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Formerly Utilized Sites Remedial Action Program (FUSRAP)
Contract No. DE-AC05-81OR20722

RADIOLOGICAL CHARACTERIZATION REPORT FOR THE MUNICIPAL PROPERTY AT LODI FIRE STATION NO. 2 (KENNEDY DRIVE)

Lodi, New Jersey

September 1989

Bechtel National, Inc.

063982

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SEP 29 1989

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Attention: Robert G. Atkin
Technical Services Division

Subject: Bechtel Job No. 14501, FUSRAP Project
DOE Contract No. DE-AC05-81OR20722
Publication of Radiological Characterization Report for seventeen residential properties, four municipa properties, and seven commercial properties in Lodi and Maywood, New Jersey
Code: 7315/WBS: 138

Dear Mr. Atkin:

Enclosed is one copy each of the 28 subject published reports for the properties listed in Attachment 1. These reports incorporate all comments received in this review cycle (CCNs 063165, 063327, 062285, and 061568) and are being published wit approval of Steve Oldham, as reported in CCN 063868.

Also enclosed (as Attachment 2) is a proposed distribution list for these reports. Please send us any changes to the proposed distribution list at your earliest convenience so we may distribute the reports.

BNI would like to express our thanks to Mr. Oldham for his cooperation and efforts to review these drafts in an accelerate manner. His efforts have allowed us to publish these reports o schedule. If you have any questions about these documents, please call me at 576-4718.

Very truly yours,

R. C. Robertson
Project Manager - FUSRAP

RCR:wfs:1756x
Enclosure: As stated

CONCURRENCE

DOE/OR/20722-249

RADIOLOGICAL CHARACTERIZATION REPORT FOR THE MUNICIPAL PROPERTY AT FIRE STATION NO. 2 (KENNEDY DRIVE)

LODI, NEW JERSEY

SEPTEMBER 1989

Prepared for

UNITED STATES DEPARTMENT OF ENERGY

OAK RIDGE OPERATIONS OFFICE

Under Contract No. DE-AC05-81OR20722

By

N. C. Ring, D. J. Whiting, and W. F. Stanley

Bechtel National, Inc.

Oak Ridge, Tennessee

Bechtel Job No. 14501

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ABBREVIATIONS

cm	centimeter
cm^2	square centimeter
cpm	counts per minute
dpm	disintegrations per minute
ft	foot
h	hour
in.	inch
km^2	square kilometer
L	liter
L/min	liters per minute
m	meter
m^2	square meter
MeV	million electron volts
μR/h	microroentgens per hour
mi	mile
mi^2	square mile
min	minute
mrad/h	millirad per hour
mrem	millirem
mrem/yr	millirem per year
pCi/g	picocuries per gram
pCi/L	picocuries per liter
WL	working level
yd	yard
yd^3	cubic yard

1.0 INTRODUCTION AND SUMMARY

This section provides a brief description of the history and background of the Maywood site and its vicinity properties. Data obtained from the radiological characterization of this vicinity property are also presented.

1.1 INTRODUCTION

The 1984 Energy and Water Appropriations Act authorized the U.S. Department of Energy (DOE) to conduct a decontamination research and development project at four sites, including the site of the former Maywood Chemical Works (now owned by the Stepan Company) and its vicinity properties. The work is being administered under the Formerly Utilized Sites Remedial Action Program (FUSRAP) under the direction of the DOE Division of Facility and Site Decommissioning Projects. Several residential, commercial, and municipal properties in Lodi, New Jersey, are included in FUSRAP as vicinity properties. Figure 1-1 shows the location of the Lodi vicinity properties in relation to the former Maywood Chemical Works.

The U.S. Government initiated FUSRAP in 1974 to identify, clean up, or otherwise control sites where low-activity radioactive contamination (exceeding current guidelines) remains from the early years of the nation's atomic energy program or from commercial operations that resulted in conditions Congress has mandated that DOE remedy (Ref. 1).

FUSRAP is currently being managed by DOE Oak Ridge Operations. As the Project Management Contractor for FUSRAP, Bechtel National, Inc. (BNI) is responsible to DOE for planning, managing, and implementing FUSRAP.

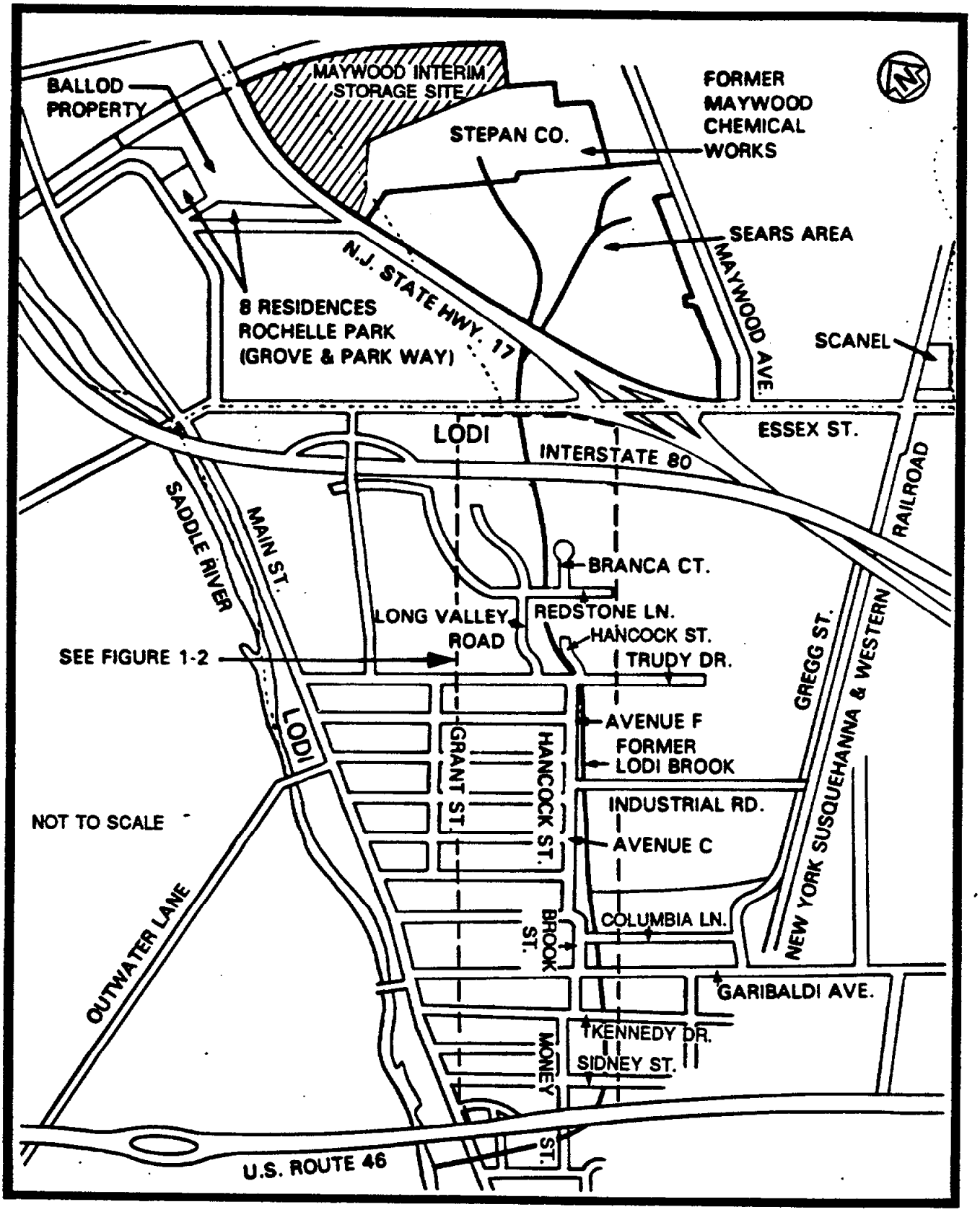

FIGURE 1-1 LOCATION OF LODI VICINITY PROPERTIES

1.2 PURPOSE

The purpose of the 1987 survey performed by BNI was to locate the horizontal and vertical boundaries of radionuclide concentrations exceeding remedial action guidelines.

1.3 SUMMARY

This report details the procedures and results of the radiological characterization of the property at Fire Station No. 2 (Figure 1-2) in Lodi, New Jersey, which was conducted in November and December 1987. Additional data were obtained in October 1988.

Ultimately, the data generated during the radiological characterization will be used to define the complete scope of remedial action necessary to release the site.

Fire Station No. 2 is a municipal property consisting of a one and one-half story concrete block building surrounded by asphalt on three sides and a grassy area at the rear of the building. The property is situated on the northeast corner of the intersection of Brook Street and Kennedy Drive. Entrance to the station is from Kennedy Drive. Nearby properties are primarily residential; however, two municipal properties are in close proximity to the fire station property. The station currently provides fire protection for the residential, municipal, and commercial properties in its vicinity.

This characterization confirmed that thorium-232 is the primary radioactive contaminant at this property. Results of surface soil samples for Fire Station No. 2 showed maximum concentrations of thorium-232 and radium-226 to be 10.9 and less than 1.1 pCi/g, respectively. The maximum

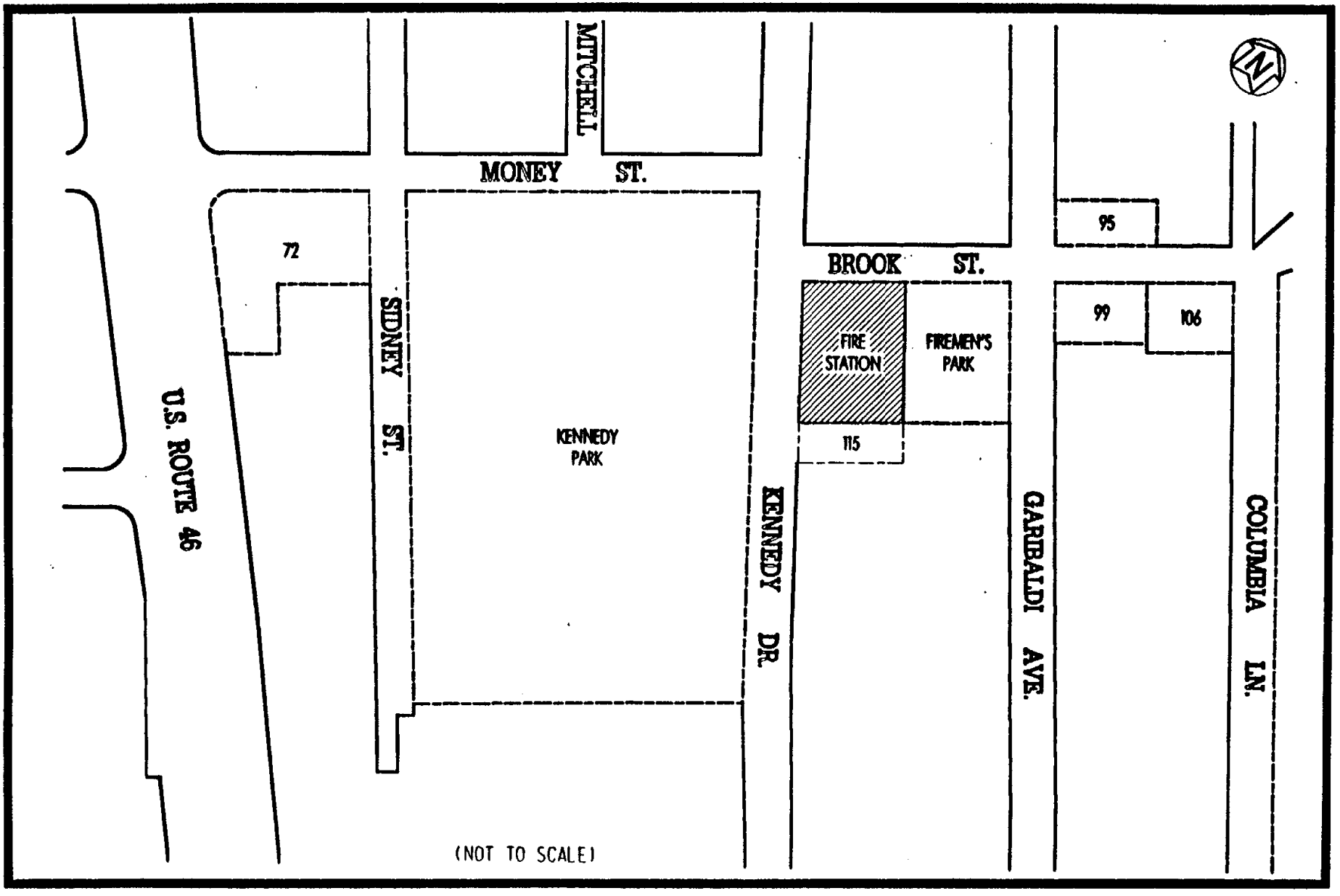

FIGURE 1-2 LOCATION OF FIRE STATION NO. 2

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concentration of uranium-238 in surface soil samples was less than 6.0 pCi/g.

Subsurface soil sample concentrations ranged from 0.4 to 61.9 pCi/g for thorium-232 and from 0.3 to 3.6 pCi/g for radium-226. The average background level in this area for both radium-226 and thorium-232 is 1.0 pCi/g. The concentrations of uranium-238 in subsurface soil samples ranged from 0.4 to less than 10.5 pCi/g. Because the major contaminants at the vicinity properties are thorium and radium, the decontamination guidelines provide the appropriate guidance for the cleanup activities. DOE believes that these guidelines are conservative for considering potential adverse health effects that might occur in the future from any residual contamination. The dose contributions from uranium and any other radionuclides not numerically specified in these guidelines are not expected to be significant following decontamination. In addition, the vicinity properties will be decontaminated in a manner so as to reduce future doses to levels that are as low as reasonably achievable (ALARA) (Ref. 2).

