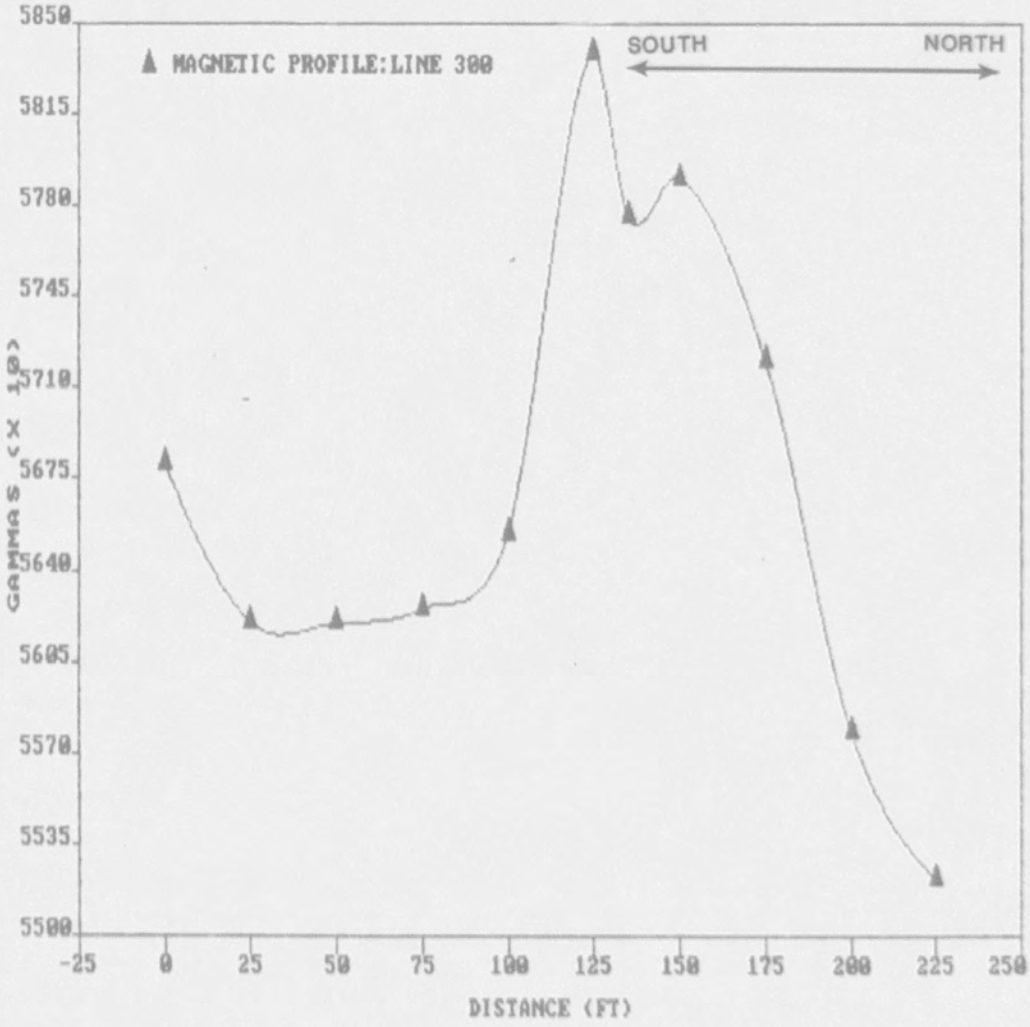
A very strong magnetic gradient occurs over the north-central portion of the quarry. A profile of this gradient, along line 300, is shown in Figure 6B. Cultural obstructions, including two storage sheds and several pieces of heavy equipment, contributed significantly to this strong gradient, though the magnitude of the gradient suggests a more influential source lies beneath the surface. An estimated depth of this source can be calculated by utilizing criteria involving the measurement of the horizontal gradient, or slope, of the anomaly. This technique is expressed in the formula $Z = KX_z$ where Z is the source depth, X_z is the horizontal distance, or run, of the measured slope, and K is a factor between 0.5 and 1.5. Using the method, a depth range of 7.5 to 22.5 feet was calculated for the source of this large magnetic anomaly.

