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Formerly Utilized Sites Remedial Action Program (FUSRAP)

ADMINISTRATIVE RECORD

for Maywood, New Jersey



U.S. Department of Energy

Bechtel

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Job No. 14501, FUSRAP Project
DOE Contract No. DE-AC05-91OR21949
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MAR 03 1994

U.S. Department of Energy
Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, TN 37831-8723

Attention: Susan M. Cange, Site Manager
Former Sites Restoration Division

Subject: MISS - Plan for Radon and Gamma Radiation Measurements -
Transmittal

Dear Ms. Cange:

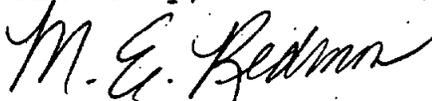
Enclosed for your use are two copies of the *Plan for Radon and Gamma Radiation Measurements at the Commercial Properties of the Maywood Site*. The document was revised in response to EPA and SAIC comments on the previous draft; a comment response package is enclosed. Also enclosed for your signature are letters to EPA and NJDEPE forwarding copies of this document for their information.

This document and all attachments were prepared under my direction or supervision in accordance with a system designed to ensure that the information submitted was properly gathered and evaluated. To the best of my knowledge and belief, they are true, accurate, and complete.

The text of the transmittal letters was transferred electronically to FSRD and can be accessed under filename S_1380.

If you have any questions about this document, please call me at 576-4718.

Sincerely,



M. E. Redmon
Project Manager - FUSRAP

ebs:gmh:LR_1380

Enclosure: As stated

ACTION REQ'D	<input checked="" type="checkbox"/> YES	<input type="checkbox"/> NO	DUE DATE	3/7/94
RESPONSE TO CHRON NO.				
<input type="checkbox"/> FFA	<input type="checkbox"/> Permit	<input type="checkbox"/> Milestone	<input type="checkbox"/> OcR	<input checked="" type="checkbox"/> CCN
<input type="checkbox"/> CAR	<input type="checkbox"/> Mid-Yr	<input type="checkbox"/> Yr-End	<input type="checkbox"/> Periodic Rpt	



Bechtel National, Inc.

Formerly Utilized Sites Remedial Action Program (FUSRAP)
Contract No. DE-AC05-91OR21949

Plan for Radon and Gamma Radiation Measurements at the Commercial Properties of the Maywood Site

Maywood, New Jersey

March 1994



PLAN FOR RADON AND GAMMA RADIATION MEASUREMENTS
AT THE COMMERCIAL PROPERTIES OF THE MAYWOOD SITE
MAYWOOD, NEW JERSEY

MARCH 1994

Prepared For

United States Department of Energy

Oak Ridge Operations Office

Under Contract No. DE-AC05-91OR21949

By

Bechtel National, Inc.

Oak Ridge, Tennessee

Bechtel Job No. 14501

CONTENTS

	Page
FIGURES	iv
TABLES	vi
ACRONYMS	vii
UNITS OF MEASURE	viii
1.0 INTRODUCTION	1
2.0 SAMPLING APPROACH AND RATIONALE	6
2.1 DATA REQUIREMENTS FOR COMMERCIAL PROPERTIES	6
2.1.1 Objective 1: Obtain Outdoor Gamma Exposure Rate Measurements	6
2.1.2 Objective 2: Determine Indoor Radon Concentrations	27
2.1.3 Objective 3: Determine Need for Followup Radon Measurements	34
2.2 FIELD NOTES AND DOCUMENTATION	34
3.0 QUALITY CONTROL	37
REFERENCES	38

FIGURES

Figure	Title	Page
1-1	Locations of Properties that Comprise the Maywood Site	2
2-1	Areas of Contamination at the New Jersey Vehicle Inspection Station Property	8
2-2	Areas of Contamination at 160 and 174 Essex Street	9
2-3	Areas of Contamination at the Hunter Douglas Property	10
2-4	Areas of Contamination at the Sunoco Station Property	11
2-5	Areas of Contamination at the Federal Express Property	12
2-6	Areas of Contamination at 205 Maywood Avenue	13
2-7	Areas of Contamination at Essex Street and State Route 17	14
2-8	Areas of Contamination at 200 State Route 17	15
2-9	Areas of Contamination at 80 Hancock Street	16
2-10	Areas of Contamination at 100 Hancock Street	17
2-11	Areas of Contamination at 80 Industrial Road	18
2-12	Areas of Contamination at 113 Essex Street	19
2-13	Areas of Contamination at the Sears Property	20
2-14	Areas of Contamination at the Gulf Station Property	21
2-15	Areas of Contamination at the DeSaussure Property	22
2-16	Areas of Contamination at the Stepan Property	23
2-17	Areas of Contamination at the Bergen Cable Property	24
2-18	Areas of Contamination at Kennedy Park	25
2-19	Areas of Contamination at Fire Station No. 2	26
2-20	Gamma Exposure Rate Survey Form	28

FIGURES

(continued)

Figure	Title	Page
2-21	Radon Canister Label	33
2-22	Field Sample Collection Form	35

TABLES

Table	Title	Page
1-1	Commercial Properties	3
1-2	Commercial Properties not Included in Sampling Effort	5
2-1	Minimum Number of Detectors	30

ACRONYMS

AC	absorption canister
AEC	Atomic Energy Commission
AT	alpha track
BNI	Bechtel National, Inc.
DOE	Department of Energy
EPA	Environmental Protection Agency
FUSRAP	Formerly Utilized Sites Remedial Action Program
MISS	Maywood Interim Storage Site
NJDEPE	New Jersey Department of Environmental Protection and Energy
PIC	pressurized ionization chamber
QA	quality assurance
QC	quality control
RI/FS	remedial investigation/feasibility study
RSS	radiological support subcontractor

UNITS OF MEASURE

ft	feet
h	hour
in.	inch
L	liter
μ R	microroentgen
m	meter
mrem	millirem
pCi	picocurie
yr	year

1.0 INTRODUCTION

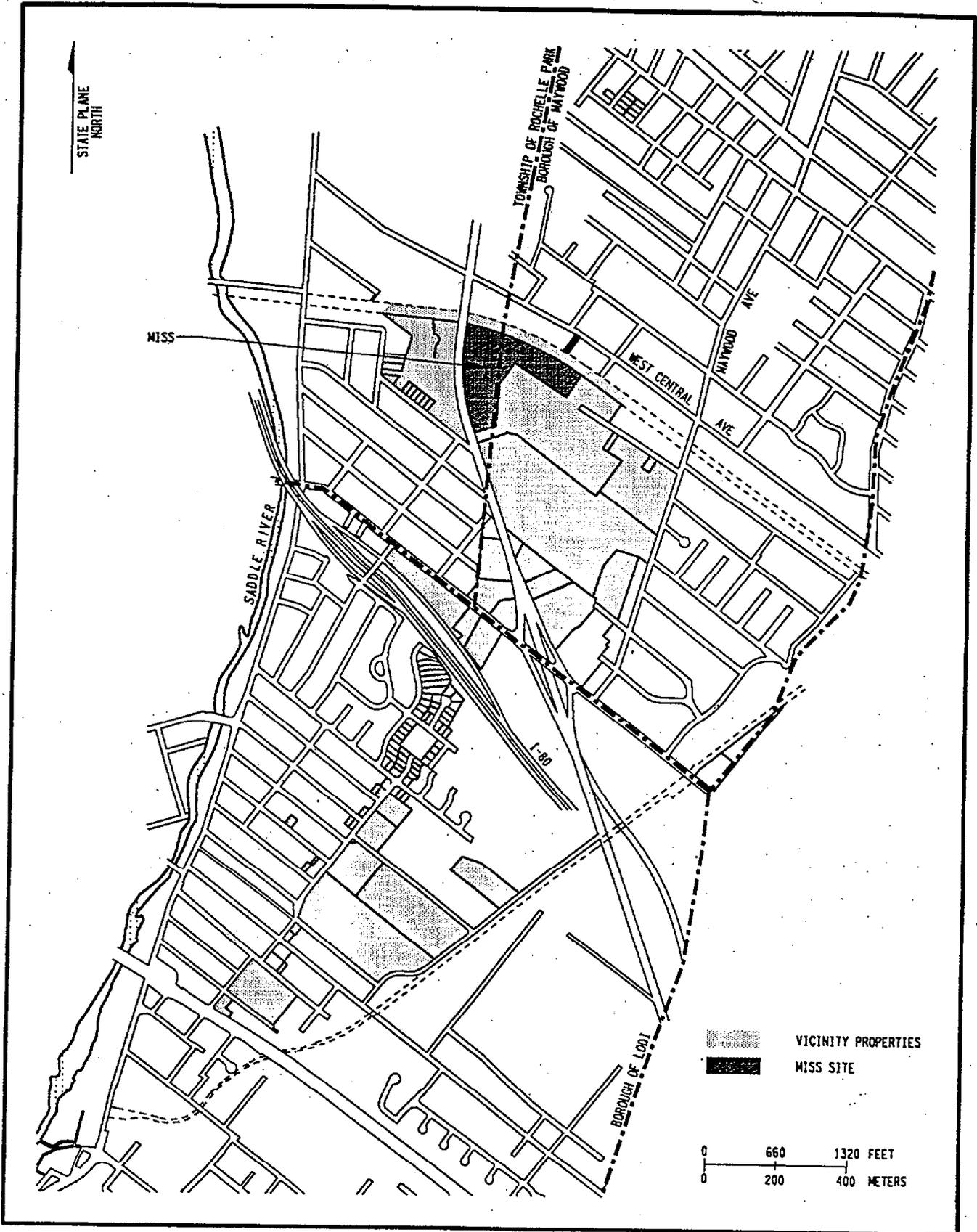
In 1974, the Atomic Energy Commission (AEC), a predecessor agency to the U.S. Department of Energy (DOE), instituted the Formerly Utilized Sites Remedial Action Program (FUSRAP), a program now managed by DOE. The objective of FUSRAP is to identify and clean up or otherwise control sites where residual radioactive contamination (exceeding current guidelines) remains from activities carried out under contract to the Manhattan Engineer District and AEC. In addition to these sites, the U.S. Congress authorized DOE to undertake remedial actions at four other sites where commercial operations had resulted in radioactive contamination of the environment. One of these four sites is located in Maywood, New Jersey.