Soil analysis data for this property indicated surface contamination. Subsurface investigation by gamma logging indicated contamination to a depth of 2.13 m (7.0 ft).

Exterior gamma radiation exposure rates ranged from 7 to 11 μR/h, including background. This property is an active municipal fire station; therefore, no indoor measurement was obtained because of limited access and the need for characterization activities not to interfere with normal station activities.

The radon-222 measurement inside the station house indicated a concentration of 0.6 pCi/L, which is within the DOE guideline of 3.0 pCi/L.

The measurement for radon daughters was 0.005 working level (WL), and the measurement for thoron daughters was 0.003 WL.

All data tables for this property appear at the end of this report.

1.4 CONCLUSIONS

Evaluation of data collected, analyses performed, and historical documentation reviewed indicates the presence of radiological contamination on the Fire Station No. 2 property. This contamination is primarily subsurface contamination ranging from a depth of 15.2 cm (6.0 in.) to 2.13 m (7.0 ft). In addition, the contamination appears to extend beneath the station house, and there is a high probability that the contamination extends beneath the street (Kennedy Drive) in front of the property. An isolated area of surface contamination in the northeast corner of the property was indicated by soil analysis. The total affected area is estimated to be approximately 45 percent of the property. These conclusions are supported by documentation that establishes the presence of the former channel of Lodi Brook in this area. This channel is the suspected transport mechanism for the radiological contamination.

2.0 SITE HISTORY

The Maywood Chemical Works was founded in 1895. The company began processing thorium from monazite sand in 1916 (during World War I) for use in manufacturing gas mantles for various lighting devices. Process wastes from manufacturing operations were pumped to two areas surrounded by earthen dikes on property west of the plant. Subsequently, some of the contaminated wastes migrated onto adjacent and vicinity properties.

In 1928 and again between 1944 and 1946, some of the residues from the processing operations were moved from the company's property and used as mulch and fill in nearby low-lying areas. The fill material consisted of tea and coca leaves mixed with other material resulting from operations at the plant. Some fill material apparently contained thorium process wastes (Ref. 3).

Uncertainty exists as to how the properties in Lodi were contaminated. According to an area resident, fill from an unknown source was brought to Lodi and spread over large portions of the previously low-lying and swampy area. For several reasons, however, a more plausible explanation is that the contamination migrated along a drainage ditch originating on the Maywood Chemical Works property. First, it can be seen from photographs and tax maps of the area that the course of a previously existing stream known as Lodi Brook, which originated at the former Maywood Chemical Works, generally coincides with the path of contamination in Lodi. The brook was subsequently replaced by a storm drain system as the area was developed. Second, samples taken from Lodi properties indicate elevated concentrations of a series of elements known as rare earths. Rare earth elements are typically found in monazite sands, which also contain

thorium. This type of sand was feedstock at the Maywood Chemical Works, and elevated levels are known to exist in the by-product of the extraction process. Third, the ratio of thorium to other radionuclides found on these Lodi properties is comparable to the ratio found in contaminated material on other properties in Lodi (Ref. 4). And finally, long-time residents of Lodi recalled chemical odors in and around the brook in Lodi and steam rising off the water. These observations suggest that discharges of contaminants occurred upstream.

The Stepan Chemical Company (now called the Stepan Company) purchased Maywood Chemical Works in 1959. The Stepan Company itself has never been involved in the manufacture or processing of any radioactive materials (Ref. 5).

2.1 PREVIOUS RADIOLOGICAL SURVEYS

Numerous surveys of the Maywood site and its vicinity properties have been conducted. Among the past surveys, three that are pertinent to this vicinity property are detailed in this section.

January 1981--The Nuclear Regulatory Commission directed that a survey be conducted of the Stepan Company property and its vicinity properties in January 1981. Using the Stepan Company plant as the center, a 10.3-km^2 (4-mi^2) aerial survey was conducted by the EG&G Energy Measurements Group, which identified anomalous concentrations of thorium-232 to the north and south of the Stepan Company property. The Lodi vicinity properties were included in this survey (Ref. 6).

June 1984--In June 1984, Oak Ridge National Laboratory (ORNL) conducted a "drive-by" survey of Lodi using its

"scanning van." Although not comprehensive, the survey indicated areas requiring further investigation (Ref. 7).

September 1986--At the request of DOE, ORNL conducted radiological surveys of the vicinity properties in Lodi in September 1986 to determine which properties contained radioactive contamination in excess of DOE guidelines and would, therefore, require remedial action (Ref. 8).

2.2 REMEDIAL ACTION GUIDELINES

Table 2-1 summarizes the DOE guidelines for residual contamination. The thorium-232 and radium-226 limits listed in Table 2-1 will be used to determine the extent of remedial action required at the vicinity properties. DOE developed these guidelines to be consistent with the guidelines established by the U.S. Environmental Protection Agency (EPA) for the Uranium Mill Tailings Remedial Action Program.

TABLE 2-1
SUMMARY OF RESIDUAL CONTAMINATION GUIDELINES

BASIC DOSE LIMITS

The basic limit for the annual radiation dose received by an individual member of the general public is 100 mrem/yr.

SOIL GUIDELINES

Radionuclide	Soil Concentration (pCi/g) Above Background[a,b,c]
Radium-226 Radium-228 Thorium-230 Thorium-232	5 pCi/g when averaged over the first 15 cm of soil below the surface; 15 pCi/g when averaged over any 15-cm-thick soil layer below the surface layer.
Other Radionuclides	Soil guidelines will be calculated on a site-specific basis using the DOE manual developed for this use.

STRUCTURE GUIDELINES

Airborne Radon Decay Products

Generic guidelines for concentrations of airborne radon decay products shall apply to existing occupied or habitable structures on private property that has no radiological restrictions on its use; structures that will be demolished or buried are excluded. The applicable generic guideline (40 CFR 192) is: In any occupied or habitable building, the objective of remedial action shall be, and reasonable effort shall be made to achieve, an annual average (or equivalent) radon decay product concentration (including background) not to exceed 0.02 WL[d]. In any case, the radon decay product concentration (including background) shall not exceed 0.03 WL. Remedial actions are not required in order to comply with this guideline when there is reasonable assurance that residual radioactive materials are not the cause.

External Gamma Radiation

The average level of gamma radiation inside a building or habitable structure on a site that has no radiological restrictions on its use shall not exceed the background level by more than 20 μR/h.

Indoor/Outdoor Structure Surface Contamination

Radionuclide[f]	Allowable Surface Residual Contamination[e] (dpm/100 cm²) Average[g,h]	Maximum[h,i]	Removable[h,i]
Transuranics, Ra-226, Ra-228, Th-230, Th-228 Pa-231, Ac-227, I-125, I-129	100	300	20
Th-Natural, Th-232, Sr-90, Ra-223, Ra-224 U-232, I-126, I-131, I-133	1,000	3,000	200
U-Natural, U-235, U-238, and associated decay products	5,000 α	15,000 α	1,000 α
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above	5,000 β - γ	15,000 β - γ	1,000 β - γ

TABLE 2-1
(CONTINUED)

[a]These guidelines take into account ingrowth of radium-226 from thorium-230 and of radium-228 from thorium-232, and assume secular equilibrium. If either thorium-230 and radium-226 or thorium-232 and radium-228 are both present, not in secular equilibrium, the guidelines apply to the higher concentration. If other mixtures of radionuclides occur, the concentrations of individual radionuclides shall be reduced so that 1) the dose for the mixtures will not exceed the basic dose limit, or 2) the sum of ratios of the soil concentration of each radionuclide to the allowable limit for that radionuclide will not exceed 1 ("unity").

[b]These guidelines represent allowable residual concentrations above background averaged across any 15-cm-thick layer to any depth and over any contiguous 100-m^2 surface area.

[c]Localized concentrations in excess of these limits are allowable, provided that the average concentration over a 100-m^2 area does not exceed these limits. In addition, every reasonable effort shall be made to remove any source of radionuclide that exceeds 30 times the appropriate soil limit, regardless of the average concentration in the soil.

[d]A working level (WL) is any combination of short-lived radon decay products in 1 liter of air that will result in the ultimate emission of 1.3 x 105 MeV of potential alpha energy.

[e]As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[f]Where surface contamination by both alpha- and beta-gamma-emitting radionuclides exists, the limits established for alpha- and beta-gamma-emitting radionuclides should apply independently.

[g]Measurements of average contamination should not be averaged over more than 1 m^2. For objects of less surface area, the average shall be derived for each such object.

[h]The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/h and 1.0 mrad/h, respectively, at 1 cm.

[i]The maximum contamination level applies to an area of not more than 100 cm^2.

[j]The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and measuring the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of surface area less than 100 cm^2 is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. The numbers in this column are maximum amounts.

3.0 HEALTH AND SAFETY PLAN

BNI is responsible for protecting the health of personnel assigned to work at the site. As such, all subcontractors and their personnel were required to comply with the provisions of BNI health and safety requirements and as directed by the on-site BNI Health and Safety Officer.

3.1 SUBCONTRACTOR TRAINING

Before the start of work, all subcontractor personnel attended an orientation session presented by the BNI Health and Safety Officer to explain the nature of the material to be encountered in the work and the personnel monitoring and safety measures that are required.

3.2 SAFETY REQUIREMENTS

Subcontractor personnel complied with the following BNI requirements:

- Bioassay--Subcontractor personnel submitted bioassay samples before or at the beginning of on-site activity, upon completion of the activity, and periodically during site activities as requested by BNI.
- Protective Clothing/Equipment--Subcontractor personnel were required to wear the protective clothing/equipment specified in the subcontract or as directed by the BNI Health and Safety Officer.
- Dosimetry--Subcontractor personnel were required to wear and return daily the dosimeters and monitors issued by BNI.
- Controlled Area Access/Egress--Subcontractor personnel and equipment entering areas where access and egress were controlled for radiation and/or chemical safety purposes were surveyed by the BNI Health and Safety Officer (or personnel representing BNI) for contamination before leaving those areas.

- Medical Surveillance--Upon written direction from BNI, subcontractor personnel who work in areas where hazardous chemicals might exist were given a baseline and periodic health assessment defined in BNI's Medical Surveillance Program.

Radiation and/or chemical safety surveillance of all activities related to the scope of work was under the direct supervision of personnel representing BNI.

Health and safety-related requirements for all activities involving exposure to radiation, radioactive material, chemicals, and/or chemically contaminated materials and other associated industrial safety hazards are generated in compliance with applicable regulatory requirements and industry-wide standards. Copies of these requirements are located at the BNI project office for use by project personnel.

4.0 CHARACTERIZATION PROCEDURES

A master grid was established by the surveyor. BNI's radiological support subcontractor, Thermo Analytical/Eberline (TMA/E), established a grid on individual properties. The size of the grid blocks was adjusted to characterize each property adequately. The grid origin allows the grid to be reestablished during remedial action and is correlated with the New Jersey state grid system. All data correspond to coordinates on the characterization grid. The grid with the east and north coordinates is shown on all figures included in Sections 4.0 and 5.0 of this report.

4.1 FIELD RADIOLOGICAL CHARACTERIZATION

This section provides a description of the instrumentation and methodologies used to obtain exterior surface and subsurface measurements during radiological characterization of this property.

4.1.1 Measurements Taken and Methods Used

An initial walkover survey was performed using an unshielded gamma scintillation detector [5.0- by 5.0-cm (2- by 2-in.) thallium-activated sodium iodide probe] to identify areas of elevated radionuclide activity. Near-surface gamma measurements taken using a cone-shielded gamma scintillation detector were also used to determine areas of surface contamination. The shielded detector ensured that the majority of the radiation detected by the instrument originated from the ground directly beneath the unit. Shielding against lateral gamma flux, or shine, from nearby areas of contamination minimized potential sources of error in the measurements. The measurements were taken 30.4 cm (12 in.) above the ground at the intersections of

3.0-m (10-ft) grid lines. The shielded detector was calibrated at the Technical Measurements Center (TMC) in Grand Junction, Colorado, to provide a correlation of counts per minute (cpm) to picocuries per gram (pCi/g). This calibration demonstrated that approximately 11,000 cpm corresponds to the DOE guideline of 5 pCi/g plus local average background of 1 pCi/g for thorium-232 in surface soils (Ref. 9).

A subsurface investigation was conducted to determine the depth to which the previously identified surface contamination extended and to locate subsurface contamination where there was no surface manifestation. The subsurface characterization consisted of drilling 12 boreholes on the property and one borehole near the sidewalk adjacent to the property (Figure 4-1), using either a 7.6-cm- (3-in.-) or 15.2-cm- (6-in.-) diameter auger bit, and gamma logging them. The boreholes were drilled to depths determined in the field by the radiological and geological support representatives.

The downhole gamma logging technique was used because the procedure can be accomplished in less time than collecting soil samples, and the need for analyzing these samples in a laboratory is eliminated. A 5.0- by 5.0-cm (2- by 2-in.) sodium iodide gamma scintillation detector was used to perform the downhole logging. The instrument was calibrated at TMC where it was determined that a count rate of approximately 40,000 cpm corresponds to the 15-pCi/g subsurface contamination guideline for thorium-232. This relationship has also been corroborated by results from previous characterizations where thorium-232 was found (Ref. 9).