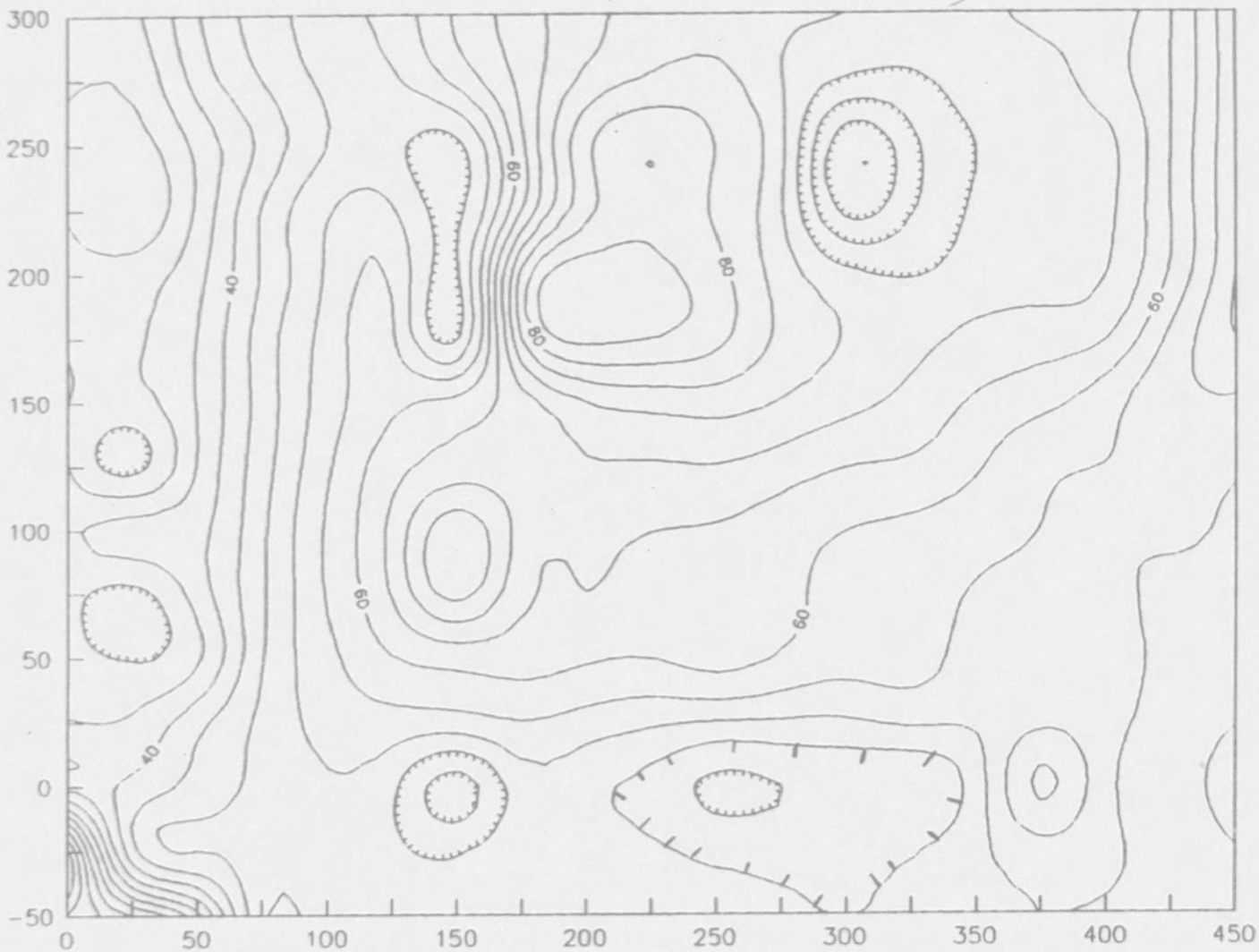


Contour Interval: 200 gammas

FIGURE 6A MAGNETIC SURVEY MARNATI QUARRY FRONTENAC,MO.