The Maywood Chemical Works plant extracted thorium and rare earths from monazite sand from 1916 to 1959. The extracted material was used for manufacturing industrial products such as mantles for gas lanterns. Operations at the plant resulted in contamination of numerous properties in Maywood, Rochelle Park, and Lodi, including the property previously owned by Maywood Chemical Works (now owned by the Stepan Company); the DOE-owned property referred to as the Maywood Interim Storage Site (MISS); and residential, commercial, and governmental vicinity properties (Figure 1-1). To organize and segment the investigation and remedial actions at these properties, DOE has grouped them into four operable units:

- Stepan Company property
- MISS property
- Residential properties
- Commercial and governmental properties

These four operable units comprise the Maywood site.

This plan, prepared by DOE, will direct the field work for the radon and gamma radiation investigation at 19 commercial properties. These properties are listed in Table 1-1. Gamma exposure measurements and radon-222 measurements will be conducted at all properties. Limited radon-220 analysis will be conducted at properties where contamination



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Figure 1-1
Locations of the Properties that Comprise
the Maywood Site

Table 1-1
Commercial Properties

Company	Address	Characterization Report
New Jersey Vehicle Inspection Station	8 Mill Street, Lodi	BNI 1987a
National Community Bank	160/174 Essex Street, Lodi	BNI 1989a
Hunter Douglas	87-99 Route 17 North, Maywood	BNI 1987b
Sunoco Station	167 Route 17 North, Maywood	BNI 1987c
Federal Express	137 Route 17 North, Maywood	BNI 1987d
Myron Manufacturing	205 Maywood Avenue, Maywood	BNI 1992a
Joseph Muscarelle	Route 17 and Essex Street, Maywood	BNI 1992a
Sears Truck Repair Center	200 Route 17 South, Maywood	BNI 1992a
Airco Medical	80 Hancock Street, Lodi	BNI 1989b
Appleton Electric (Heather Hill)	100 Hancock Street, Lodi	BNI 1989c
Flint Ink	80 Industrial Road, Lodi	BNI 1989d
National Community Bank	113 Essex Street, Maywood	BNI 1992a
Sears Distribution Center	149-151 Maywood Avenue, Maywood	BNI 1987e
Gulf Station	239 Route 17 North, Maywood	BNI 1989e
DeSaussure Property	23 W. Howcroft Avenue, Maywood	BNI 1989f
Stepan Property	100 West Hunter Avenue, Maywood	BNI 1992a
Bergen Cable	170 Gregg Street, Lodi	Kannard 1987
John F. Kennedy Municipal Park	Money and Sidney Streets, Lodi	BNI 1989g
Fire Station No. 2	Kennedy Drive, Lodi	BNI 1989h

extends beneath the building. Data obtained during this investigation will be used to support the evaluation of remedial alternatives for the sites. These data are being collected to ensure that site conditions have not changed since the initial characterization was performed and to collect additional data on some of the properties. Some of the remedial alternatives being considered by DOE will result in contaminated soil being left in place under the buildings; the data will also be used to evaluate the dose and risk to current and future occupants. DOE and the Environmental Protection Agency (EPA), in its oversight role for activities at the Maywood site, have agreed that the data are necessary to support a selected remedial action alternative.

Radon measurement activities conducted in the State of New Jersey are governed by the New Jersey Department of Environmental Protection and Energy (NJDEPE). Because these data are being collected to support the remedial investigation/feasibility study (RI/FS) and were not requested by the property owners, the radon test will not comply with all aspects of the New Jersey requirements. DOE has reviewed the requirements and used them as guidelines in preparing this plan.

Some commercial properties are empty lots and not normally occupied; therefore, no sampling activities will be conducted at these properties. Table 1-2 lists these properties.

The sampling activities described in this plan are intended to perform a screening level for indoor radon concentrations at nineteen commercial properties. If radon concentrations equal or exceed the DOE-recommended value of 3 pCi/L above background, long-term integrated radon concentration sampling will be performed. (The State of New Jersey and EPA recommend using a value of 4 pCi/L; however, DOE will use the more conservative value of 3 pCi/L.) Both indoor and outdoor gamma exposure rate measurements will be taken at all properties.

Table 1-2
Commercial Properties not Included in Sampling Effort

Company	Address	Characterization Report
Ballod Associates	Route 17, Rochelle Park	BNI 1985a
Scanel	Essex Street, Maywood	BNI 1985b
Municipal Property	New Jersey Route 17, Maywood and Rochelle Park	BNI 1986a
New York, Susquehanna, and Western Railroad Property (Western right-of-way)	Maywood	BNI 1986b
Firemen's Memorial Park	Garibaldi Avenue, Lodi	BNI 1989j
Schenk Chevrolet	72 Sidney Street, Lodi	BNI 1989k
Municipal Property	Interstate 80 (Right-of-way), Lodi	BNI 1989l

2.0 SAMPLING APPROACH AND RATIONALE

The additional data to be collected at the 19 commercial properties will provide a better understanding of the contaminant conditions at the properties and will be used to determine whether measures are necessary to protect workers. Specific data and data requirements for the 19 commercial properties are summarized below.

- Surface and subsurface soil concentration data are available for uranium-238, radium-226, and thorium-232. No additional soil data are required.
- Limited gamma exposure rate measurements at the 19 commercial properties are available. Additional measurements will be taken at each of the commercial properties.
- Limited data on indoor radon concentrations are available. Radon measurements will be taken at each of the commercial properties.

The following sections delineate the data requirements for the commercial properties and describe the technical approach that will be implemented.

2.1 DATA REQUIREMENTS FOR COMMERCIAL PROPERTIES

The primary objectives for the 19 commercial properties are:

- Objective 1: Obtain outdoor gamma exposure rate measurements
- Objective 2: Determine indoor radon (radon-222 and radon-220) concentrations
- Objective 3: Determine need for followup radon measurements

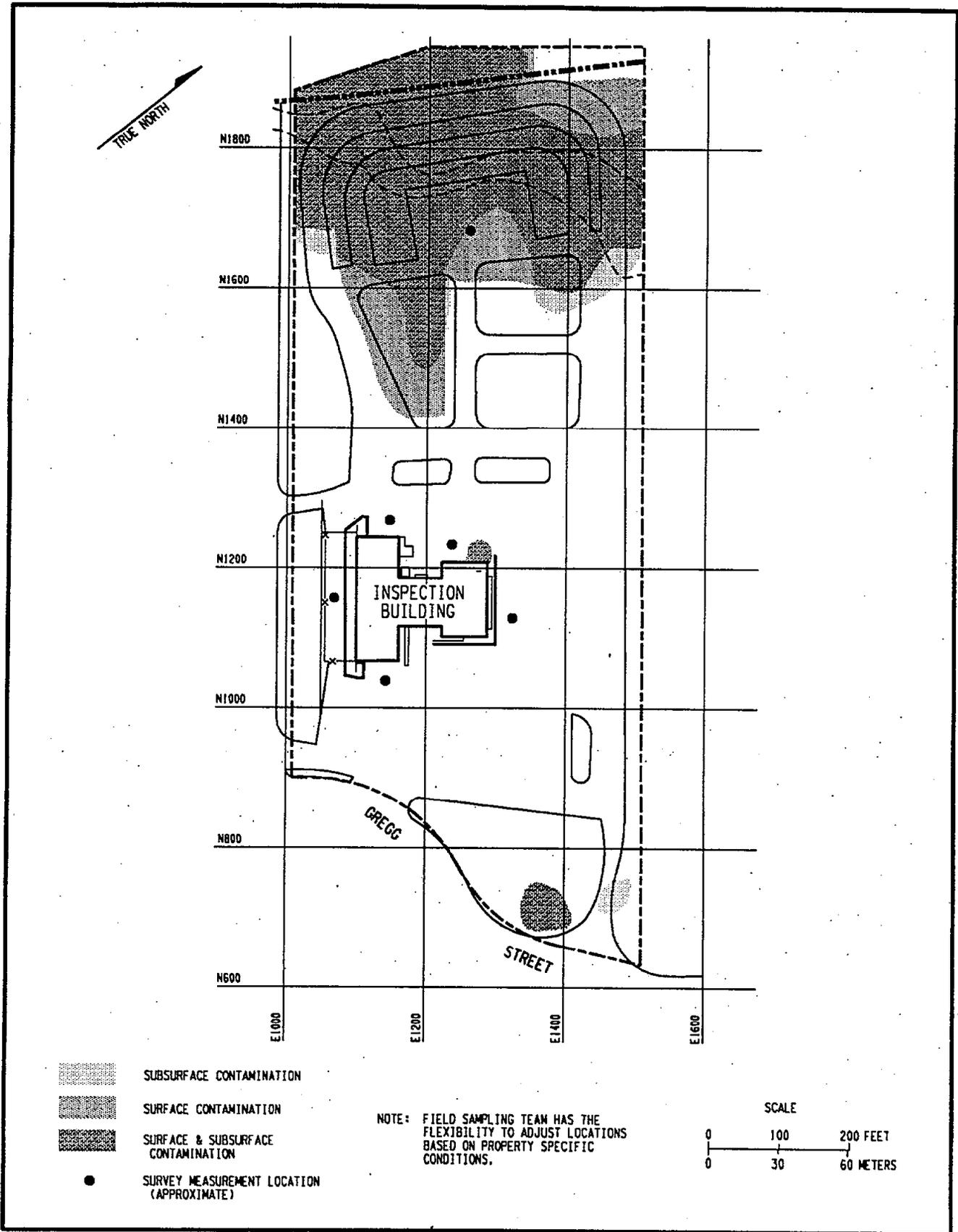
2.1.1 Objective 1: Obtain Outdoor Gamma Exposure Rate Measurements

Approximately five exterior and two interior gamma exposure rate measurements per property will be obtained using a pressurized ionization chamber (PIC). The number of sampling locations may vary according to the size of the property. The PIC instrument is a

tripod-mounted device that consists of a chamber filled with gas and an electrometer. As radiation passes through the gas-filled chamber, ion pairs are produced by the absorbed energy. These ion pairs produce a current that is measured by the electrometer and is proportional to the exposure rate.