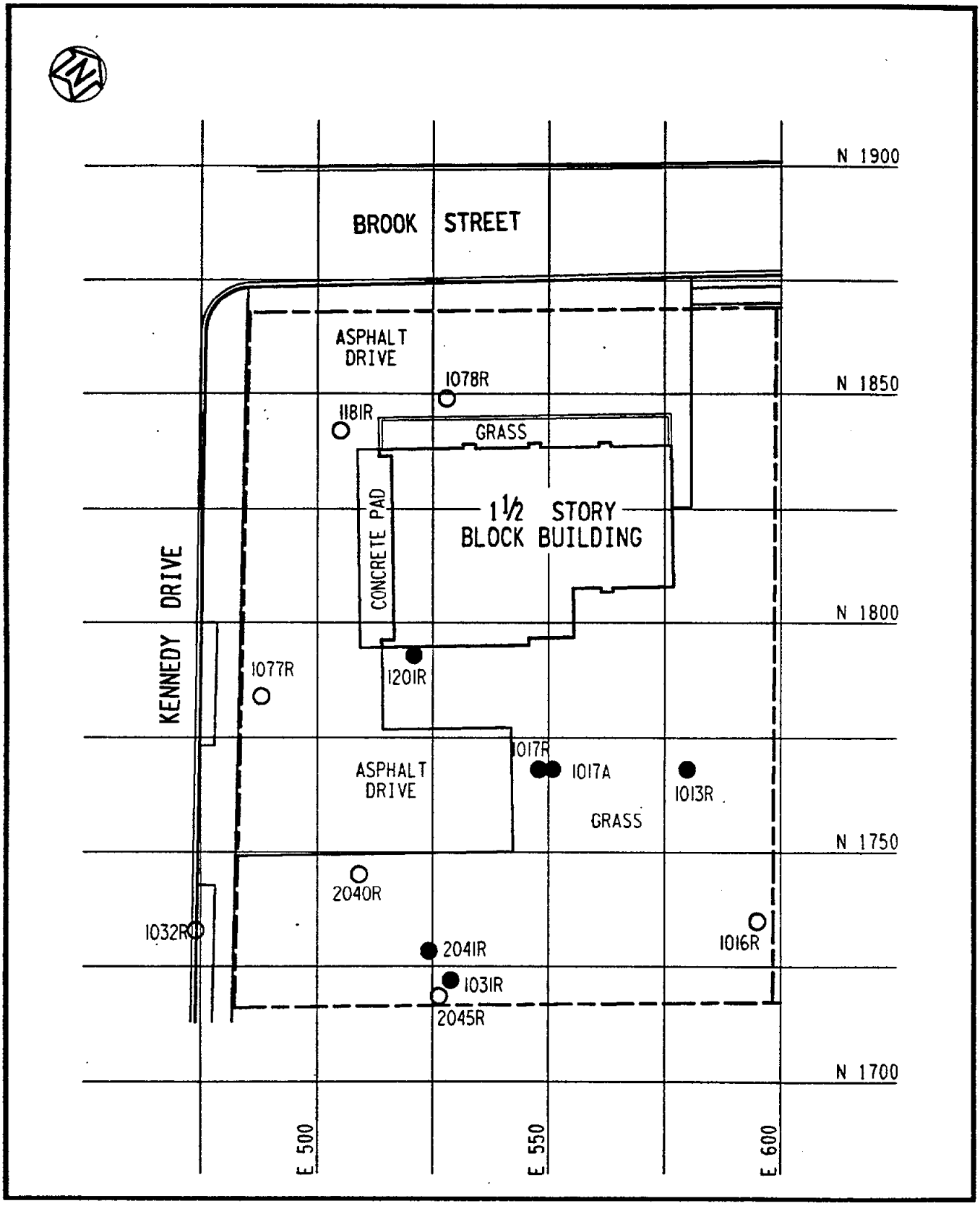

FIGURE 4-1 BOREHOLE LOCATIONS AT FIRE STATION NO. 2

Gamma radiation measurements were taken at 15.2-cm (6-in.) vertical intervals to determine the depth and concentration of the contamination. The gamma-logging data were reviewed to identify trends, whether or not concentrations exceeded the guidelines.

4.1.2 Sample Collection and Analysis

To identify surface areas where the level of contamination exceeded the DOE guideline of 5 pCi/g for thorium-232, areas with measurements of more than 11,000 cpm were plotted. Using these data as well as data from previous surveys (Refs. 5, 6, 7, and 8), the locations of biased surface soil samples were selected to better define the limits of contamination. Surface soil samples were taken at ten locations (Figure 4-2) and analyzed for thorium-232, uranium-238, and radium-226. Each sample was dried, pulverized, and counted for 10 min using an intrinsic germanium detector housed in a lead counting cave lined with cadmium and copper. The pulse height distribution was sorted using a computer-based, multichannel analyzer. Radionuclide concentrations were determined by comparing the gamma spectrum of each sample with the spectrum of a certified counting standard for the radionuclide of interest.

Subsurface soil samples were collected from 13 locations (Figure 4-2) using a 7.6-cm (3.0-in.) outside diameter (O.D.) split-spoon sampler mounted on a tripod or attached to a truck-mounted auger stem. The subsurface soil samples were analyzed for radium-226, uranium-238, and thorium-232 in the same manner as the surface soil samples.

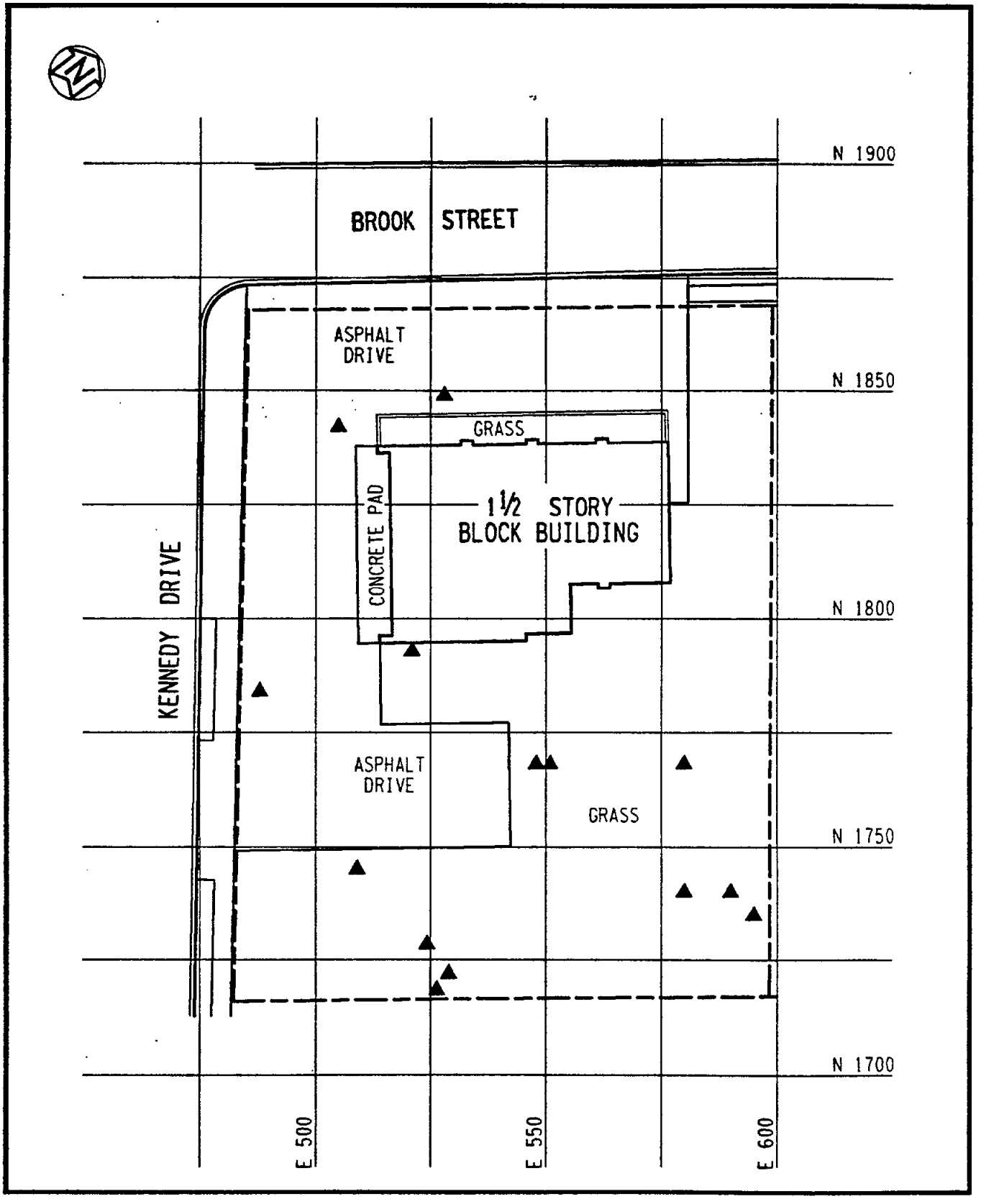

FIGURE 4-2 SURFACE AND SUBSURFACE SOIL SAMPLING LOCATIONS AT FIRE STATION NO. 2

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4.2 BUILDING RADIOLOGICAL CHARACTERIZATION

After evaluating previous radiological survey data as well as data from this characterization, it was suspected that contamination might be present under the foundation of the building. A radon measurement was obtained to verify the presence of contaminated material under the building and to estimate potential occupational exposures during future remedial actions.

Indoor radon measurements were made using the Tedlar bag method. Samples were collected by pumping air into a Tedlar bag at a rate of approximately 2 L/min. The air sample was transferred directly into a scintillation cell with an interior coating of zinc sulfide and an end window for viewing the scintillations. Analysis of the sample was simplified by allowing the radon decay products to build up over time. This method allowed all the radon decay products to come into secular equilibrium with the radon. The scintillation cell was placed in contact with a photomultiplier tube, and the scintillations were counted using standard nuclear counting instrumentation.

Indoor air samples were also collected to determine a WL for radon and thoron daughters. To measure radon daughters, an air sample was collected for exactly 5 min through a 0.45-micron membrane filter at a rate of 11 L/min for a total sample volume of 55 L. Alpha particle activity on the filter paper was counted 40 to 90 min after sampling. An alpha scintillation detector coupled to a count-rate meter or a digital scaler was used. Measurements for thoron daughters were made using the same method as for radon daughters with the exception of the time between collection of the air sample and counting of the alpha particle activity. In the case of thoron daughters, the sample was allowed to age for

at least 5 h after sampling before alpha activity was counted. This elapsed time allowed radon daughters, which may have been present with the thoron daughters, to decay sufficiently so as not to interfere in calculating the WL for thoron daughters.

Exterior gamma exposure rate measurements were made at five locations throughout the property grid system. No interior measurement was obtained because of limited access to the station house. To obtain these measurements, either a 5.0- by 5.0-cm (2- by 2-in.) thallium-activated sodium iodide gamma scintillation detector designed to detect gamma radiation only or a pressurized ionization chamber (PIC) was used. Measurement locations are shown in Figure 4-3. The PIC instrument has a response to gamma radiation that is proportional to exposure in roentgens. A conversion factor for gamma scintillation to the PIC was established through a correlation of these two measurements at four locations in the vicinity of the property. The unshielded gamma scintillation detector readings were then used to estimate gamma exposure rates for each location. These measurements were taken 1 m (3 ft) above the ground. The locations were determined to be representative of the entire property.

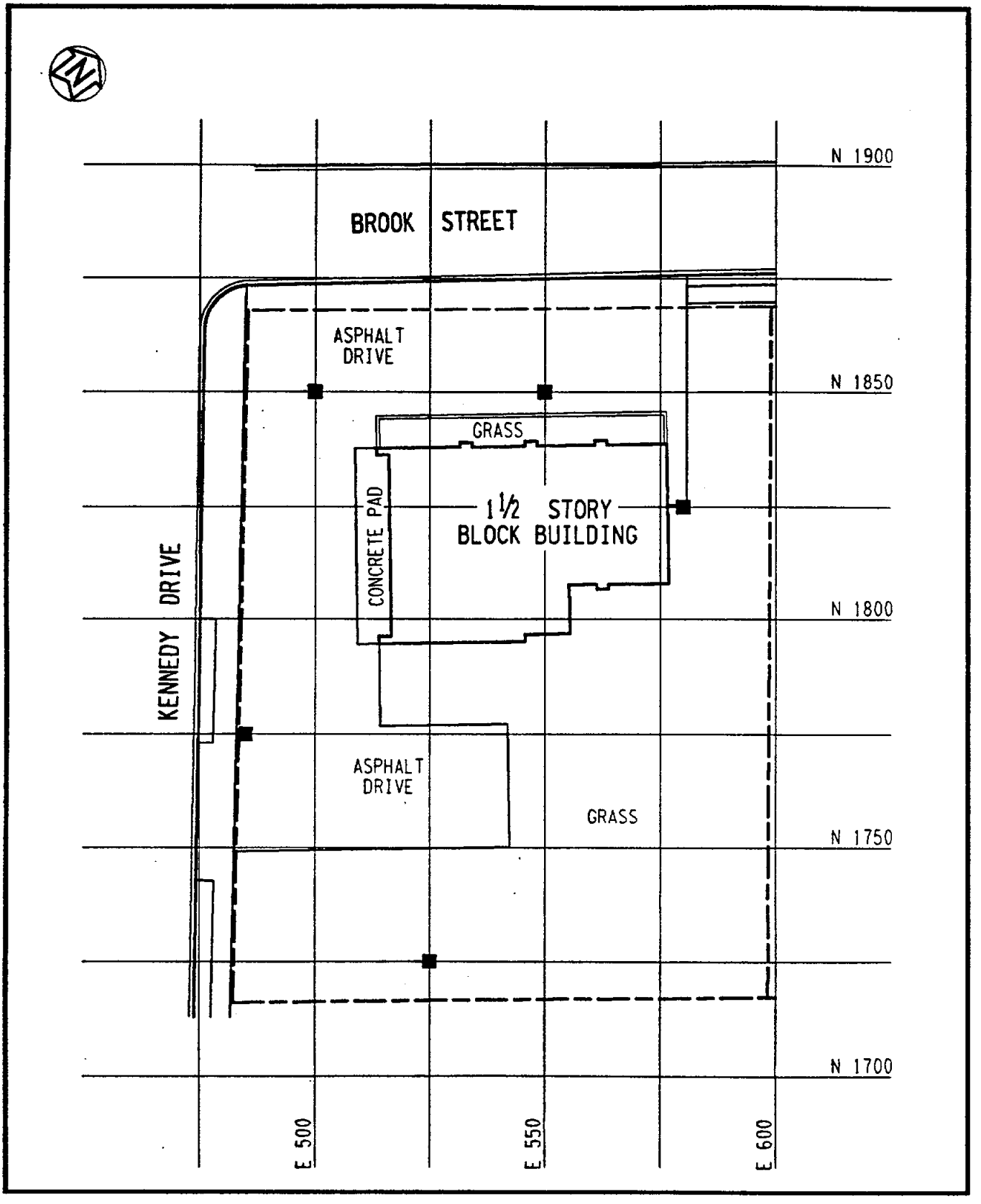

FIGURE 4-3 GAMMA EXPOSURE RATE MEASUREMENT LOCATIONS AT FIRE STATION NO. 2

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5.0 CHARACTERIZATION RESULTS

Radiological characterization results are presented in this section. The data included represent exterior surface and subsurface radiation measurements and interior radiation measurements.