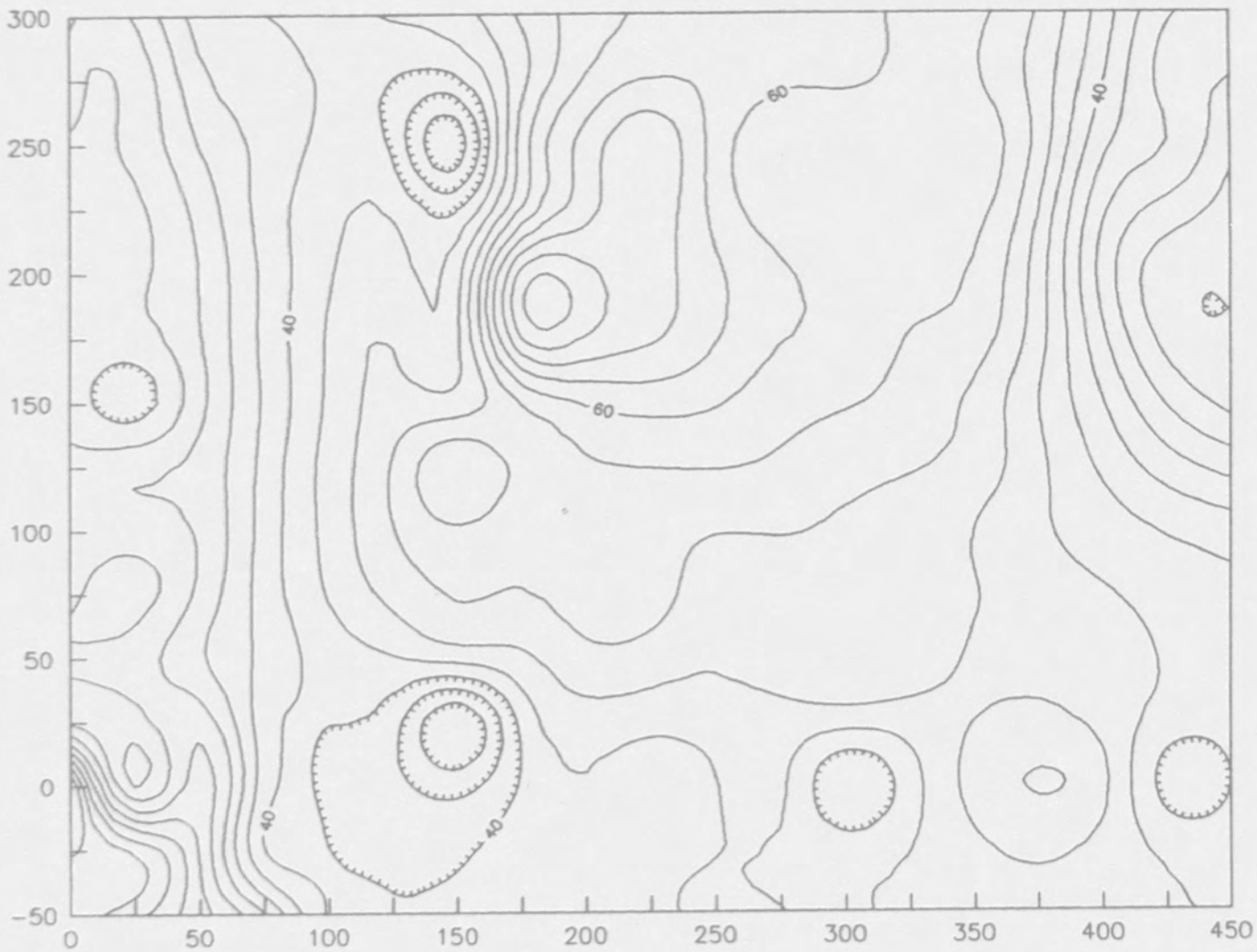
FIGURE 6B: MARNATI QUARRY — MAGNETIC PROFILE LINE 300