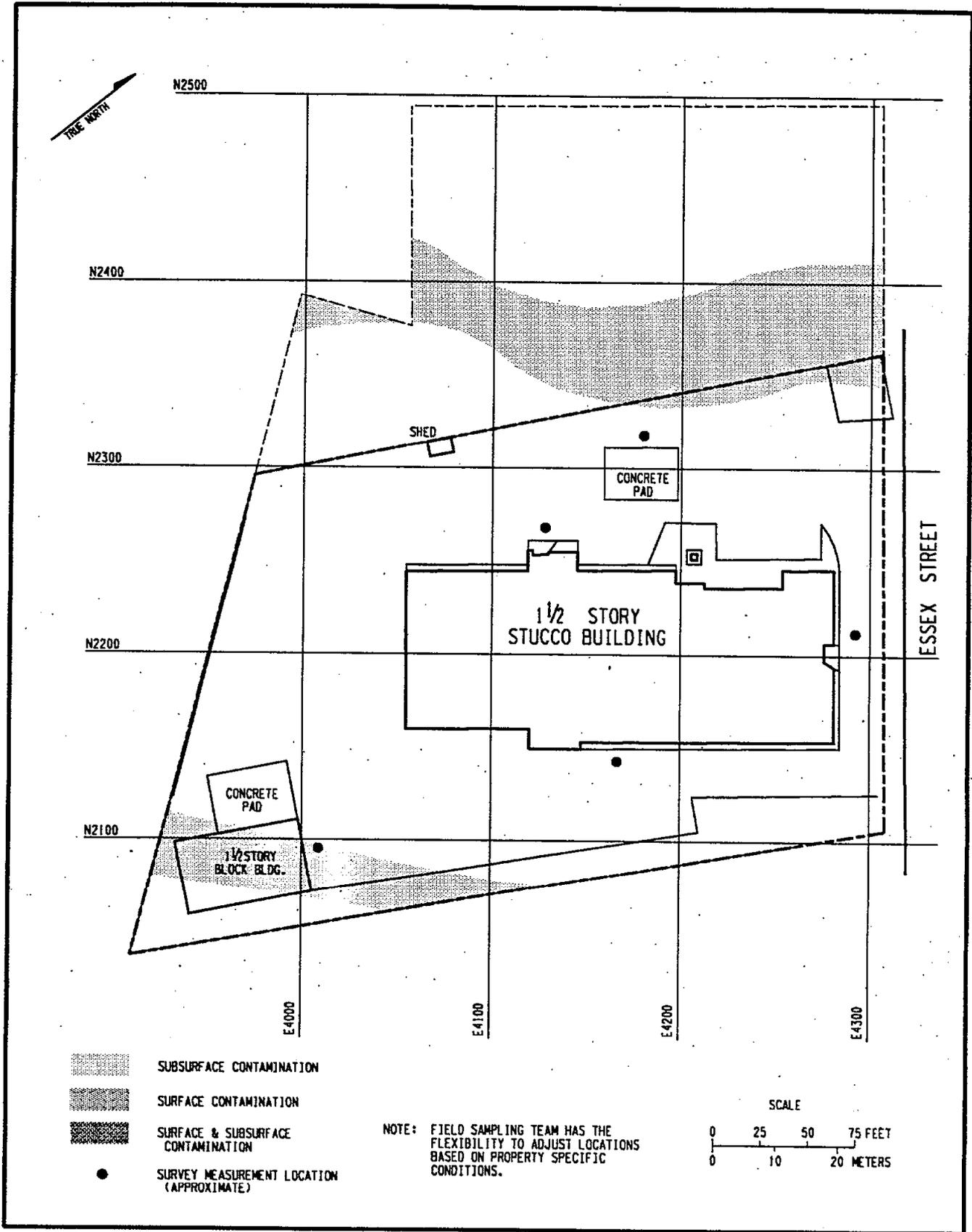
Before any measurements are taken, an access agreement will be negotiated with each property owner to grant DOE permission to enter the property and to protect the interest of the property owner. After these access agreements are obtained, field personnel will contact each property owner to request an appointment to obtain gamma exposure measurements. Figures 2-1 through 2-19 show the approximate locations where outdoor gamma exposure rate measurements will be taken for each property. The measurement locations were chosen so that exposure rates could be measured in areas where workers might spend part of their time (e.g., doorways, parking lots). In addition, some measurement locations are biased to be over suspected areas of surface and subsurface radioactive contamination. Indoor gamma measurement locations will be determined by field personnel. As a general rule, the indoor measurements will be taken in areas normally occupied by workers.

If contamination extends beneath the building as shown in some of the figures, field personnel will obtain a portion of the measurements above the contaminated area. The number of exposure rate measurements taken above the contaminated area will be proportional to the total contaminated area of the site (e.g., if 20 percent of the building floor area lies above suspected contaminated soil, then 20 percent of the indoor exposure rate measurements will be taken over the contaminated areas in order to obtain representative exposure rates for the entire building). The data from the gamma exposure rate measurements will be used to determine whether the dose to workers exceeds the DOE limit of 100 mrem/yr above background and whether exposure rates exceed the DOE limit of 20 μ R/h. DOE will obtain information from each property owner about the work shifts, the number of employees, and any other information that might be useful in performing dose calculations.



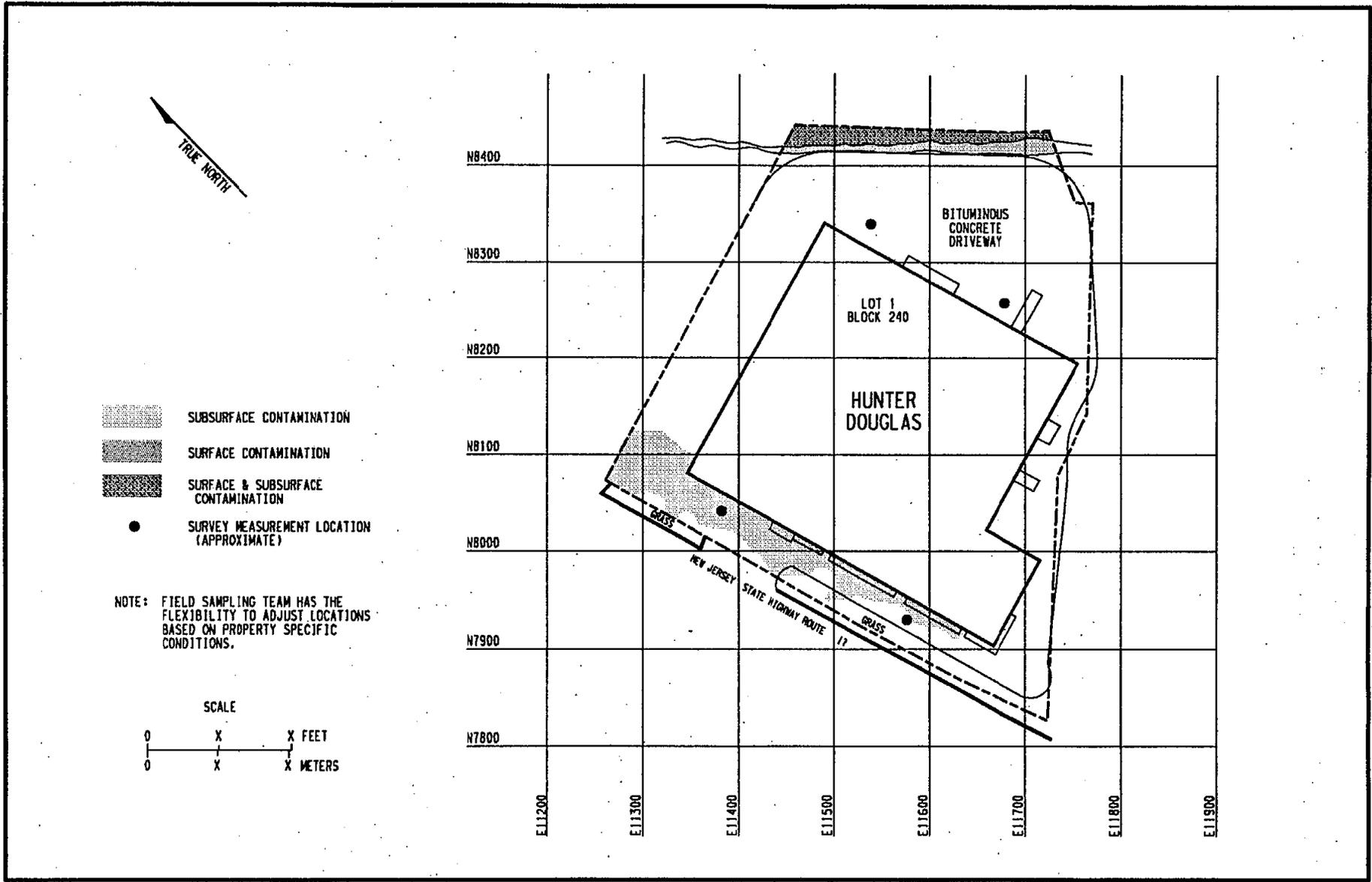
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Figure 2-1
 Areas of Contamination at the New Jersey Vehicle
 Inspection Station Property