5.1 FIELD RADIOLOGICAL CHARACTERIZATION

Near-surface gamma radiation measurements on the property ranged from 7,000 cpm to approximately 12,000 cpm. The average background level for this area is 5,000 cpm. A measurement of 11,000 cpm is approximately equal to the DOE guideline for thorium-232 of 5 pCi/g above background for surface soil contamination. Using this correlation, the near-surface gamma measurements were used to determine the extent of surface contamination and the basis for selecting the locations of soil samples. Areas of surface contamination are shown in Figure 5-1.

Surface soil samples [depths from 0.0 to 15.2 cm (6.0 in.)] were taken at nine locations on the property and one location near a sidewalk adjacent to the property (Figure 4-2). These samples were analyzed for thorium-232, uranium-238, and radium-226. The concentrations in these samples ranged from 0.7 to less than 6.0 pCi/g for uranium-238, from 0.6 to 10.9 pCi/g for thorium-232, and from 0.5 to less than 1.1 pCi/g for radium-226. Analytical results for surface soils are provided in Table 5-1; these data showed that concentrations of thorium-232 exceeded DOE guidelines (5 pCi/g plus background of 1 pCi/g for surface soils) with a maximum concentration of 10.9 pCi/g. Use of the "less than" (<) notation in reporting results indicates that the radionuclide was not present in concentrations that are quantitative with the instruments and techniques used.

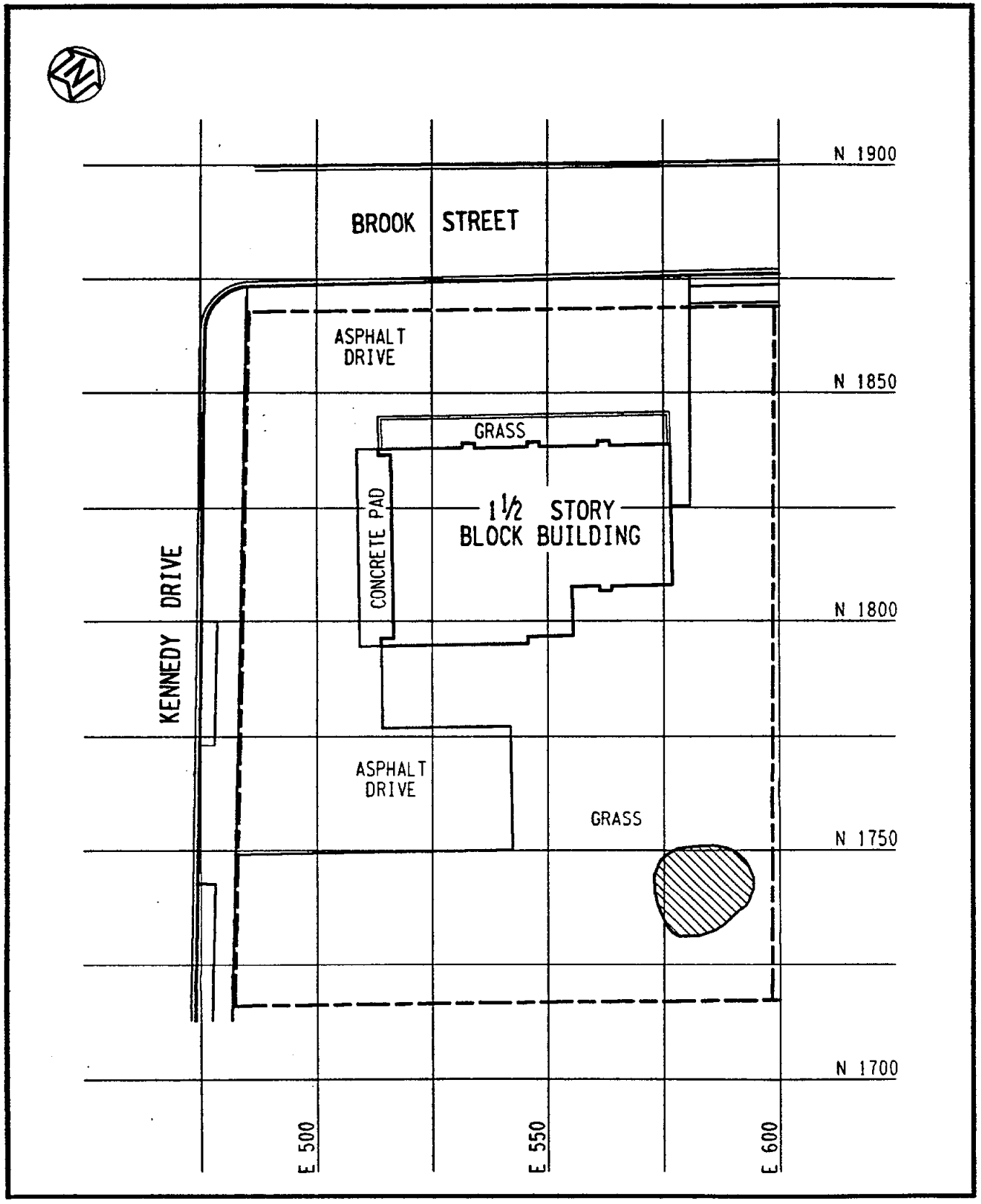

FIGURE 5-1 AREAS OF SURFACE CONTAMINATION AT FIRE STATION NO. 2

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The "less than" value represents the lower bound of the quantitative capacity of the instrument and technique used. The "less than" value is based on various factors, including the volume, size, and weight of the sample; the type of detector used; the counting time; and the background count rate. The actual concentration of the radionuclide is less than the value indicated. In addition, since radioactive decay is a random process, a correlation between the rate of disintegration and a given radionuclide concentration cannot be precisely established. For this reason, the exact concentration of the radionuclide cannot be determined. As such, each value that can be quantitatively determined has an associated uncertainty term ($\pm$), which represents the amount by which the actual concentration can be expected to differ from the value given in the table. The uncertainty term has an associated confidence level of 95 percent.

Thorium-232, the primary contaminant at the site, is the radionuclide most likely to exceed a specific DOE guideline in soil. Parameters for soil sample analysis were selected to ensure that the thorium-232 would be detected and measured at concentrations well below the lower guideline value of 5 pCi/g in excess of background level. Radionuclides of the uranium series, specifically uranium-238 and radium-226, are also potential contaminants but at lower concentrations than thorium-232. Therefore, these radionuclides (considered secondary contaminants) would not be present in concentrations in excess of guidelines unless thorium-232 was also present in concentrations in excess of its guideline level. Parameters selected for the thorium-232 analyses also provide detection sensitivities for uranium-238 and radium-226 that demonstrate that concentrations of these radionuclides are below guidelines. However, because of the relatively low gamma photon abundance of uranium-238, many of the uranium-238 concentrations were below the detection

sensitivity of the analytical procedure; these concentrations are reported in the data tables as "less than" values. To obtain more sensitive readings for the uranium-238 radionuclide with these analytical methods, much longer instrument counting times would be required than were necessary for analysis of thorium-232, the primary contaminant.

Analytical results for subsurface soil samples are given in Table 5-1, and gamma logging data are given in Table 5-2. The results in Table 5-2 showed a range from 6,000 cpm to 221,000 cpm. A measurement of 40,000 cpm is approximately equal to the DOE guideline for subsurface contamination of 15 pCi/g. Analyses of subsurface soil samples indicated uranium-238 concentrations ranging from 0.4 to less than 10.5 pCi/g, thorium-232 concentrations ranging from 0.4 to 61.9 pCi/g, and radium-226 concentrations ranging from 0.3 to 3.6 pCi/g.

On the basis of near-surface gamma radiation measurements, surface and subsurface soil sample analyses, and downhole gamma logging, contamination on this property is believed to consist of surface and subsurface contamination. Surface contamination depths range from 15.2 cm (6.0 in.) to 2.13 m (7.0 ft). The areas of subsurface contamination are shown in Figure 5-2. The subsurface contamination appears to extend beneath the station house and the street (Kennedy Drive) in front of the property.

It is apparent from review of historical documentation (e.g., aerial photographs of the area, interviews with local residents, and previous radiological surveys) that the subsurface contamination on this property lies along the former channel of Lodi Brook and its associated floodplain.

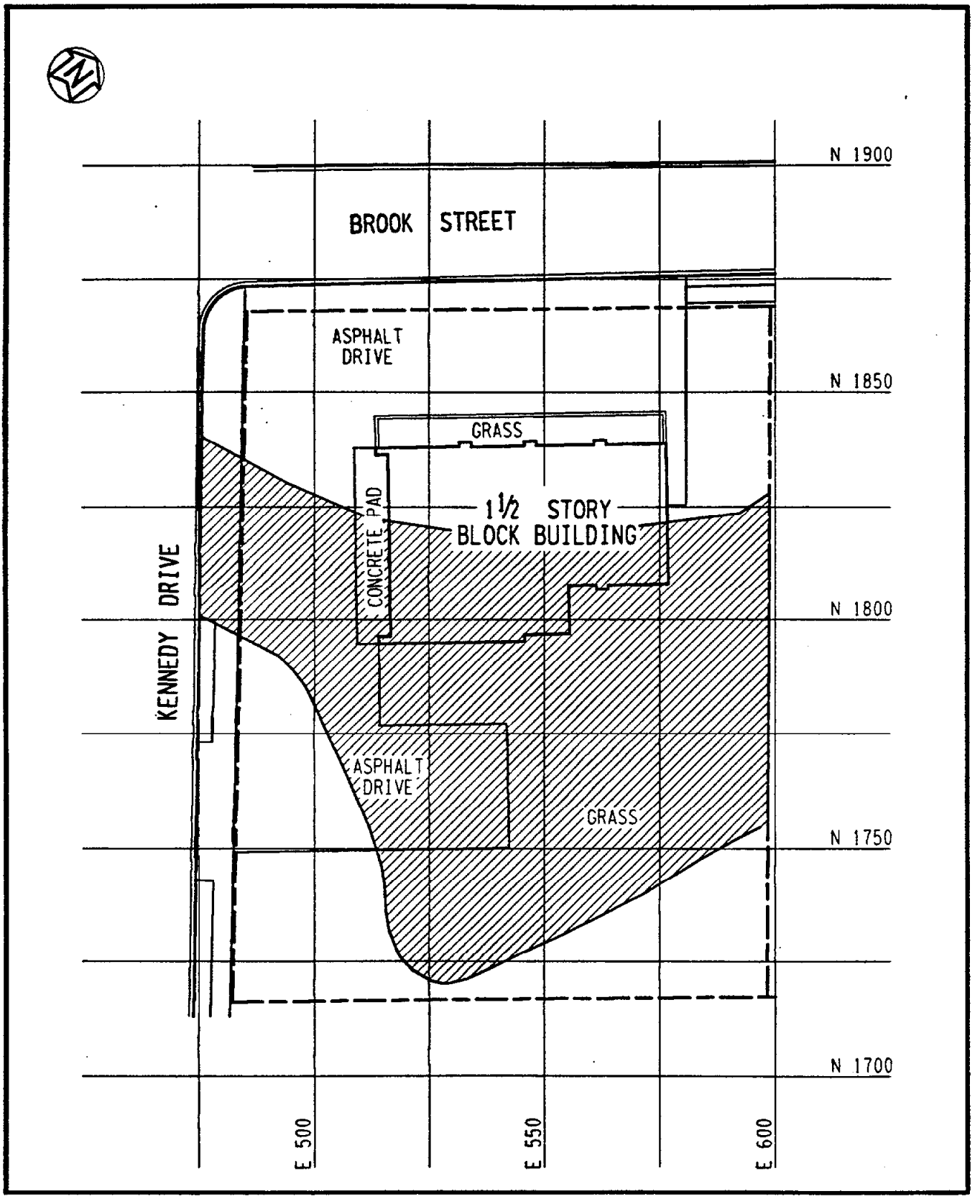

FIGURE 5-2 AREAS OF SUBSURFACE CONTAMINATION AT FIRE STATION NO. 2

M38W9850.DGN

The contamination on this property is similar to contamination found on municipal properties in close proximity to this property. It has been established that the Lodi Brook channel through these neighboring properties once occupied locations connecting to those where stream sediments were found at Fire Station No. 2. Thus, the elevated gamma readings shown on gamma logs from boreholes drilled on this property serve as further indication of the suspected mechanism of transport for radiological contamination (i.e., stream deposition from Lodi Brook).

The vertical and horizontal limits of contamination as determined by this characterization effort are being evaluated to determine the volume of contaminated material that will require remedial action. To develop this estimate, BNI will consider the location of the contamination, construction techniques, and safety procedures.