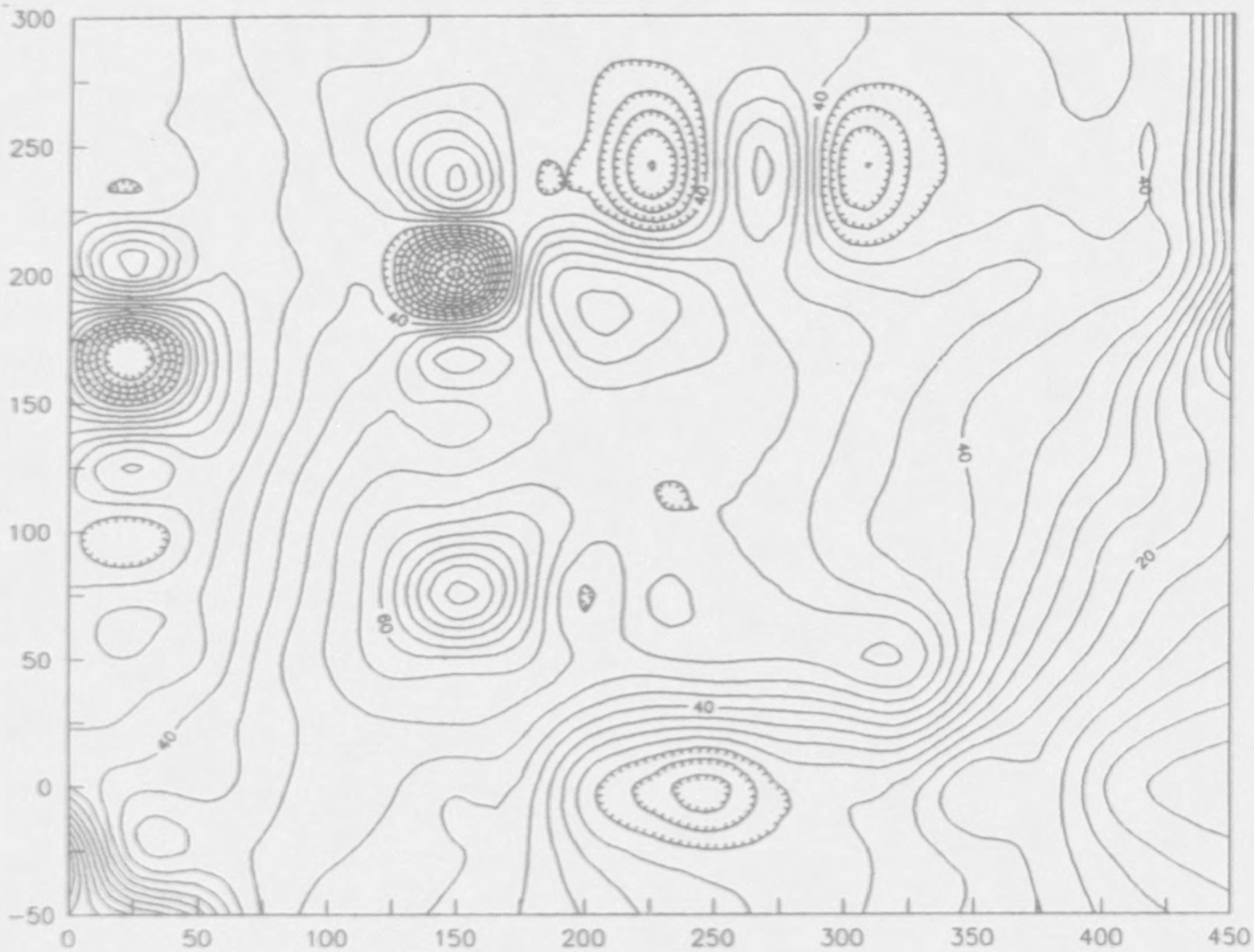
Contour Interval: 4 millimhos/meter

FIGURE 7 ELECTROMAGNETIC SURVEY EM34-10M COIL SEPARATION-HORZ. DIPOLE



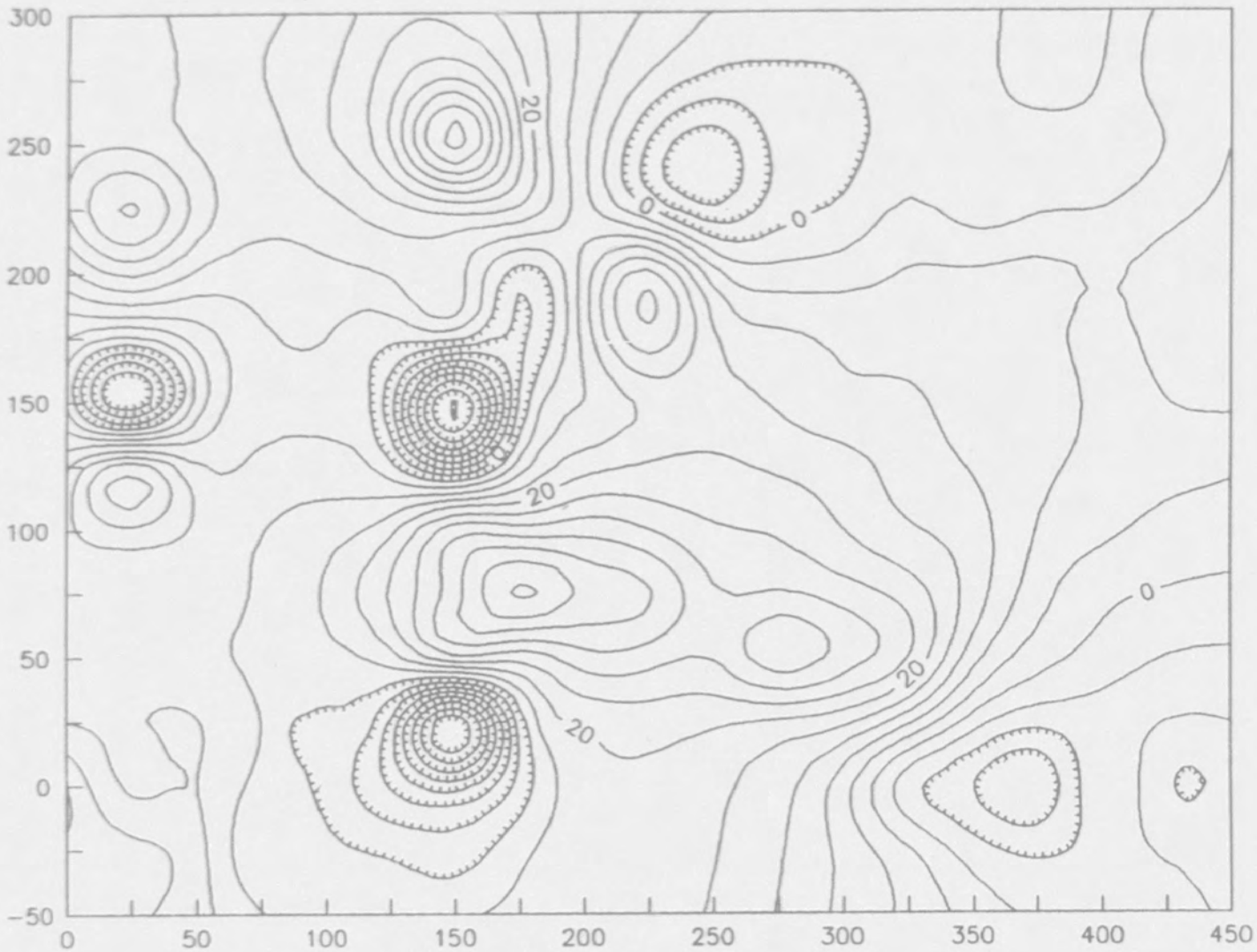
Contour Interval: 4 millimhos/meter

FIGURE 8 ELECTROMAGNETIC SURVEY EM34-20M COIL SEPARATION-HORZ. DIPOLE



Contour Interval: 4 millimhos/meter

FIGURE 9 ELECTROMAGNETIC SURVEY EM34-10M COIL SEPARATION-VERT. DIPOLE



Contour Interval: 4 millimhos/meter

FIGURE 10 ELECTROMAGNETIC SURVEY EM34-20M COIL SEPARATION-VERT. DIPOLE

The electromagnetic data generally supports the magnetic data over most areas of the quarry. Contour maps of the 10m and 20m coil spacing data (both vertical and horizontal dipole) each indicate separate anomalies which correspond with magnetic anomalies in the same general area, lending support to the idea that ferrous conductors are located along the south wall. It may be that open dumping occurred along this wall as the quarry was filled with foundry sands and rubble over the years. A comparison of data from the different dipole modes and coil spacings suggests that depths of sources along the south wall may range from 25 to 100 feet.

Electromagnetic data from the 10m vertical dipole and 20m vertical dipole (15m and 30m depths, respectively) contour maps supports the possibility that buried conductor(s) are located in the north-central area of the quarry. Several closely spaced, negative electromagnetic anomalies occur in this area on both the 10m vertical dipole and 20m vertical dipole maps. Only slight anomalies are present on the 