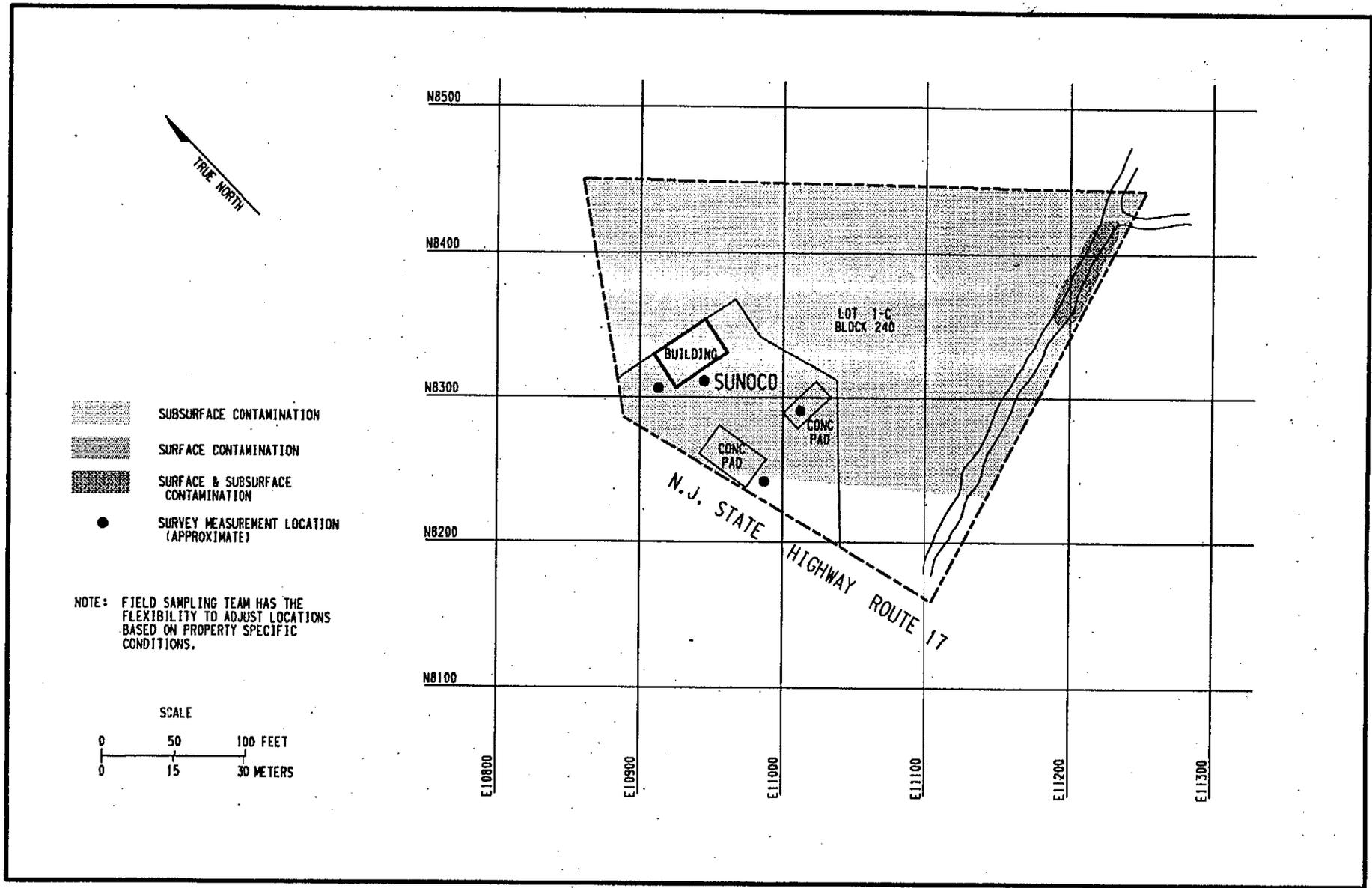
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Figure 2-2
 Areas of Contamination at 160 and 174 Essex Street



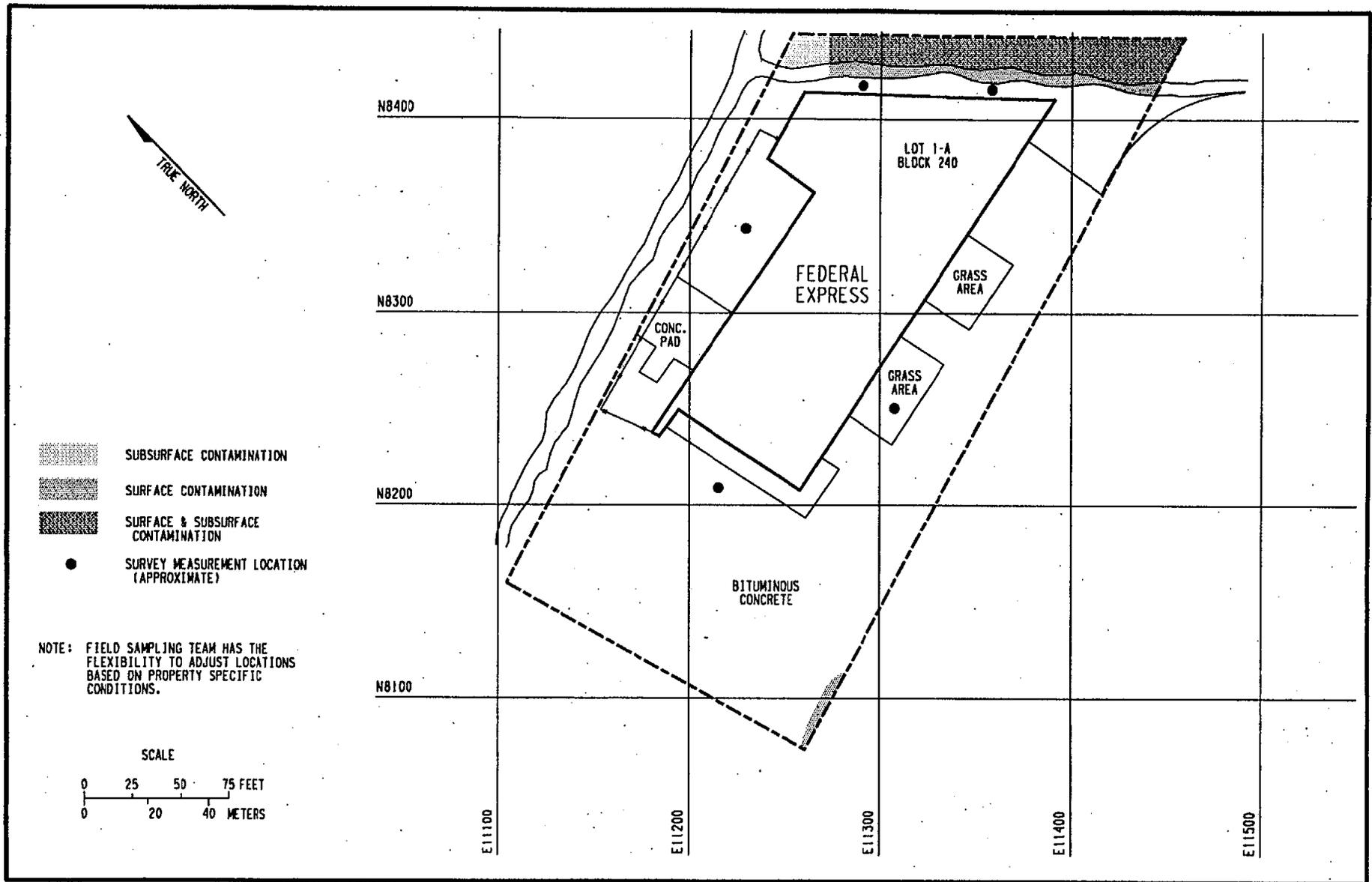
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Figure 2-3
Areas of Contamination at the Hunter Douglas Property



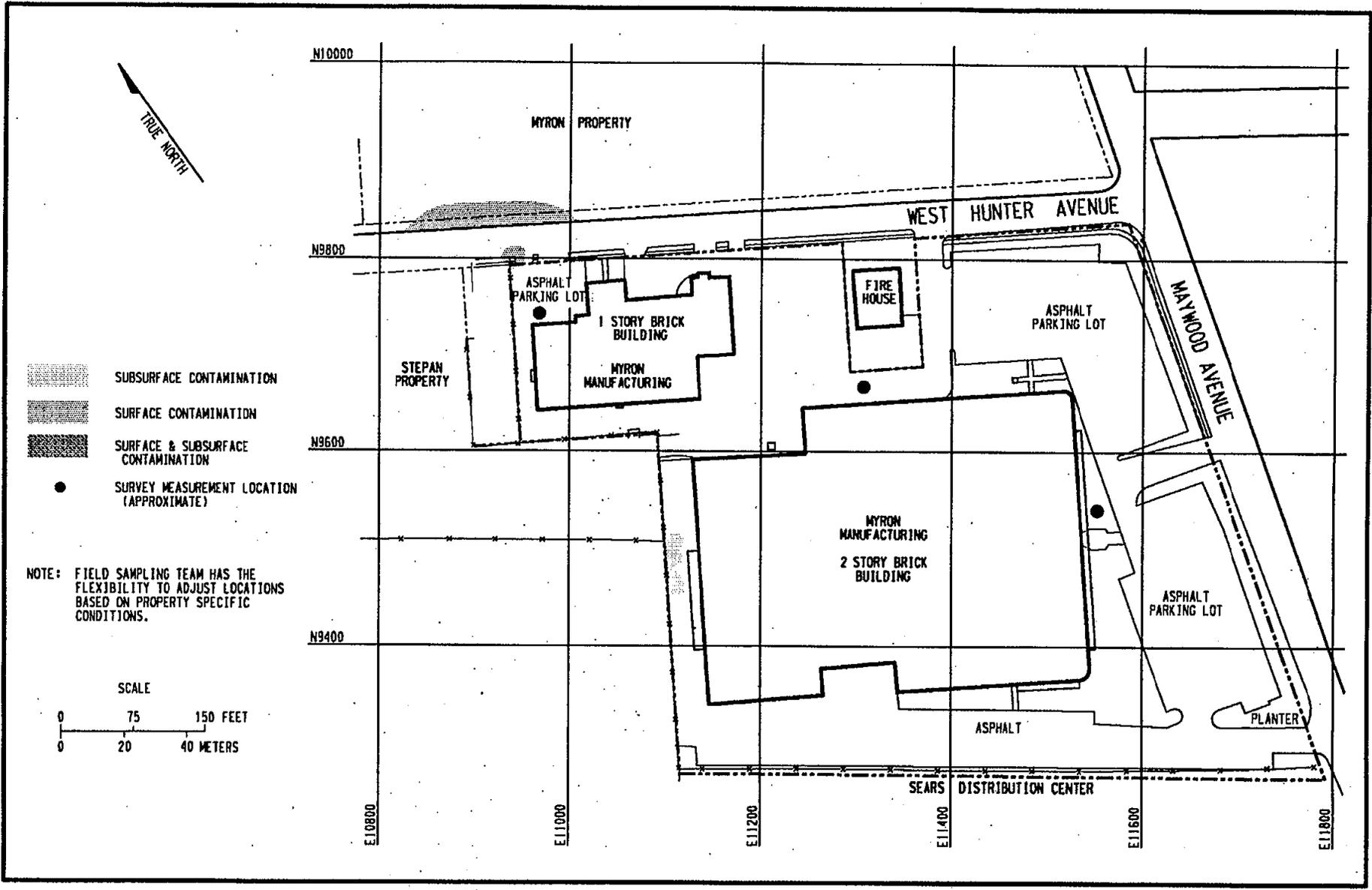
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Figure 2-4
Areas of Contamination at the Sunoco Station Property