5.2 BUILDING RADIOLOGICAL CHARACTERIZATION

Results of an indoor radon measurement using the Tedlar bag method indicated a concentration of 0.6 pCi/L. This measurement was substantially less than the applicable DOE guideline of 3.0 pCi/L above guidelines (Ref. 10).

The result of a measurement for radon daughters was 0.005 WL. This result was substantially less than the applicable generic guideline detailed in the Code of Federal Regulations, 40 CFR 192 (Ref. 10), which states that an annual average (or equivalent) radon decay product concentration not exceed 0.02 WL.

The result of a measurement for thoron daughters was 0.003 WL. The generic guideline is more restrictive for radon-222 (radon) than for radon-220 (thoron) according to the National Council

on Radiological Protection [see NCRP Report No. 50 (Ref. 11), which was used as the guideline for thoron daughter measurements].

Exterior gamma radiation exposure rate measurements ranged from 7 to 11 μR/h, including background. The results can be found in Table 5-3. The average exposure rate for this property is 9 μR/h, which is equivalent to the average background exposure rate (Ref. 12). The occupants of the fire station, therefore, receive no dose in excess of average background as a result of contamination on the property. No indoor exposure rate measurement was obtained.

Based on the above information, the exposure rates and doses at this property are within DOE guidelines. Further, it should be emphasized that natural background exposure rates vary widely across the United States and are significantly higher than average background for this area.

TABLE 5-1

SURFACE AND SUBSURFACE RADIONUCLIDE CONCENTRATIONS IN SOIL

FOR FIRE STATION NO. 2

Coordinates[a] East	Coordinates[a] North	Depth (ft)	Concentration (pCi/g ± 2 sigma) Uranium-238	Radium-226	Thorium-232
474	1733	0.0 - 0.5	< 2.5	< 0.7	< 0.9
474	1733	0.0 - 1.0	< 4.3	< 0.7	< 1.7
474	1733	3.5 - 5.5	< 2.1	< 0.4	< 0.9
474	1733	5.5 - 7.5	< 4.0	< 0.9	< 1.4
474	1733	7.5 - 8.8	< 3.4	< 0.9	< 1.5
474	1733	8.5 - 9.5	< 3.3	< 0.8	< 1.1
474	1733	9.5 - 10.5	< 2.1	< 0.5	< 0.6
474	1733	10.5 - 11.5	< 4.1	< 1.3	< 1.7
488	1784	0.0 - 2.0	< 4.7	< 0.9	< 1.9
488	1784	7.0 - 8.0	< 4.1	< 0.7	< 1.8
488	1784	8.0 - 10.0	< 2.9	< 0.7	< 1.1
488	1784	14.0 - 16.0	< 2.6	< 0.9	< 1.0
488	1784	16.0 - 18.0	< 3.0	< 0.7	< 1.1
505	1842	0.0 - 0.5	< 4.3	< 0.9	< 1.2
505	1842	0.0 - 2.0	< 2.9	< 0.6	< 0.8
505	1842	6.0 - 7.0	< 6.7	< 1.1	< 1.8
505	1842	9.0 - 10.0	< 4.7	< 0.8	< 1.1
505	1842	10.0 - 11.0	< 8.1	< 1.3	< 2.0
505	1842	11.0 - 12.0	< 4.6	< 0.8	< 1.2
509	1745	0.0 - 0.5	< 2.0	< 1.0	< 1.0
509	1745	0.5 - 1.0	< 2.0	0.6 ± 0.2	0.8 ± 0.2
509	1745	1.0 - 1.5	< 2.0	< 1.0	< 1.0
509	1745	1.5 - 2.0	< 2.0	< 1.0	< 1.0
509	1745	2.0 - 2.5	< 1.0	< 1.0	< 1.0

TABLE 5-1

(continued)

Page 2 of 6

Coordinates[a] East	Coordinates[a] North	Depth (ft)	Concentration (pCi/g ± 2 sigma) Uranium-238	Radium-226	Thorium-232
509	1745	2.5 - 3.0	< 1.0	0.5 ± 0.3	< 1.0
509	1745	4.0 - 4.5	3.6 ± 0.8	1.2 ± 0.1	4.0 ± 0.2
509	1745	4.5 - 5.0	3.4 ± 2.3	2.0 ± 0.9	2.6 ± 0.8
509	1745	5.0 - 5.5	3.2 ± 2.0	1.0 ± 0.3	< 1.0
509	1745	6.0 - 6.5	4.2 ± 2.0	0.9 ± 0.3	1.6 ± 0.2
509	1745	6.5 - 7.0	2.8 ± 0.8	0.8 ± 0.2	1.9 ± 0.3
509	1745	7.0 - 7.5	< 2.0	0.7 ± 0.1	< 1.0
509	1745	7.5 - 8.0	< 3.0	0.8 ± 0.1	1.4 ± 0.3
509	1745	8.0 - 8.5	1.3 ± 1.2	0.5 ± 0.1	1.0 ± 0.3
509	1745	8.5 - 9.0	< 2.0	< 1.0	< 1.0
509	1745	9.0 - 9.5	2.3 ± 1.7	0.5 ± 0.2	0.7 ± 0.3
509	1745	9.5 - 10.0	< 2.0	0.8 ± 0.4	0.9 ± 0.2
521	1793	0.0 - 0.5	< 5.0	< 1.1	< 1.6
521	1793	0.0 - 1.0	< 3.0	< 0.7	< 1.3
521	1793	3.0 - 5.0	< 3.3	< 0.7	< 1.0
521	1793	5.0 - 6.0	< 2.4	< 0.5	< 0.7
521	1793	7.0 - 8.0	< 10.7	< 1.3	38.3 ± 2.1
521	1793	8.0 - 9.0	< 3.2	< 0.6	< 1.4
521	1793	9.0 - 11.0	< 4.9	< 1.0	< 1.8
524	1728	0.0 - 0.5	0.7 ± 0.3	0.5 ± 0.1	0.7 ± 0.1
524	1728	0.5 - 1.0	< 2.0	< 1.0	< 1.0
524	1728	1.0 - 1.5	1.7 ± 0.6	0.7 ± 0.1	1.1 ± 0.4
524	1728	2.0 - 2.5	< 1.0	< 1.0	< 1.0
524	1728	2.5 - 3.0	< 1.0	< 1.0	< 1.0
524	1728	3.0 - 3.5	1.3 ± 1.0	< 1.0	< 1.0
524	1728	3.5 - 4.0	< 1.0	< 1.0	< 1.0

TABLE 5-1

(continued)

Coordinates[a] East	Coordinates[a] North	Depth (ft)	Concentration (pCi/g ± 2 sigma) Uranium-238	Radium-226	Thorium-232
524	1728	4.0 - 4.5	< 1.0	0.4 ± 0.3	0.7 ± 0.5
524	1728	4.5 - 5.0	< 1.0	< 1.0	< 1.0
524	1728	5.0 - 5.5	< 1.0	< 1.0	0.5 ± 0.2
524	1728	5.5 - 6.0	< 1.0	< 1.0	< 1.0
524	1728	6.0 - 6.5	< 2.0	0.7 ± 0.2	0.9 ± 0.5
524	1728	6.5 - 7.0	1.5 ± 0.4	0.7 ± 0.1	1.0 ± 0.2
524	1728	7.0 - 7.5	2.8 ± 2.2	1.0 ± 2.7	4.8 ± 1.0
524	1728	7.5 - 8.0	< 8.0	1.4 ± 0.3	28.3 ± 0.4
524	1728	8.0 - 8.5	< 12.0	< 1.0	52.5 ± 2.9
524	1728	8.5 - 9.0	< 4.0	0.9 ± 0.2	6.2 ± 0.9
524	1728	9.0 - 9.5	0.9 ± 0.3	0.3 ± 0.1	0.5 ± 0.1
524	1728	9.5 - 10.0	0.4 ± 0.2	0.3 ± 0.1	0.4 ± 0.1
526	1718	0.0 - 0.5	< 1.0	0.5 ± 0.1	0.6 ± 0.4
526	1718	0.5 - 1.0	< 2.0	< 1.0	< 1.0
526	1718	1.0 - 1.5	< 1.0	0.7 ± 0.4	0.7 ± 0.4
526	1718	1.5 - 2.0	< 1.0	0.5 ± 0.2	< 1.0
526	1718	2.0 - 2.5	< 2.0	< 1.0	< 1.0
526	1718	2.5 - 3.0	0.9 ± 0.3	0.5 ± 0.1	0.8 ± 0.1
526	1718	3.0 - 3.5	0.9 ± 0.3	0.6 ± 0.1	0.7 ± 0.1
526	1718	3.5 - 4.0	< 2.0	< 1.0	< 1.0
526	1718	4.0 - 4.5	< 2.0	0.4 ± 0.2	0.4 ± 0.2
526	1718	4.5 - 5.0	< 2.0	0.6 ± 0.1	0.7 ± 0.4
526	1718	6.0 - 6.5	< 2.0	0.5 ± 0.1	< 1.0
526	1718	6.5 - 7.0	2.4 ± 1.7	< 1.0	< 1.0
526	1718	7.0 - 7.5	< 2.0	0.5 ± 0.2	0.6 ± 0.1
526	1718	7.5 - 8.0	< 2.0	< 1.0	< 1.0

TABLE 5-1

(continued)

Page 4 of 6

Coordinates[a] East	Coordinates[a] North	Depth (ft)	Concentration (pCi/g ± 2 sigma) Uranium-238	Radium-226	Thorium-232
528	1849	0.0 - 2.0	< 2.0	< 0.4	< 0.9
528	1849	4.0 - 6.0	< 2.9	< 0.9	< 1.4
528	1849	8.0 - 10.0	< 3.8	< 0.8	< 1.5
529	1722	0.0 - 1.0	< 2.7	< 0.6	< 0.9
529	1722	3.5 - 5.5	< 3.1	< 0.7	< 1.4
529	1722	5.5 - 7.5	< 1.8	< 0.5	< 0.9
529	1722	7.5 - 9.5	< 2.3	< 0.7	< 0.7
529	1722	9.5 - 11.5	< 2.0	< 0.5	< 0.6
529	1722	11.5 - 13.5	< 2.7	< 0.6	< 0.8
529	1722	13.5 - 16.5	< 2.0	< 0.5	< 0.7
548	1768	0.0 - 1.0	< 2.9	< 0.8	< 1.2
548	1768	1.0 - 2.0	< 6.8	< 1.1	8.3 ± 0.5
548	1768	2.0 - 2.2	< 4.7	< 2.3	< 0.6
551	1768	0.0 - 0.5	< 2.3	< 0.6	< 1.0
551	1768	0.0 - 1.0	< 5.0	< 0.9	< 1.5
551	1768	1.0 - 2.0	< 4.3	< 1.1	< 2.1
551	1768	2.0 - 3.5	< 2.1	< 0.6	< 0.8
551	1768	3.5 - 5.5	< 9.4	< 1.2	28.0 ± 0.4
551	1768	5.5 - 6.5	< 6.3	< 1.0	11.0 ± 0.9
551	1768	7.5 - 8.5	< 2.3	< 0.6	< 0.9
551	1768	8.5 - 9.5	< 2.2	< 0.4	< 0.9
551	1768	9.5 - 10.0	< 2.0	< 0.4	< 0.9
551	1768	10.0 - 10.5	< 5.0	< 0.8	7.6 ± 0.6
580	1740	0.0 - 0.5	< 6.0	< 1.0	10.3 ± 1.0

TABLE 5-1

(continued)

Page 5 of 6

Coordinates[a] East	Coordinates[a] North	Depth (ft)	Concentration (pCi/g ± 2 sigma) Uranium-238	Radium-226	Thorium-232
580	1768	0.0 - 1.0	< 3.7	< 0.7	13.4 ± 0.2
580	1768	1.0 - 2.0	< 4.1	< 0.8	5.2 ± 1.0
580	1768	2.0 - 4.0	< 4.3	< 0.7	< 1.5
580	1768	4.0 - 5.0	< 10.5	< 1.9	61.9 ± 4.4
580	1768	5.0 - 6.0	< 7.1	3.6 ± 0.2	23.9 ± 1.9
580	1768	6.0 - 7.0	< 7.9	< 1.2	14.1 ± 0.8
580	1768	7.0 - 8.0	< 2.5	< 0.5	< 1.0
580	1768	8.0 - 9.0	< 6.8	2.1 ± 0.4	8.4 ± 0.6
580	1768	9.0 - 10.0	< 4.0	< 0.9	7.7 ± 1.0
580	1768	10.0 - 11.0	< 3.4	< 0.8	< 1.3
580	1768	11.0 - 12.0	< 4.2	< 0.8	< 1.2
580	1768	12.0 - 13.0	< 3.0	< 0.7	< 1.3
580	1768	13.0 - 14.0	< 2.3	< 0.5	< 0.8
580	1768	14.0 - 15.0	< 1.7	< 0.4	< 0.6
580	1768	15.0 - 16.0	< 3.7	1.9 ± 0.4	< 1.1
580	1768	16.0 - 17.0	< 1.9	< 0.6	< 0.9
590	1740	0.0 - 0.5	< 4.0	0.9 ± 0.4	10.9 ± 1.9
595	1737	0.0 - 0.5	< 5.4	< 0.9	< 1.9
595	1737	2.0 - 4.5	< 2.7	< 0.5	< 1.1
595	1737	4.5 - 5.0	< 5.8	< 1.0	5.2 ± 0.2
595	1737	5.0 - 6.0	< 3.2	< 0.7	< 0.8

TABLE 5-1

(continued)

Page 6 of 6

Coordinates[a] East	Coordinates[a] North	Depth (ft)	Concentration (pCi/g ± 2 sigma) Uranium-238	Radium-226	Thorium-232
595	1737	6.0 - 7.0	< 3.4	< 0.8	< 1.0
595	1737	8.0 - 8.7	< 4.4	< 1.1	< 1.6
595	1737	8.7 - 9.5	< 1.8	< 0.5	< 0.7
595	1737	9.5 - 10.5	< 3.1	< 0.7	< 1.1
595	1737	10.5 - 11.5	< 2.8	< 0.7	< 1.0
595	1737	11.5 - 13.5	< 2.1	< 0.5	< 0.8

[a]Sampling locations are shown in Figure 4-2.