10m horizontal dipole contour map. During the sampling activities, the FIT located the end of a drainage pipe extruding from the north edge of the quarry, approximately 150 ft. east of the bridge and about 30 ft. below the surface of the quarry. It is possible that this drainage pipe extends to the western border of the quarry as part of the drainage system which was installed in the 1970s. Particularly large anomalies in this area may also be influenced by other buried objects and, perhaps, to a lesser extent by lateral variations in the foundry sands. The large magnetic anomaly within the north-central area may reflect a least one source of the electromagnetic aberrances.

The survey results cannot confirm that a drum burial took place at the site, though neither can they confirm that such a burial did not take place. Electromagnetic and magnetic anomalies along the south wall indicate the presence of buried conductors which are likely comprised of

ferrous materials. This area might be considered the most suspect area for a drum burial since it is evident that open dumping has occurred at this end of the quarry. Large gradients in the magnetic and electromagnetic fields, though partially a result of cultural interferences, also reflect potential buried targets in the north-central portion of the quarry.

SECTION 7: SUMMARY AND CONCLUSIONS

Fifteen samples, including two duplicates and one field blank (Table 1), were submitted to the EPA Region VII lab in Kansas City, Kansas on December 19, 1986. Included were three surface soil samples, one foundry sand sample, five sediment samples (including one duplicate), six surface water samples (including one duplicate), and one field blank. All 15 samples were analyzed for total metals, acid/base/neutrals, pesticide, and volatile organic fractions. The samples were collected on December 17, 1986 by E & E/FIT members Jim Alldritt, Eric Hess, and Ted Faile. Relatively thorough EM 34-3 and magnetometer surveys were conducted at the site, despite large amounts of brush pile on-site (see Figure 2). The surveys were somewhat slowed by having to move various disabled motorized vehicles in order to do a more complete survey.

The objectives of the Marnati Quarry site investigation were to determine if geophysical surveys of the site could detect anomalies representing alleged buried drums and to characterize the hazardous waste potential of the site, especially within the primary migration route of Deer Creek. As reported in the previous section (Section 6), the geophysical survey identified several anomalies which are attributable, in part, to metallic wastes buried on site. The analytical results of the soil and water samples indicate possible minor migration of compounds leaching from the abandoned quarry, however, most wastes in the Marnati Quarry fill appear to be fairly stable and were not detected in the Deer Creek samples. Potential ground water contamination (primarily heavy metals) is not a major hazard at this site, because all local water use is from surface sources.

SECTION 8: REFERENCES

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