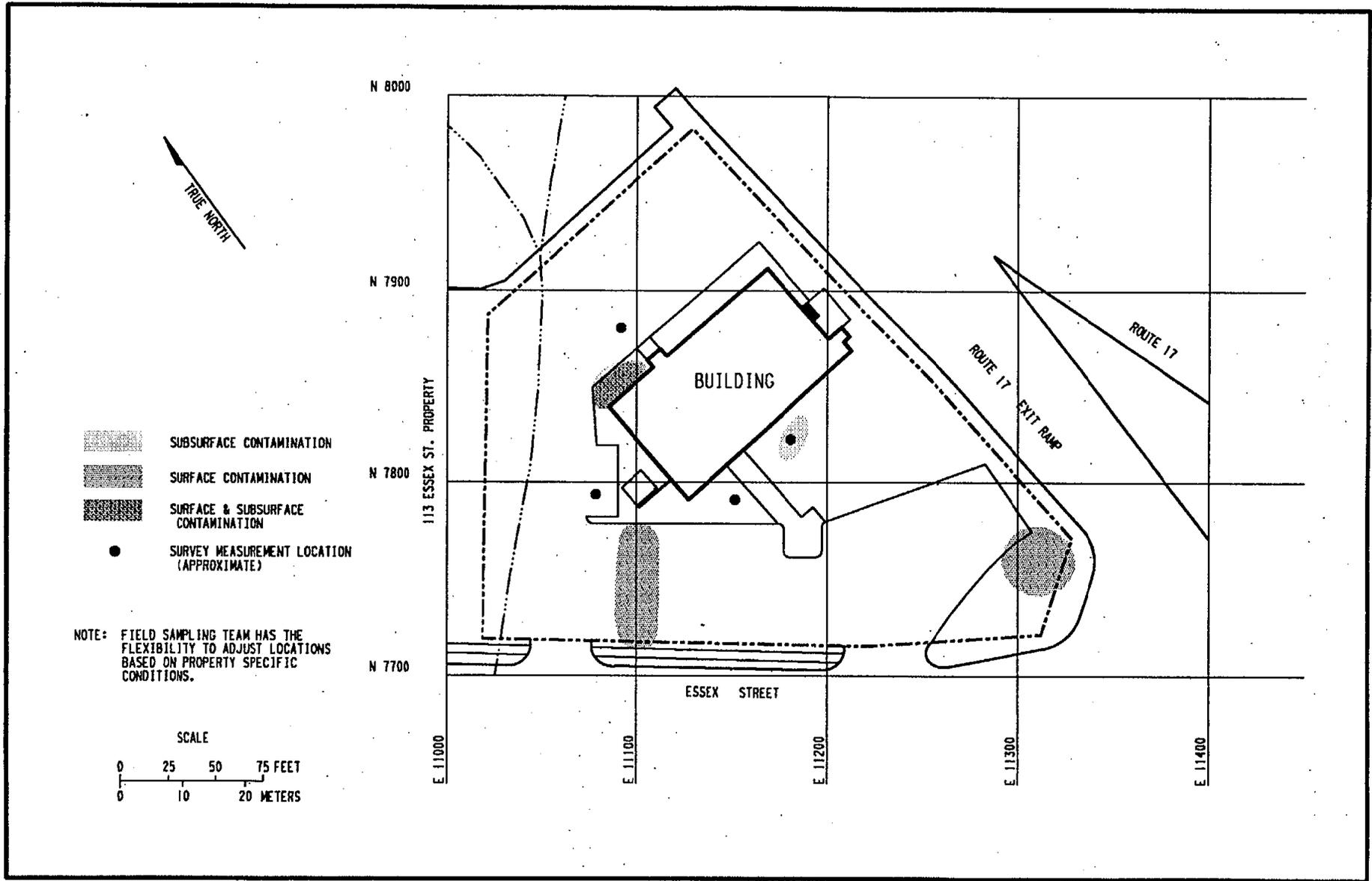
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Figure 2-5
Areas of Contamination at the Federal Express Property



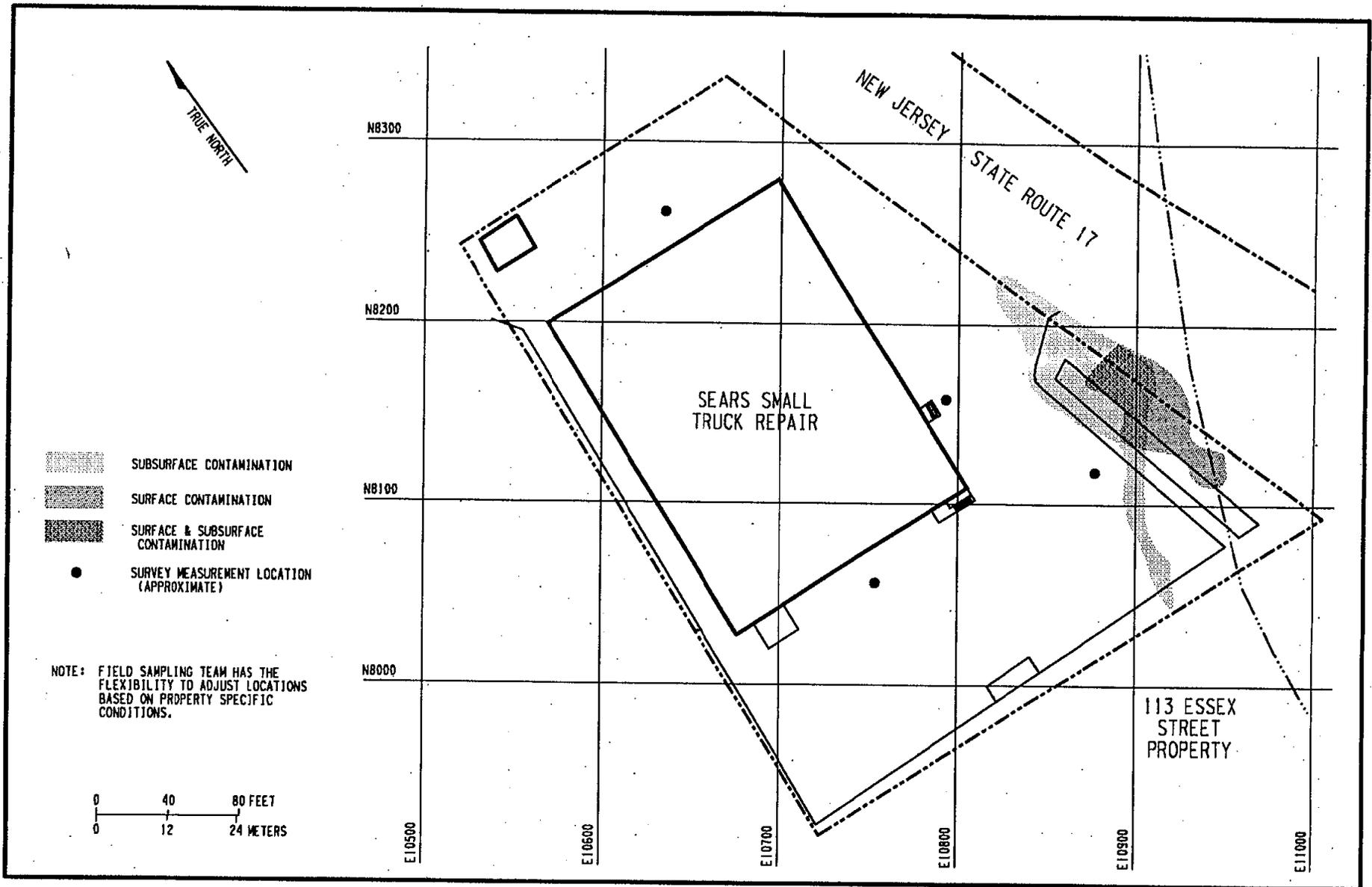
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Figure 2-6
Areas of Contamination at 205 Maywood Avenue