TABLE 5-2

DOWNHOLE GAMMA LOGGING RESULTS

FOR FIRE STATION NO. 2

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole 1032R[d]			
474	1733	0.5	9000
474	1733	1.0	10000
474	1733	1.5	9000
474	1733	2.0	8000
474	1733	2.5	8000
474	1733	3.0	9000
474	1733	3.5	9000
474	1733	4.0	9000
474	1733	4.5	10000
474	1733	5.0	11000
474	1733	5.5	10000
474	1733	6.0	9000
474	1733	6.5	9000
474	1733	7.0	9000
Borehole 1077R[d]			
488	1784	0.5	8000
488	1784	1.0	9000
488	1784	1.5	9000
488	1784	2.0	9000
488	1784	2.5	9000
488	1784	3.0	9000
488	1784	3.5	9000
488	1784	4.0	9000
488	1784	4.5	9000
488	1784	5.0	9000
488	1784	5.5	9000
488	1784	6.0	11000
488	1784	6.5	16000
488	1784	7.0	29000
488	1784	7.5	24000
488	1784	8.0	11000
488	1784	8.5	11000
488	1784	9.0	10000
488	1784	9.5	10000

TABLE 5-2

(continued)

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole 1077R (continued)[d]			
488	1784	10.0	10000
488	1784	10.5	10000
488	1784	11.0	11000
488	1784	11.5	11000
488	1784	12.0	11000
488	1784	12.5	11000
488	1784	13.0	11000
488	1784	13.5	10000
488	1784	14.0	10000
488	1784	14.5	10000
Borehole 1181R[d]			
505	1842	0.5	8000
505	1842	1.0	8000
505	1842	1.5	8000
505	1842	2.0	7000
505	1842	2.5	8000
505	1842	3.0	7000
505	1842	3.5	8000
505	1842	4.0	8000
505	1842	4.5	8000
505	1842	5.0	8000
505	1842	5.5	9000
505	1842	6.0	9000
505	1842	6.5	10000
505	1842	7.0	10000
505	1842	7.5	10000
505	1842	8.0	11000
505	1842	8.5	11000
505	1842	9.0	11000
Borehole 2040R			
509	1745	0.5	9000
509	1745	1.0	8000
509	1745	1.5	7000
509	1745	2.0	8000
509	1745	2.5	9000
509	1745	3.0	13000
509	1745	3.5	22000

TABLE 5-2

(continued)

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole 2040R (continued)			
509	1745	4.0	37000
509	1745	4.5	35000
509	1745	5.0	23000
509	1745	5.5	14000
509	1745	6.0	11000
509	1745	6.5	11000
509	1745	7.0	11000
509	1745	7.5	11000
509	1745	8.0	10000
509	1745	8.5	10000
509	1745	9.0	10000
509	1745	9.5	10000
509	1745	10.0	10000
Borehole 1201R[d]			
521	1793	0.5	8000
521	1793	1.0	9000
521	1793	1.5	8000
521	1793	2.0	8000
521	1793	2.5	9000
521	1793	3.0	10000
521	1793	3.5	10000
521	1793	4.0	20000
521	1793	4.5	55000
521	1793	5.0	53000
521	1793	5.5	21000
521	1793	6.0	12000
521	1793	6.5	12000
521	1793	7.0	12000
Borehole 2041R			
524	1728	0.5	10000
524	1728	1.0	10000
524	1728	1.5	9000
524	1728	2.0	7000
524	1728	2.5	7000
524	1728	3.0	6000
524	1728	3.5	7000
524	1728	4.0	16000

TABLE 5-2

(continued)

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole 2041R (continued)			
524	1728	4.5	32000
524	1728	5.0	81000
524	1728	5.5	166000
524	1728	6.0	174000
524	1728	6.5	92000
524	1728	7.0	34000
524	1728	7.5	18000
524	1728	8.0	10000
524	1728	8.5	10000
524	1728	9.0	8000
524	1728	9.5	8000
524	1728	10.0	8000
Borehole 2045R			
526	1718	0.5	8000
526	1718	1.0	10000
526	1718	1.5	10000
526	1718	2.0	9000
526	1718	2.5	8000
526	1718	3.0	9000
526	1718	3.5	10000
526	1718	4.0	10000
526	1718	4.5	10000
526	1718	5.0	10000
526	1718	5.5	10000
526	1718	6.0	10000
526	1718	6.5	9000
526	1718	7.0	9000
526	1718	7.5	8000
526	1718	8.0	8000
526	1718	8.5	7000
526	1718	9.0	7000
526	1718	9.5	7000
526	1718	10.0	7000

TABLE 5-2

(continued)

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole 1078R[d]			
528	1849	0.5	9000
528	1849	1.0	9000
528	1849	1.5	8000
528	1849	2.0	9000
528	1849	2.5	9000
528	1849	3.0	9000
528	1849	3.5	9000
528	1849	4.0	9000
528	1849	4.5	9000
528	1849	5.0	10000
528	1849	5.5	12000
528	1849	6.0	12000
528	1849	6.5	12000
528	1849	7.0	12000
528	1849	7.5	13000
528	1849	8.0	12000
Borehole 1031R[d]			
529	1722	0.5	16000
529	1722	1.0	18000
529	1722	1.5	18000
529	1722	2.0	13000
529	1722	2.5	9000
529	1722	3.0	9000
529	1722	3.5	13000
529	1722	4.0	19000
529	1722	4.5	20000
529	1722	5.0	22000
529	1722	5.5	28000
529	1722	6.0	23000
529	1722	6.5	19000
529	1722	7.0	17000
529	1722	7.5	16000
529	1722	8.0	15000
Borehole 1017R[d]			
548	1768	0.5	14000
548	1768	1.0	17000
548	1768	1.5	19000

TABLE 5-2

(continued)

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole 1017R (continued)[d]			
548	1768	2.0	15000
548	1768	2.5	18000
548	1768	3.0	27000
548	1768	3.5	45000
548	1768	4.0	132000
548	1768	4.5	99000
548	1768	5.0	40000
548	1768	5.5	22000
548	1768	6.0	18000
548	1768	6.5	16000
Borehole 1017R-A[d]			
551	1768	1.0	12000
551	1768	1.5	20000
551	1768	2.0	23000
551	1768	2.5	20000
551	1768	3.0	22000
551	1768	3.5	28000
551	1768	4.0	54000
551	1768	4.5	168000
551	1768	5.0	111000
551	1768	5.5	87000
Borehole 1013R[d]			
580	1768	0.5	43000
580	1768	1.0	20000
580	1768	1.5	12000
580	1768	2.0	20000
580	1768	2.5	47000
580	1768	3.0	82000
580	1768	3.5	178000
580	1768	4.0	221000
580	1768	4.5	129000
580	1768	5.0	95000
580	1768	5.5	69000
580	1768	6.0	38000
580	1768	6.5	27000

TABLE 5-2

(continued)

Coordinates[a] East	Coordinates[a] North	Depth[b] (ft)	Count Rate[c] (cpm)
Borehole 1013R (continued)[d]			
580	1768	7.0	25000
580	1768	7.5	26000
580	1768	8.0	25000
580	1768	8.5	22000
580	1768	9.0	16000
580	1768	9.5	12000
Borehole 1016R[d]			
595	1735	1.5	15000
595	1735	2.0	11000
595	1735	2.5	7000
595	1735	3.0	7000
595	1735	3.5	8000
595	1735	4.0	11000
595	1735	4.5	21000
595	1735	5.0	29000
595	1735	5.5	18000
595	1735	6.0	13000
595	1735	6.5	11000
595	1735	7.0	10000
595	1735	7.5	9000
595	1735	8.0	9000

[a]Borehole locations are shown in Figure 4-1.

[b]The variations in depths of boreholes and corresponding results given in this table are based on the boreholes penetrating the contamination or the drill reaching refusal.

[c]Instrument used was 5.0- by 5.0-cm (2- by 2-in.) thallium-activated sodium iodide gamma scintillation detector.

[d]Bottom of borehole collapsed.

TABLE 5-3

GAMMA RADIATION EXPOSURE RATES

FOR FIRE STATION NO. 2

Coordinates[a]		Rate[b]
East	North	(μR/h)
480	1775	11
500	1850	7
525	1725	10
550	1850	7
580	1825	10

[a]Measurement locations are shown in Figure 4-3.

[b]Measurements include background.

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APPENDIX A
GEOLOGIC DRILL LOGS FOR FIRE STATION NO. 2

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
FUSRAP	14501-138	1 OF 1	1032R

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
LODI Fire Station No. 2	N 1,733 E 474	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
10-23-87	10-23-87	Bechtel National	Minuteman Auger	4"	10.5		13.5

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
9.0/67		9			▽ 8.5/ 10/23/87	/

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
140 lbs./30 in.	NA	D. Harnish

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
SS	1.0	0.6									0.0 - 2.0 Ft. SAND FILL.	Borehole advanced 0-13.5 Ft. using 3" i.d. split-spoon sampler and 4" o.d. solid stem augers. Boring radiologically sampled and gamma-logged by TMA-Eberline, Corp.
SS	1.0	0.8									0.0-1.5 Ft. Organic SAND. Dark brown (10YR3/3), very fine-grained, loose "clods", slightly damp.	
SS	1.5	0.9									1.5-2.0 Ft. Silty SAND. Yellowish brown (10YR5/6), very fine-grained, dry; crushes to powder easily.	
SS	2.0	1.4						5			2.0 - 3.5 Ft. SILT (FILL?) (OL). Black, damp, soft.	
SS	1.8	1.8									3.5 - 5.5 Ft. Silty SAND (SM). Brown (10YR4/3), fine-grained.	
SS	1.2	1.2									5.5 - 9.2 Ft. SILT and Silty SAND (ML-SM). Brown (10YR4/3), medium- to coarse-grained.	8.5 ft. Groundwater observed.
SS	1.0	1.0						10			5.5-7.3 Ft. SILT.	
SS	1.0	1.0									7.3-7.8 Ft. SAND. Dry.	10.5-13.5 ft. Drilled through soft sand very easily. Bottom of hole caved in immediately after pulling augers.
SS	3.0	0.3									7.8-9.2 Ft. Silty SAND. Brown (10YR5/3), wet, silt on top.	
											9.2 - 10.5 Ft. CLAY (CL). Brown (7.5YR4/2), slightly plastic.	
											10.5 - 13.5 ft. SAND (SP). Brown (10YR5/3), saturated.	
											Bottom of borehole at 13.5 ft. Borehole backfilled with spoils, 11/3/87.	Description and classification of samples by visual examination.

S = SPLIT SPOON; ST = SHELBY TUBE; * = DENNISON; P = PITCHER; O = OTHER

SITE: LODI Fire Station No. 2

HOLE NO.: 1032R

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
FUSRAP	14501-138	1 OF 1	1077R

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
LODI Fire Station No. 2	N 1,784 E 488	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
10-29-87	10-29-87	E.D.I.	MOBILE B-57	6.5"	29.0	1.0	30.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
13.6/76		9			▽ 6.0/ 10/29/87 ▽ /	29.0/

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
140 lbs/30 in	NA	D. Harnish

DRILL BIT TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
SS	2.0	1.1	2-5-1-1								0.0 - 8.0 Ft. SAND and SILT FILL (SM-ML).	Borehole advanced 0-30 Ft. with 3 in. i.d. split-spoon sampler and 6.5 in. o.d. hollow stem auger. Borehole radiologically sampled and gamma-logged by TMA-Eberline, Corp.
SS	2.0	1.3	3-2-5-5								0.0-2.0 Ft. SILT, dark brown (10YR3/3) mixed with dark yellowish brown; some broken glass, gravel, light gray coal ash.	
SS	2.0	0.8	1-1-1-3					5			2.0-4.0 Ft. SAND, yellowish brown (10YR5/6), fine-grained mixed with SILT, pinkish brown.	
SS	2.0	2.0	5-15-11 11								4.0-6.0 Ft. SILT, interlayered pinkish brown and green.	6 Ft. Groundwater observed.
SS	2.0	1.3	5-8-14 7								6.0-7.2 Ft. SAND, greenish gray, very fine-grained, saturated, liquified.	
SS	2.0	1.3	6-9-10 12					10			7.2-8.0 Ft. Oil, coated wood, grayish green SILT with fuel smell.	Auger refusal at 8.0 Ft. by concrete block; hole moved and continued three feet to the north.
SS	2.0	2.0	10-7-12 15								8.0 - 16.0 Ft. SAND and SILT (SP, ML). Sand is fine- to medium-grained, interbedded.	
SS	2.0	2.0	6-12-15 12								8.0-10.0 Ft. Greenish gray, minor gravel.	
SS	2.0	1.8	18-18 18-18					15			10.0-16.0 Ft. SAND, reddish brown, very fine-grained, interbedded with weak red SILT/CLAY. Layers are 5 - 10 mm.	
											16.0 - 20 Ft. CLAY and SAND (CL, SP)	
											16.0-17.1 Ft. CLAY, reddish gray (5YR5/2).	
											17.1-17.2 Ft. SAND, medium-grained.	18-30 Ft. Augered only. No samples taken.
								20			17.2-18.0 Ft. CLAY and SAND, very fine-grained.	
											20.0 - 24.0 Ft. SAND and GRAVEL (SG).	
											24.0 - 29.0 Ft. GRAVEL (GP).	
								25				
												30 Ft. Auger refusal.
											29.0 - 30.0 Ft. DECOMPOSED BEDROCK. Brunswick Formation.	
											Bottom of borehole at 30.0 Ft. Borehole backfilled with spoils, 10/29/87.	Identification and classification of soils by visual examination.

S = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: LODI Fire Station No. 2

HOLE NO.: 1077R

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
FUSRAP	14501-138	1 OF 1	1181R

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
LODI Fire Station No. 2	N 1,842 E 505	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
12-1-87	12-1-87	E.D.I.	MOBILE B-57	6.5"	12.0		12.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
7.7/64		6			▽ / ▼ /	/

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
140 lbs./ 30 in.	NONE	D. Harnish

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE "N" BLOWS % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
SS	2.0	1.4	15-26 15-12								0.0 - 2.6 Ft. GRAVEL and Silty SAND FILL (GP, SM). 0.0-0.5 Ft. GRAVEL, broken cement, basalt. 0.5-2.3 Ft. Silty SAND, dark brown (10YR3/2), fine-grained, gravelly at base. 2.3-2.6 Ft. Coal ash and gravel.	Borehole advanced 0-12 Ft. with 3 in. i.d. split-spoon sampler and 6.5 in. o.d. hollow stem auger. Borehole radiologically sampled and gamma-logged by TMA-Eberline, Corp.
SS	2.0	1.5	6-7-4-3									
SS	2.0	0.8	1-1-1-2					5				
SS	2.0	1.3	2-7-7 10								2.6 - 4.7 Ft. Sandy SILT (FILL?) (ML-SM). Very dark grayish brown (10YR3/2), very fine-grained. 4.7 - 6.0 Ft. SILT (FILL?) (ML). Black.	
SS	2.0	1.3	10-10 13-11								6.0 - 10.0 ft. Silty SAND (SM). Light gray (10YR7/1) with yellowish brown iron-oxide stain; very fine-grained.	
SS	2.0	1.4	3-5-8 11					10			8.0-10.0 Ft. Interbeds of fine-grained sand, some silt. 8.9-10.0 Ft. Light brownish gray (2.5Y6/2).	
											10.0 - 12.0 Ft. SILT (ML). Laminated with 3-10 mm. thick layers. 10.0-10.5 Ft. Strong brown (7.5YR4/6). 10.5-12.0 ft. Dark gray (5YR4/1).	
											Bottom of borehole at 12.0 ft. Borehole backfilled with spoils, 12/1/87.	
												Identification and classification of samples by visual examination.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: LODI Fire Station No. 2

HOLE NO. 1181R

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
FUSRAP	14501-138	1 OF 1	2040R

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
LODI Fire Station No. 2	N 1,745 E 509	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
9-30-88	9-30-88	EMPIRE SOILS	CME 45B	12"	10.0		10.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
9.0/90		5			▽ / 9/30/88	/

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
300 lbs. / 24 in.	NONE	J. Lord

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE "N" BLOWS % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
SS	2.0	2.0	12-10-9 9								0.0 - 1.0 Ft. TOPSOIL (SM). Pale yellowish brown (10YR6/2). Dry, loose, poorly sorted material with grass, roots, and gravel.	Borehole advanced 0-10 Ft. using 12 in. o.d. hollow stem augers. Radiologically sampled and gamma-logged by TMA-Eberline, Inc.
SS	2.0	1.0	5-8-8-7								1.0 - 1.4 Ft. Gravelly SAND (SG). Moderate brown (5YR3/4). Dry, loose coarse-grained sand with angular gravel.	
SS	2.0	2.0	2-2-4-6					5			1.4 - 3.8 Ft. SAND (SP). Dusky brown (5YR2/2) to dark gray (N3). Partially stratified or lenticular. Moist, coarse-grained, loose, poorly sorted sand, with stain patches of angular pods, blebs, and lenses of very pale orange (10YR8/2), black (N1), and light brown (5YR6/4).	Groundwater not detected in hole.
SS	2.0	2.0	5-7-9-12									
SS	2.0	2.0	11-12 11-11					10			3.8 - 5.0 Ft. GRAVEL (G). Black (N1), greasy-looking, saturated angular coarse-grained gravel. Petroleum odor and sheen. Loose.	
											5.0 - 6.0 Ft. Clayey sandy SILT (ML-SM). Grayish brown (5YR3/2). Moist to wet, soft, plastic. Weak thread. Sand is poorly sorted medium- to fine-grained, subrounded.	6.0 Ft. Top of undisturbed soil.
											6.0 - 10.0 Ft. Silty SAND (SM). Moderate brown to dark yellowish orange. Coarse-grained sand with some silt layers of 2-3 inches thick. Subangular, loose, wet. 7.0-7.3 Ft. Very coarse. Well sorted. 7.5-10.0 Ft. Increasing silt content.	Elevated gamma-log at 3.5-5.5 interval.
											Bottom of borehole at 10.0 Ft. Borehole backfilled with grout to 6', clean spoils to 6", and resodded in the top 6", 9/30/88.	

Description and classification of soils by visual examination.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: LODI Fire Station No. 2

HOLE NO.: 2040R

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
FUSRAP	14501-138	1 OF 1	1201R

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
LODI Fire Station No. 2	N 1,793 E 521	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
12-2-87	12-2-87	G. Engel; BNI.	Tripod\Little Beaver	4"	11.0		11.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
7.6/69		10			▽ / ▼ /	/

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
140 lbs./ 18 in.	NONE	R. Migues

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE
SS	1.0	0.6								
SS	1.0	0.7								
SS	1.0	0.5								
SS	2.0	1.2								
SS	1.0	1.0						5		
SS	1.0	0.6								
SS	1.0	1.0								
SS	1.0	1.0								
SS	1.0	0.5						10		
SS	1.0	0.5								

DESCRIPTION AND CLASSIFICATION

0.0 - 3.2 Ft. SAND (SP). Pebbly, clayey, silty dusky yellowish brown (10YR2/2). Fine- to very coarse-grained.

1.4-3.2 Ft. Moderate brown (5YR4/4).

1.5-1.6 Ft. Dusky yellowish brown (10YR2/2).

3.2 - 5.2 Ft. Silty SAND (SM). Dusky yellowish brown (10YR2/2), fine- to very coarse-grained.

3.7-4.0 Ft. Moderate reddish brown (10R4/6) mottling.

5.2 - 7.4 Ft. SAND (SP). Light brown (5YR6/4). Fine- to coarse-grained.

7.4 - 8.0 Ft. Sandy CLAY to SAND (CL-SC). Grayish black (N2) to grayish green (10G4/2), very fine- to fine-grained sand.

8.0 - 11.0 Ft. CLAY (CL). Medium gray (N5) mottled with olive gray (5Y4/1), and grayish black (N2).

10.5-11.0 Ft. Pale red (5R6/2).

Bottom of borehole at 11.0 Ft.
Borehole backfilled with grout, 12/2/87.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

Borehole advanced 0-11 Ft. with 3 in. i.d. split-spoon sampler and 4.0 in. o.d. solid-stem auger. Borehole radiologically sampled and gamma-logged by TMA-Eberline, Corp.

Augered to 8.0 Ft. Gamma-logged to 7.0 Ft.

Auger refusal at 2.0 Ft. Moved 3 Ft. NNW and augered to 8.0 Ft.

Identification and classification of samples by visual examination.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE	HOLE NO.
LODI Fire Station No. 2	1201R

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
FUSRAP	14501-138	1 OF 1	2041R

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
LODI Fire Station No. 2	N 1,728 E 524	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
10-3-88	10-3-88	EMPIRE SOILS	CME 45B	12"	10.0		10.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
8.8/88		5			▽ 6.0/ 10/3/88	

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
300 lbs. / 24 in.	NONE	J. Lord

TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	PRESS. P.S.I.	TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
SS	2.0	1.5	7-8-21 25								0.0 - 1.2 Ft. TOPSOIL (SM). Pale yellowish brown (10YR6/2). Dry, loose, poorly sorted material with grass, roots, and gravel.	Borehole advanced 0-10 ft. using 12 in. o.d. hollow-stem augers. Radiologically sampled and gamma-logged by TMA-Eberline, Inc.
SS	2.0	1.6	8-7-5-5								1.4 - 6.4 Ft. SAND (SP). Dusky brown (5YR2/2) to dark gray (N3). Partially stratified or lenticular. Moist, coarse, loose, poorly sorted sand, with stain patches of angular pods, blebs, and lenses of very pale orange (10YR8/2), black (N1), and light brown (5YR6/4).	
SS	2.0	1.7	2-3-2-2					5				
SS	2.0	2.0	1-1-2-3								6.0 Ft. Saturated.	6.0 Ft. Groundwater observed.
SS	2.0	2.0	4-5-9-11								6.4 - 8.0 Ft. Clayey sandy SILT (ML-SM). Grayish brown (5YR3/2). Moist to wet, soft, plastic. Weak thread. Sand is poorly sorted medium- to fine-grained, subrounded.	
								10			8.0 - 9.6 Ft. Silty SAND (SM). Moderate brown to dark yellowish orange. Coarse-grained sand with some silt layers of 2-3 inches thick. Subangular, loose, slightly moist.	6.0 Ft. Top of undisturbed soil.
											9.6 - 10.0 Ft. SAND (SG). Moderate brown (5YR3/4) coarse-grained sand with some silt and clay (<5%). Saturated, slightly adhesive, loose. Mixed mineralogy.	Elevated gamma-log at 4.5-7.5 interval.
											Bottom of borehole at 10.0 Ft. Borehole backfilled with grout to 7', clean spoils to 6", and resodded in the top 6", 10/3/88.	

Description and classification of soils by visual examination.

S = SPLIT SPOON; ST = SHELBY TUBE; = DENNISON; P = PITCHER; O = OTHER

SITE: LODI Fire Station No. 2

HOLE NO. 2041R

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
FUSRAP	14501-138	1 OF 1	2045R

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
LODI Fire Station No. 2	N 1,718 E 526	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
10-5-88	10-5-88	EMPIRE SOILS	CME 45B	12"	10.0		10.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
6.7/84		4			▽ 7.0/ 10/5/88 /	/

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
300 lbs. / 24 in.	NONE	J. Lord

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
SS	2.0	1.8	3-4-7-11								0.0 - 3.0 Ft. Silty Sand FILL (SM). Moderate brown (5YR4/4 to 5YR6/6), poorly sorted silty sand with gravel, brick, fines. Slightly cohesive, slightly moist, dense, soft.	Borehole advanced 0-10 ft. using 12 in. o.d. hollow-stem augers. Radiologically sampled and gamma-logged by TMA-Eberline, Inc.
SS	2.0	1.9	4-4-5-5									
SS	2.0	1.0	2-2-2-2					5			3.0 - 7.0 ft. Silty SAND (SM). Moderate yellowish brown (10YR5/4). Poorly sorted, subrounded, moist, loose, soft. Some gravel, <5%. 5.0-6.0 Ft. No Recovery.	7.0 Ft. Groundwater detected in hole? Sampled to 8.0 Ft. Augered to 10.0 Ft.
SS	2.0	2.0	2-4-7-7					▽			7.0 - 10.0 Ft. SAND (SP). Pale yellowish brown (10YR6/2). Adhesive, loose, soft, poorly sorted, saturated. Coarse-grained fraction >5%. Subangular.	
								10			8.0-10.0 Ft. No samples taken, but auger flights indicate the same sand to 10.0 ft.	7.0 Ft. Top of undisturbed soil.
											Bottom of borehole at 10.0 ft. Borehole backfilled with spoils, 10/5/88.	

S = SPLIT SPOON; ST = SHELBY TUBE; = DENNISON; P = PITCHER; O = OTHER

SITE: LODI Fire Station No. 2

HOLE NO.: 2045R

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
FUSRAP	14501-138	1 OF 1	1078R

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
LODI Fire Station No. 2	N 1,849 E 528	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
10-30-87	10-30-87	E.D.I.	MOBILE B-57	6.5"	10.0		10.0

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
7.3/73		5			▽ /	/

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
140 lbs/30 in	NA	D. Harnish

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE "N" BLOWS % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
SS	2.0	1.4	7-5-4-3								0.0 - 6.3 Ft. SAND FILL (SP). Yellowish brown (10YR5/6), fine- to medium-grained, some gravel and dark brown SILT.	Borehole advanced 0-10 Ft. with 3 in. i.d. split-spoon sampler and 6.5 in. o.d. hollow stem auger. Borehole radiologically sampled and gamma-logged by TMA-Eberline, Corp. 4 inches of asphalt at the surface; parking lot.
SS	2.0	0.0	3-2-2-4								0.0-4.0 Ft. Fine-grained.	
SS	2.0	1.9	7-8-8-9					5			4.0-4.2 Ft. SILT, dark brown.	
SS	2.0	2.0	7-9-10 12								4.2-4.9 Ft. Coal ash, black, low density.	
SS	2.0	2.0	6-10 14-15								4.9-6.3 Ft. Medium-grained.	
											6.3 - 10.0 Ft. SILT and CLAY (ML, CL). Reddish gray (5YR5/2) laminated, interbedded.	
								10			6.3-8.0 Ft. CLAY is gray.	
											Bottom of borehole at 10.0 ft. Borehole backfilled with spoils, 10/30/87.	

Identification and classification of samples by visual examination.