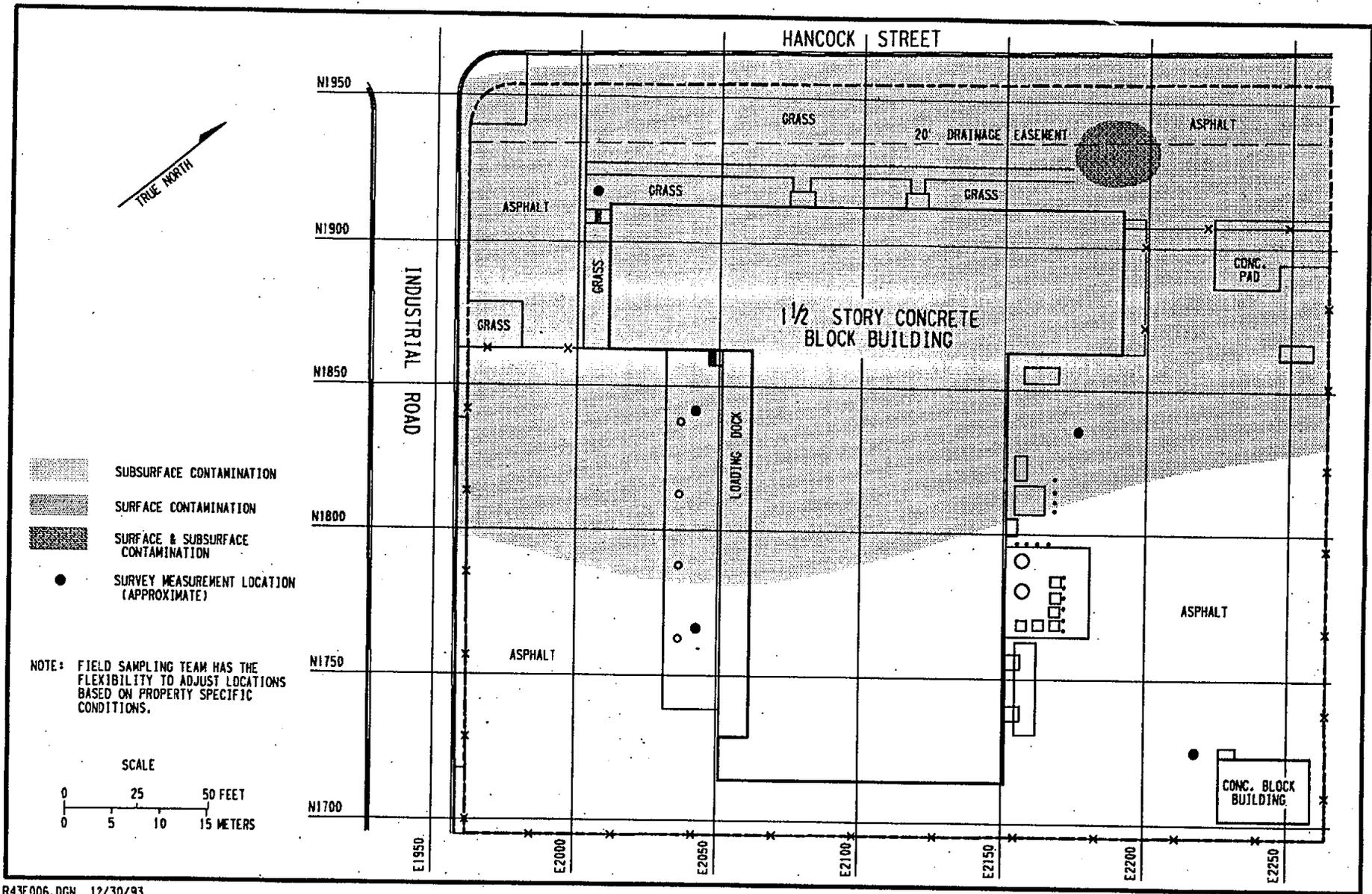
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Figure 2-7
Areas of Contamination at Essex Street and State Route 17



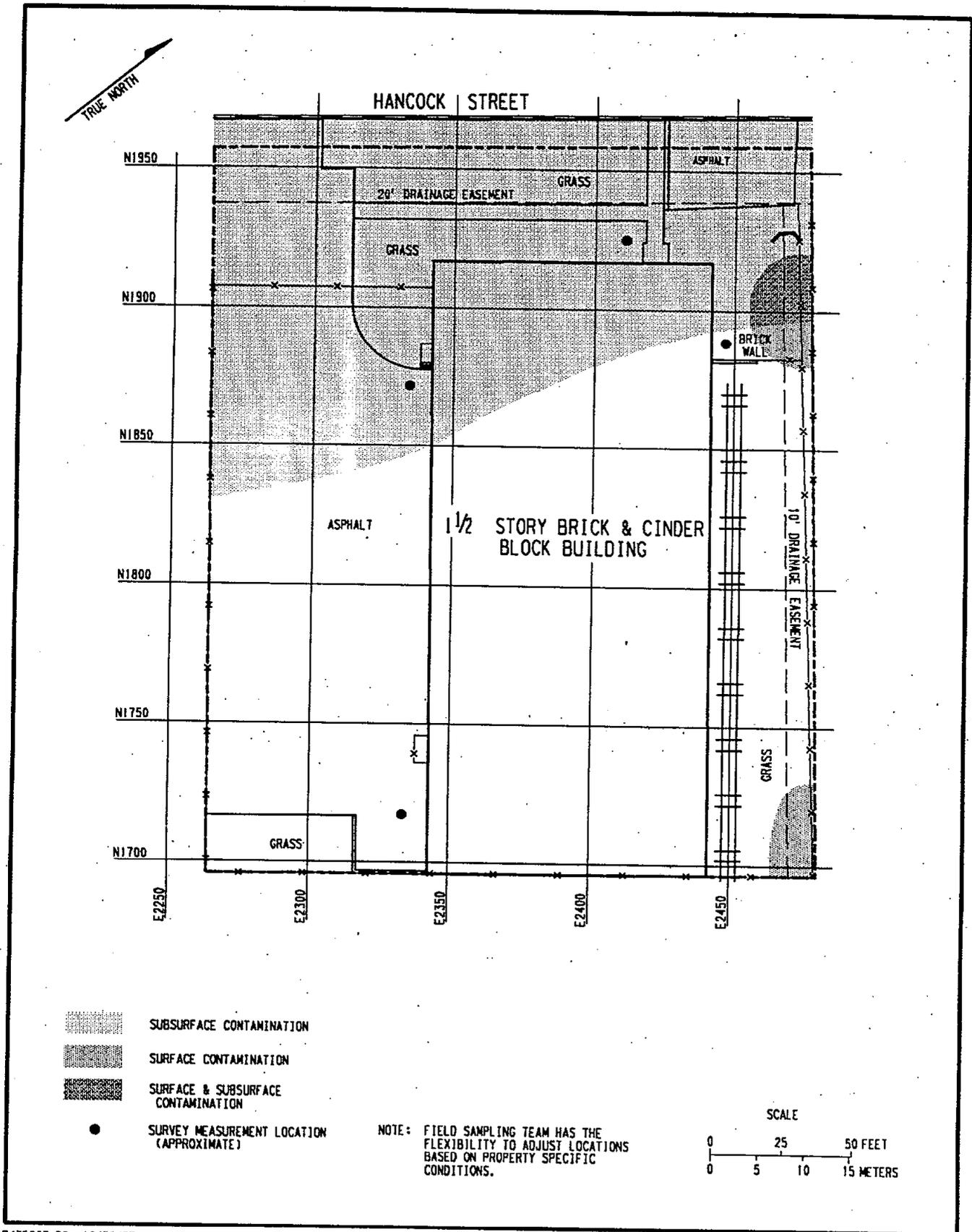
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Figure 2-8
Areas of Contamination at 200 State Route 17



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Figure 2-9
Areas of Contamination at 80 Hancock Street



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Figure 2-10
Areas of Contamination at 100 Hancock Street