S = SPLIT SPOON; ST = SHELBY TUBE; = DENNISON; P = PITCHER; O = OTHER

SITE: LODI Fire Station No. 2

HOLE NO.: 1078R

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
FUSRAP	14501-138	1 OF 1	1031R

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
LODI Fire Station No. 2	N 1,722 E 529	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
10-22-87	10-22-87	Bechtel National	Minuteman Auger	4"	16.5		16.5

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
11.6/70		10			▽ / ▼ /	/

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
140 lbs/30 in	NA	David Harnish

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
SS	1.1	0.6									0.0 - 3.7 Ft. Organic SAND (SM-OL). Dark brown (10YR3/3), fine-grained with some gravel, pieces of glass. Fill.	Borehole advanced 0-16.5 Ft. using 3" i.d. split-spoon sampler and 4" o.d. solid stem augers. Hole moved twice due to refusal (rocks) at 1.8 and 2.0 ft. Boring radiologically sampled and gamma-logged by TMA-Eberline, Corp. Purple discoloration around 5.0 Ft. due to chemicals (?).
SS	0.9	0.7										
SS	0.5	0.5										
SS	1.0	1.0										
SS	2.0	1.2										
								5			3.7 - 5.5 Ft. Organic SILT (FILL?) (OL). Very dark grayish brown (10YR3/2), damp, soft.	
SS	2.0	0.8									5.5 - 9.5 Ft. Silty SAND and SILT (fill?) (SM). Very fine-grained, wet. 5.5-7.5 Ft. Yellowish brown (2.5Y6/4). 7.5-9.5 Ft. Gray (10YR5/1), fine-grained.	7.5-9.5 Ft. Samples have strong petroleum odor.
SS	2.0	2.0										
SS	2.0	1.6						10			9.5 - 16.5 Ft. SILT and SAND (ML-SM). Dark brown, fine-grained. 10.1-11.8 Ft. SAND. Grayish brown, fine-grained. 11.8-12.1 Ft. SILT, soft, semi-liquefied. 12.1-16.5 Ft. Silty SAND, dark brown, liquefied.	12-16.5 Ft. Drilled through soft sand very easily.
SS	2.0	2.0										
SS	3.0	1.2						15				
											Bottom of borehole at 16.5 ft. Borehole backfilled with spoils, 10/22/87.	

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: LODI Fire Station No. 2

HOLE NO.: 1031R

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
FUSRAP	14501-138	1 OF 1	1017R

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
LODI Fire Station No. 2	N 1,768 E 548	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
10-6-87	10-6-87	G. Engel; BNI	Minuteman Auger	4"	10.7		10.7

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
7.2/67		8			▽ /	/

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
N/A	NONE	R. Migues

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE BLOWS "N" % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION
SS	1.0	0.5									0.0 - 1.0 Ft. Silty CLAY (CL-ML). Moderate reddish brown (10R4/6) with pieces of asphalt. FILL.
SS	1.0	0.6									
SS	1.5	0.6									1.0 - 5.5 Ft. Sandy SILT (ML-SM). Dusky yellowish brown (10YR2/2), very fine- to fine-grained sand, with clumps of tarry, clayey material; a mixture of dark yellowish brown (10YR4/4) and brownish black (5YR2/1).
SS	2.0	0.9						5			
SS	1.0	1.0									5.5 - 7.2 Ft. Sandy silty CLAY (CL-ML). Olive gray (5Y4/1) mixed with olive black (5Y2/1). Some fine- to medium-grained sand.
SS	1.0	0.4									
SS	1.0	1.0									7.2 - 8.4 Ft. SAND (SP). Olive black (5Y2/1), fine- to medium-grained with flecks of brick.
SS	1.0	1.0									
SS	0.5	0.5						10			8.4 - 8.8 Ft. Silty SAND (SM). Light olive gray (5Y5/2), fine- to medium-grained.
SS	0.7	0.7									8.8 - 9.1 Ft. Clayey SILT (ML-CL). Moderate yellowish brown (10YR5/4).
											9.1 - 9.5 Ft. Silty CLAY (CL-ML). Moderate brown (5YR4/4) mixed with olive gray (5Y2/1) and dusky yellowish brown (10YR2/2).
											9.5 - 10.0 Ft. Silty SAND (SM). Olive black (5Y2/1), fine- to medium-grained.
											10.0 - 10.7 Ft. Clayey SILT (ML-CL). Moderate yellowish brown (10YR5/4).
											Bottom of borehole at 10.7 Ft. Borehole backfilled with spoils, 10/6/87.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

Borehole advanced 0-10.7 Ft. using 3" i.d. split-spoon sampler and 4" o.d. solid stem augers. Borehole 1017R sampled to 2.2 Ft. only, but was augered and logged to 6.5 Ft. Geol. log for 1017R (1768N, 548E) is the same.

Borehole was radiologically sampled and gamma-logged by TMA-Eberline, Corp.

Borehole augered and gamma-logged to 6.5 Ft.

Description and classification of soils by visual examination.

S = SPLIT SPOON; ST = SHELBY TUBE; = DENNISON; P = PITCHER; O = OTHER

SITE: LODI Fire Station No. 2

HOLE NO.: 1017R

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
FUSRAP	14501-138	1 OF 1	1017A-R

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
LODI Fire Station No. 2	N 1,768 E 548	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
10-6-87	10-6-87	G. Engel; BNI	Minuteman Auger	4"	10.7		10.7

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
7.2/67		8			▽ / ▼ /	/

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
N/A	NONE	R. Migues

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE "N" BLOWS % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION
SS	1.0	0.5									0.0 - 1.0 Ft. Silty CLAY (CL-ML). Moderate reddish brown (10R4/6) with pieces of asphalt. FILL.
SS	1.0	0.6									1.0 - 5.5 Ft. Sandy SILT (ML-SM). Dusky yellowish brown (10YR2/2), very fine- to fine-grained sand, with clumps of tarry, clayey material; a mixture of dark yellowish brown (10YR4/4) and brownish black (5YR2/1).
SS	1.5	0.6									
SS	2.0	0.9						5			
SS	1.0	1.0									5.5 - 7.2 Ft. Sandy silty CLAY (CL-ML). Olive gray (5Y4/1) mixed with olive black (5Y2/1). Some fine- to medium-grained sand.
SS	1.0	0.4									
SS	1.0	1.0									7.2 - 8.4 Ft. SAND (SP). Olive black (5Y2/1), fine- to medium-grained with flecks of brick.
SS	1.0	1.0									
SS	0.5	0.5						10			8.4 - 8.8 Ft. Silty SAND (SM). Light olive gray (5Y5/2), fine- to medium-grained.
SS	0.7	0.7									8.8 - 9.1 Ft. Clayey SILT (ML-CL). Moderate yellowish brown (10YR5/4).
											9.1 - 9.5 Ft. Silty CLAY (CL-ML). Moderate brown (5YR4/4) mixed with olive gray (5Y2/1) and dusky yellowish brown (10YR2/2).
											9.5 - 10.0 Ft. Silty SAND (SM). Olive black (5Y2/1), fine- to medium-grained.
											10.0 - 10.7 Ft. Clayey SILT (ML-CL). Moderate yellowish brown (10YR5/4).
											Bottom of borehole at 10.7 Ft. Borehole backfilled with spoils, 10/6/87.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

Borehole advanced 0-10.7 Ft. using 3" i.d. split-spoon sampler and 4" o.d. solid stem augers. Borehole 1017R sampled to 2.2 Ft. only, but was augered and logged to 6.5 Ft. Geol. log for 1017R (1768N, 548E) is the same.

Borehole was radiologically sampled and gamma-logged by TMA-Eberline, Corp.

Borehole augered and gamma-logged to 6.5 Ft.

Description and classification of soils by visual examination.

S3 = 3" SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: LODI Fire Station No. 2

HOLE NO.: 1017A-R

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
FUSRAP	14501-138	1 OF 1	1013R

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
LODI Fire Station No. 2	N 1,768 E 580	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
9-28-87	9-28-87	G. Engel; BNI	Minuteman Auger	4"	22.5		22.5

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
11.7/52		17			▽ /	/

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
N/A	NONE	R. Migues

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE "N" BLOWS % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.	DEPTH	GRAPHICS	SAMPLE	DESCRIPTION AND CLASSIFICATION	NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.
SS	1.0	0.2									0.0 - 4.0 Ft. Silty SAND (SM). Dusky brown (5YR2/2), fine- to medium-grained.	Borehole advanced 0-22.5 Ft. using 3" i.d. split-spoon sampler and 4" o.d. solid stem augers.
SS	1.0	0.5										
SS	2.0	0.6										
SS	1.0	1.0									4.0 - 6.0 Ft. Silty CLAY (CL-ML). Brownish black (5YR2/1), with specks and blebs of light brown (5YR6/1) and medium gray (N5).	
SS	1.0	0.9						5				Borehole was radiologically sampled and gamma-logged by TMA-Eberline, Corp.
SS	1.0	1.0									6.0 - 7.3 Ft. Silty SAND (SM). Brownish black (5YR2/1), very fine- to coarse-grained.	
SS	1.0	1.0									7.3 - 8.0 Ft. Silty CLAY (CL-ML). Dark yellowish brown (10YR4/2).	
SS	1.0	1.0										
SS	1.0	0.9						10			8.0 - 8.4 Ft. Silty SAND (SM). Brownish black (5YR2/1), very fine- to coarse-grained.	Augered to 11.0 Ft. Gamma-scanned to 10.0 Ft.
SS	1.0	0.6									8.4 - 17.0 Ft. Clayey SILT (ML-CL). Pale brown (5YR5/2).	
SS	1.0	0.4										
SS	1.0	0.6									12.6-14.0 Ft. Grayish red (5R4/2).	
SS	1.0	0.6										
SS	1.0	0.6						15			14.0-16.3 Ft. Pale reddish brown (10R5/4).	
SS	0.9	0.7										
SS	3.0	0.0									16.3-17.2 Ft. Sandy, pale reddish brown (10R5/4), very fine- to fine-grained.	
											17.2 - 22.2 Ft. NO SAMPLE RECOVERY.	
SS	2.0	0.1						20				
											22.2 - 22.5 Ft. Pebbly sandy CLAY (CL-SC, GC). Dark reddish brown (10R3/4), fine- to very coarse-grained sand.	
											Bottom of borehole at 22.5 Ft. Borehole backfilled with grout by tremie method, 9/28/87.	Description and classification of soils by visual examination.

SS = SPLIT SPOON; ST = SHELBY TUBE;) = DENNISON; P = PITCHER; O = OTHER

SITE: LODI Fire Station No. 2

HOLE NO.: 1013R

GEOLOGIC DRILL LOG

PROJECT	JOB NO.	SHEET NO.	HOLE NO.
FUSRAP	14501-138	1 OF 1	1016R

SITE	COORDINATES	ANGLE FROM HORIZ	BEARING
LODI Fire Station No. 2	N 1,735 E 595	Vertical	------

BEGUN	COMPLETED	DRILLER	DRILL MAKE AND MODEL	SIZE	OVERBURDEN	ROCK (FT.)	TOTAL DEPTH
10-5-87	10-5-87	G. Engel; BNI	Minuteman Auger	4"	13.5		13.5

CORE RECOVERY (FT./%)	CORE BOXES	SAMPLES	EL. TOP CASING	GROUND EL.	DEPTH/EL. GROUND WATER	DEPTH/EL. TOP OF ROCK
8.4/62		12			▽ /	/

SAMPLE HAMMER WEIGHT/FALL	CASING LEFT IN HOLE: DIA./LENGTH	LOGGED BY:
N/A	NONE	R. Migues

SAMP. TYPE AND DIAM.	SAMP. ADV. LEN CORE	SAMPLE REC. CORE REC.	SAMPLE "N" BLOWS % CORE RECOVERY	WATER PRESSURE TESTS: LOSS IN G.P.M	WATER PRESSURE TESTS: PRESS. P.S.I.	WATER PRESSURE TESTS: TIME IN MIN.	ELEV.
SS	1.0	0.5					
SS	1.0	0.5					
SS	2.5	0.7					
SS	0.5	0.5					
SS	1.0	1.0					
SS	1.0	1.0					
SS	1.0	1.0					
SS	0.7	0.7					
SS	0.8	0.8					
SS	1.0	1.0					
SS	0.7	0.7					
SS	2.3	0.6					

DEPTH: 5, 10

GRAPHICS SAMPLE

DESCRIPTION AND CLASSIFICATION

0.0 - 5.2 Ft. Silty SNAD (SM). Dusky yellowish brown (10YR2/2), fine- to medium-grained.

0.9-1.0 Ft. Moderate reddish brown (10R4/6).

4.4-4.5 and 4.7-5.2 Ft. Clayey sand; dusky yellowish brown (10YR2/2), fine- to medium-grained.

5.2 - 6.2 Ft. Silty CLAY (CL-ML). Dusky yellowish brown (10YR2/2) mottled with moderate reddish brown (10R4/6).

6.0-6.2 Ft. Medium bluish gray (5B5/1) and dark greenish gray (5G4/1).

6.2 - 8.6 Ft. SILT (ML). Olive gray (5Y4/1) mottled with brownish gray (5YR4/1), and a single cemented sand nodule.

7.0-7.4 Ft. Olive black (5Y2/1) rimmed with very dark red (5R2/6).

8.0-8.6 Ft. Increasing sand content.

8.6 - 8.9 Ft. Silty SAND (SM). Dusky yellowish brown (10YR2/2), fine- to medium-grained.

8.9 - 9.2 Ft. Silty CLAY (CL-ML). Grayish red (5R4/2).

9.2 - 13.5 Ft. CLAY (CL). Moderate reddish brown (10R4/6).

12.9-13.0 Ft. Sand, fine- to coarse-grained.

Bottom of borehole at 13.5 Ft.
Borehole backfilled with spoils, 10/5/87.

NOTES ON: WATER LEVELS, WATER RETURN, CHARACTER OF DRILLING, ETC.

Borehole advanced 0-13.5 Ft. using 3" i.d. split-spoon sampler and 4" o.d. solid stem augers.

Borehole was radiologically sampled and gamma-logged by TMA-Eberline, Corp.

Augered and gamma-scanned to 9.0 Ft.

Description and classification of soils by visual examination.

SS = SPLIT SPOON; ST = SHELBY TUBE; D = DENNISON; P = PITCHER; O = OTHER

SITE: LODI Fire Station No. 2

HOLE NO. 1016R