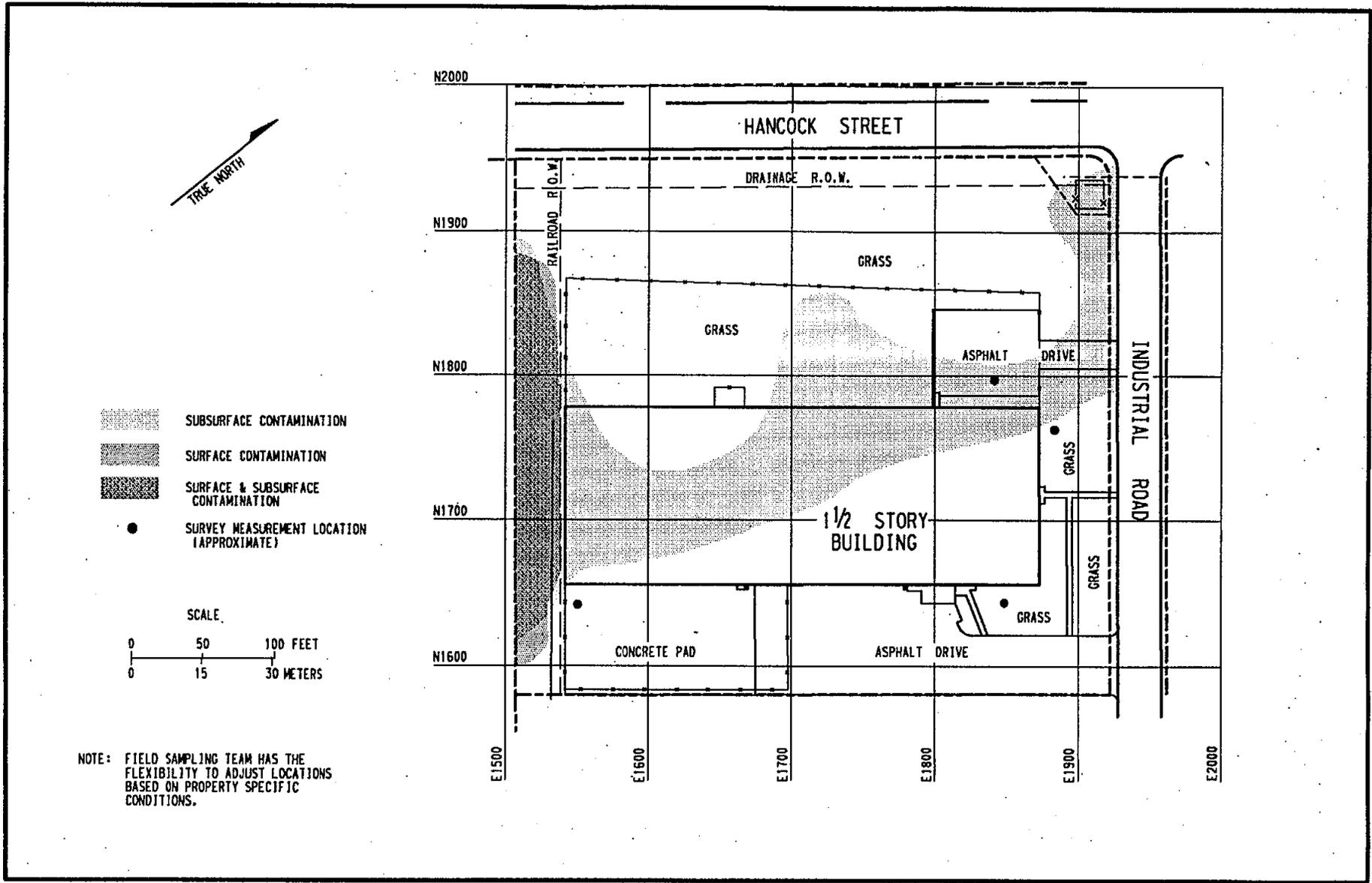
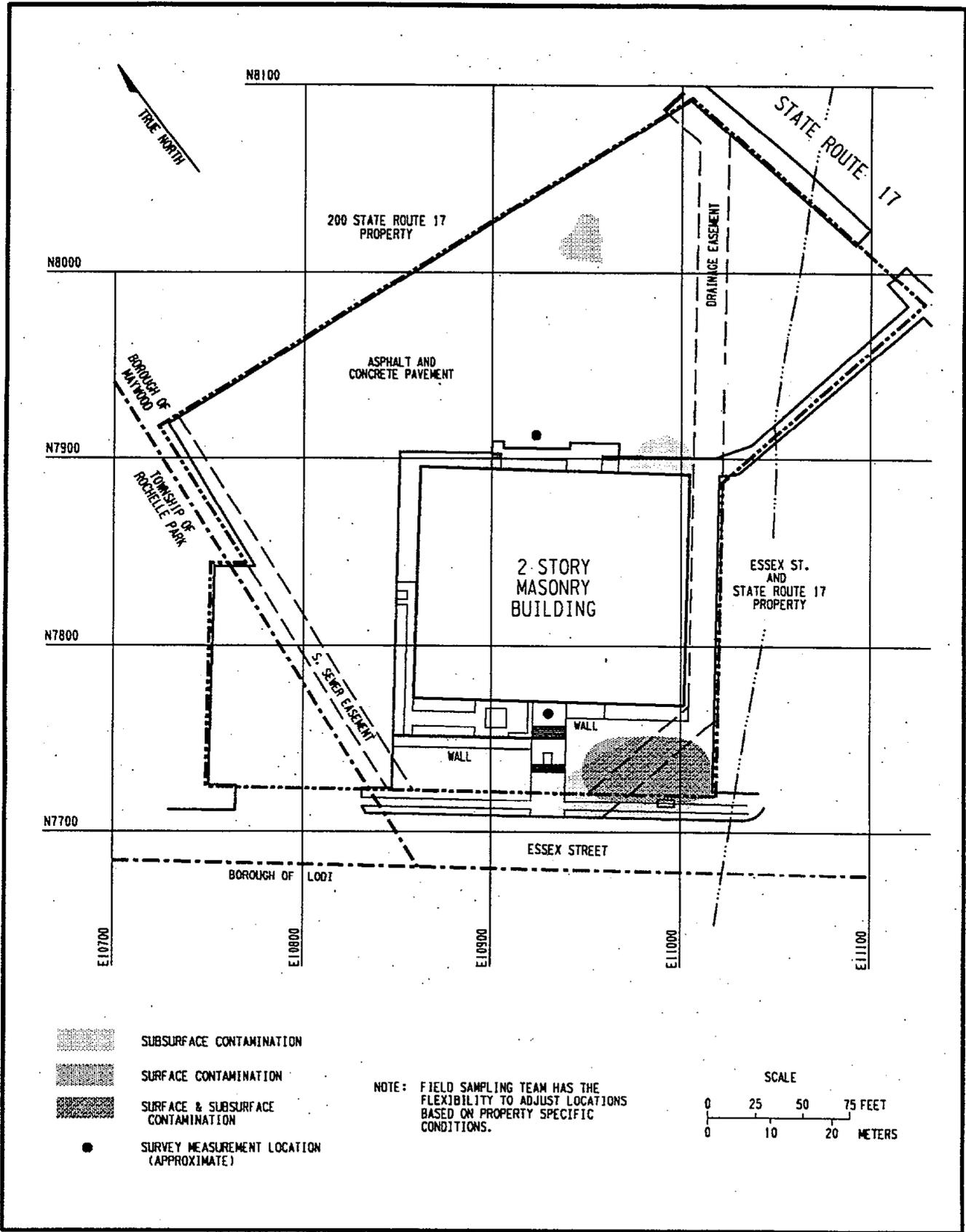
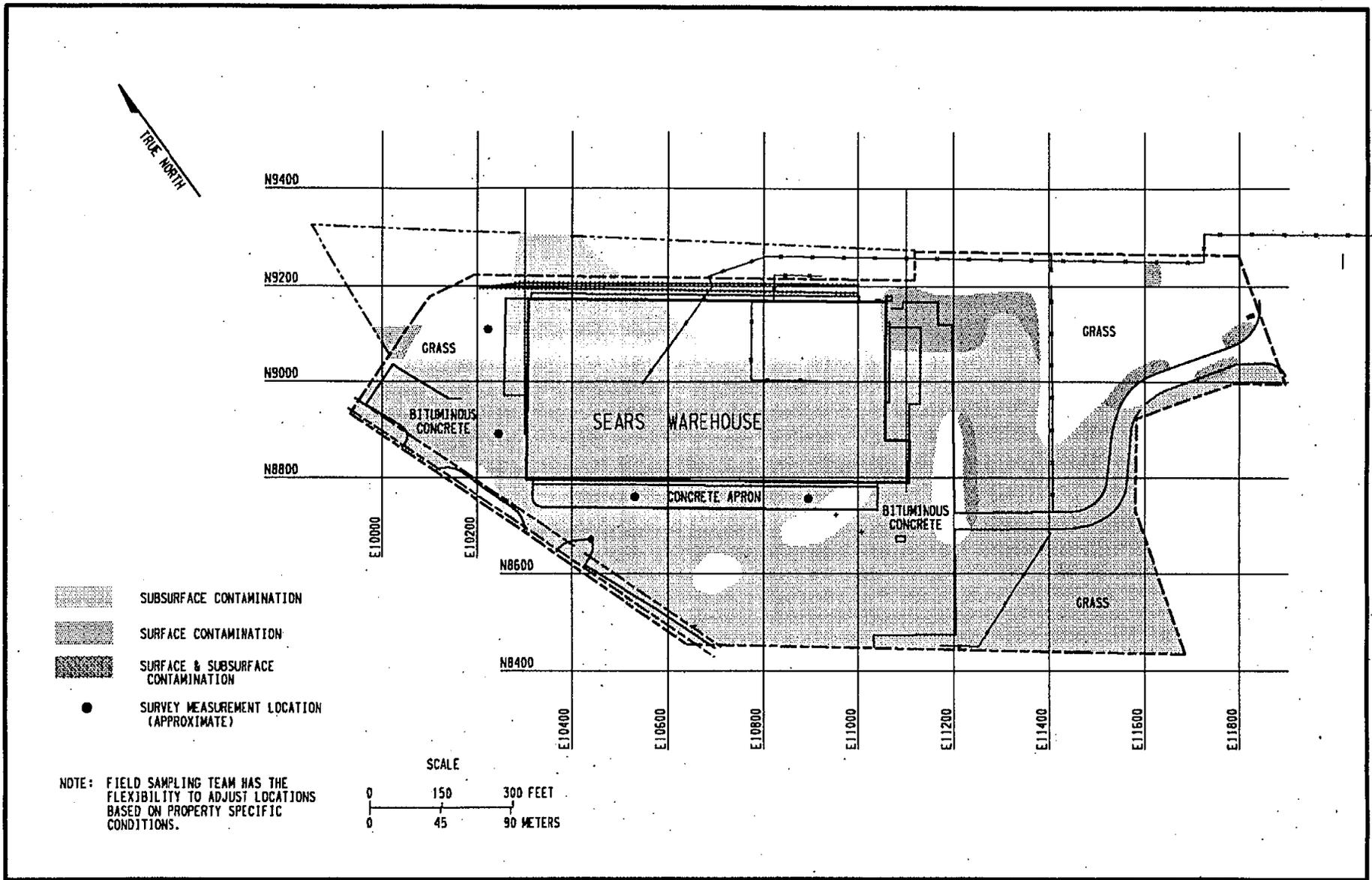


Figure 2-11
Areas of Contamination at 80 Industrial Road



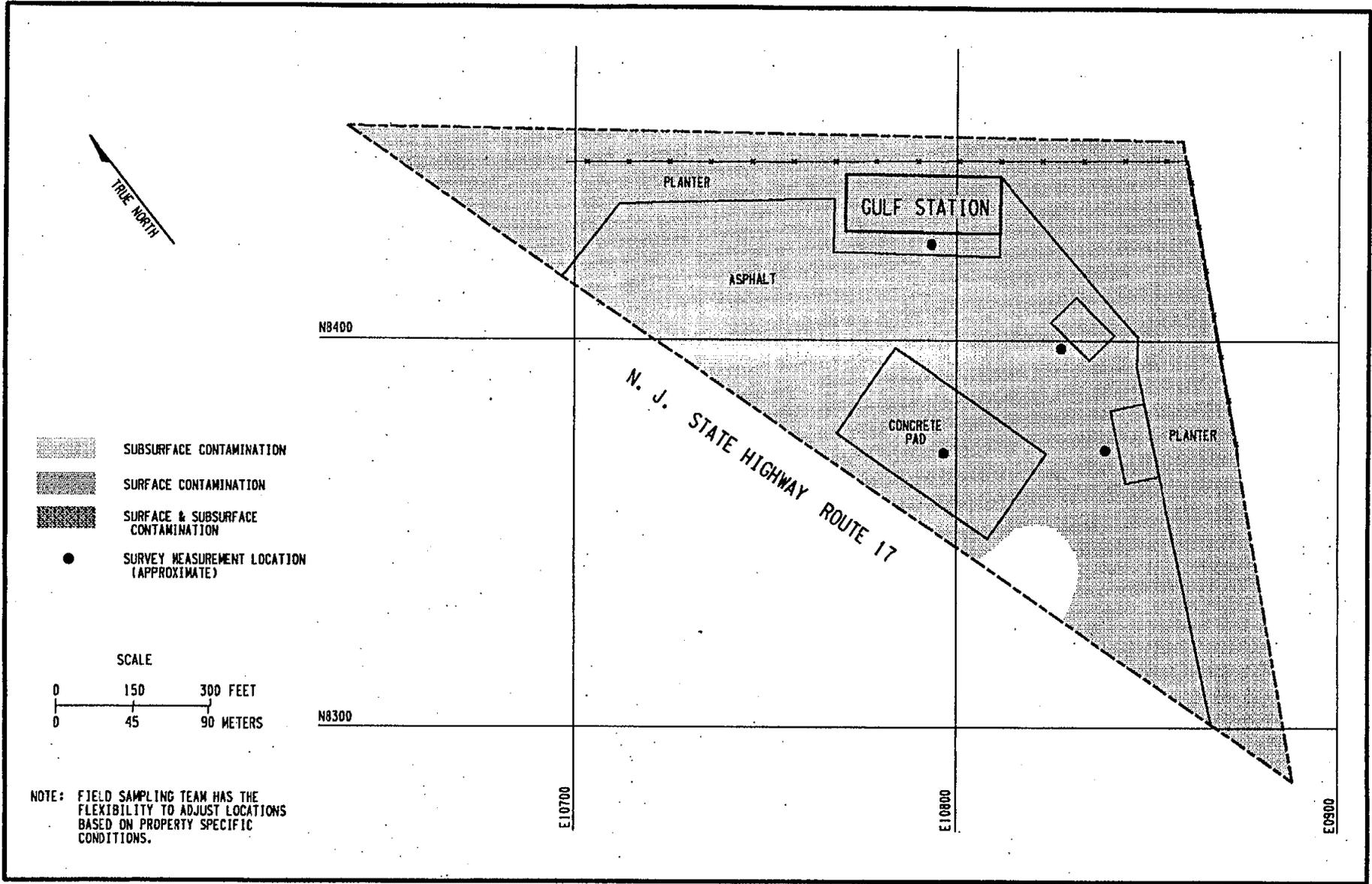
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Figure 2-12
Areas of Contamination at 113 Essex Street



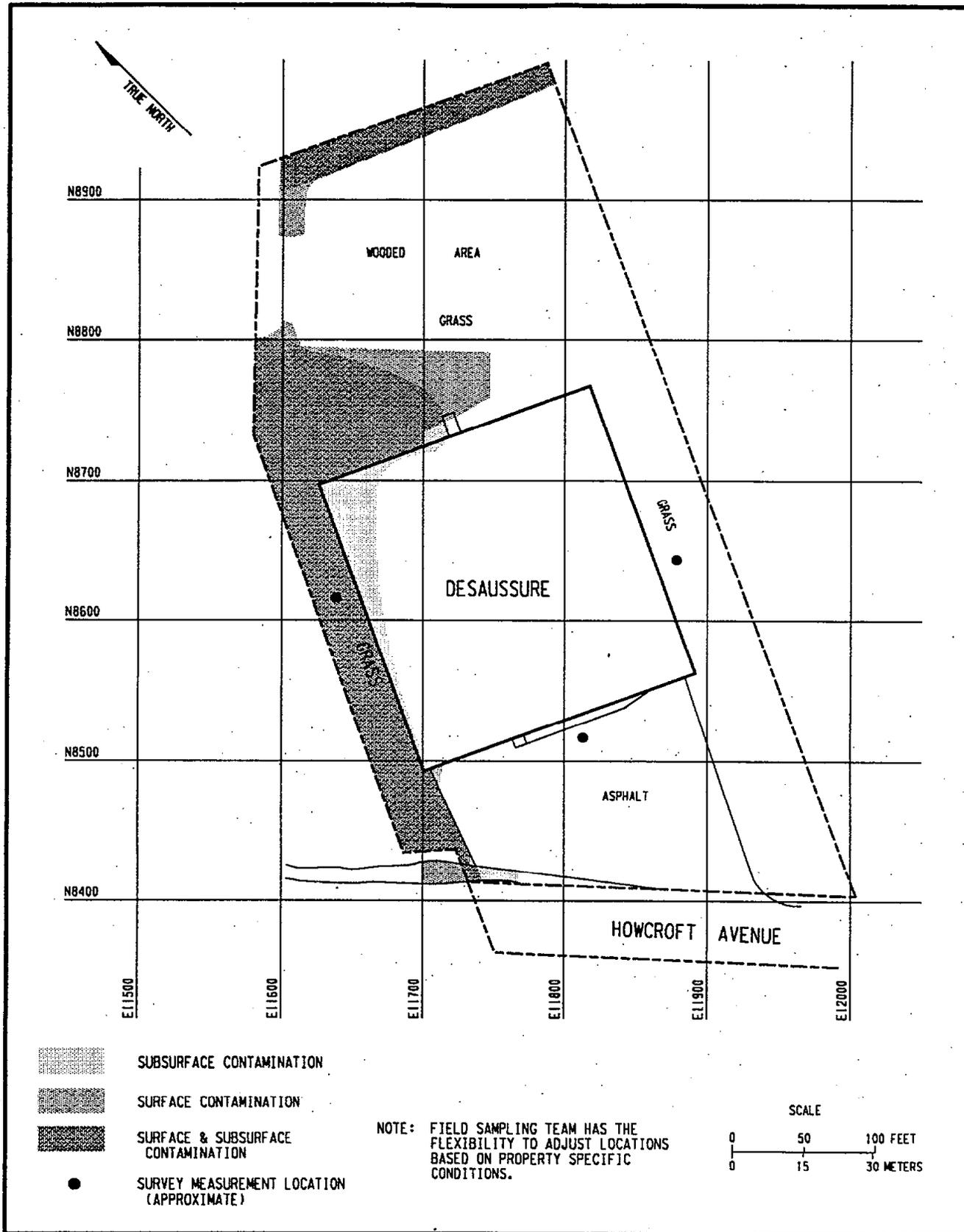
R43F003.DGN 12/29/93

Figure 2-13
Areas of Contamination at the Sears Property



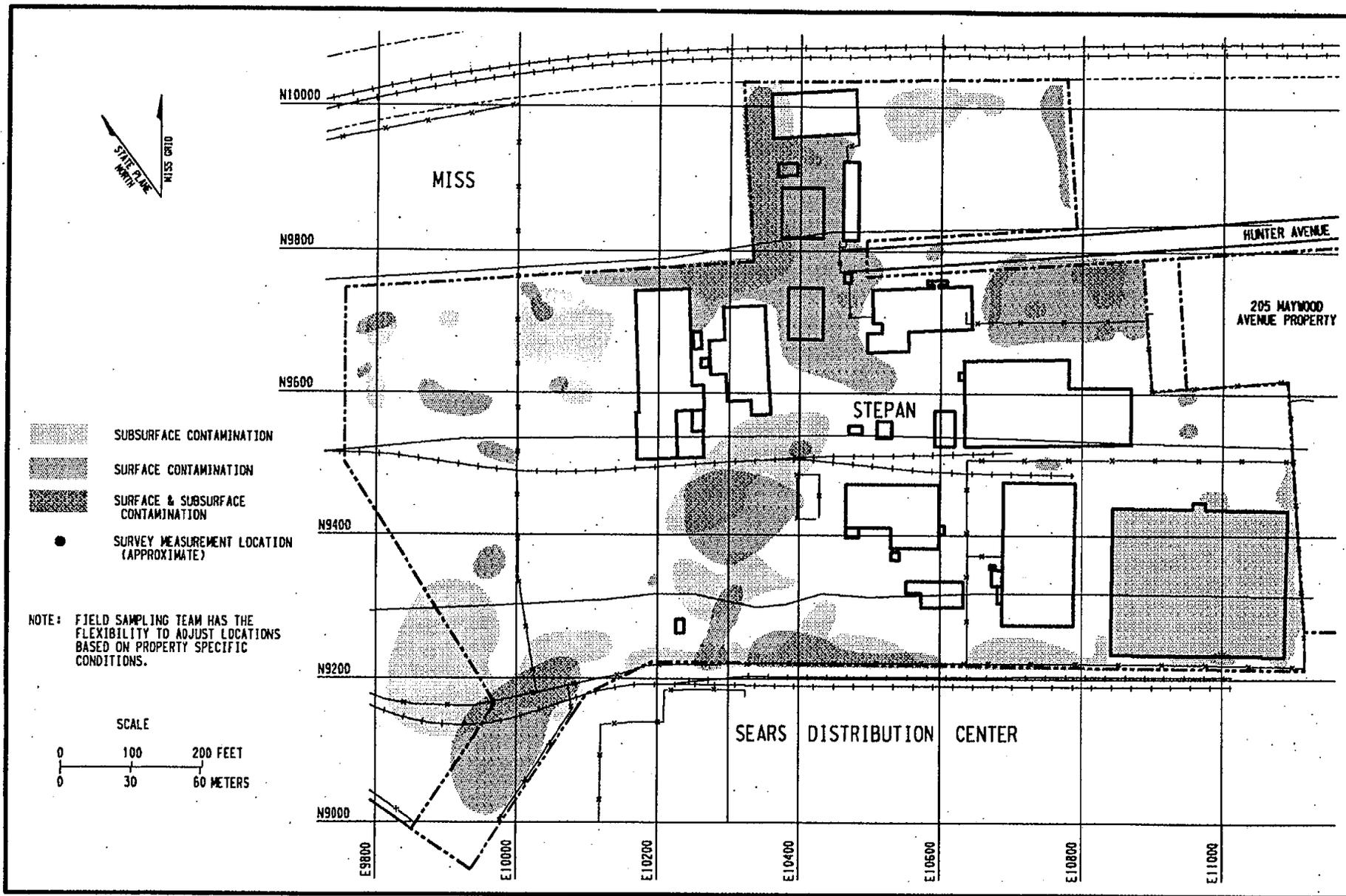
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Figure 2-14
Areas of Contamination at the Gulf Station Property



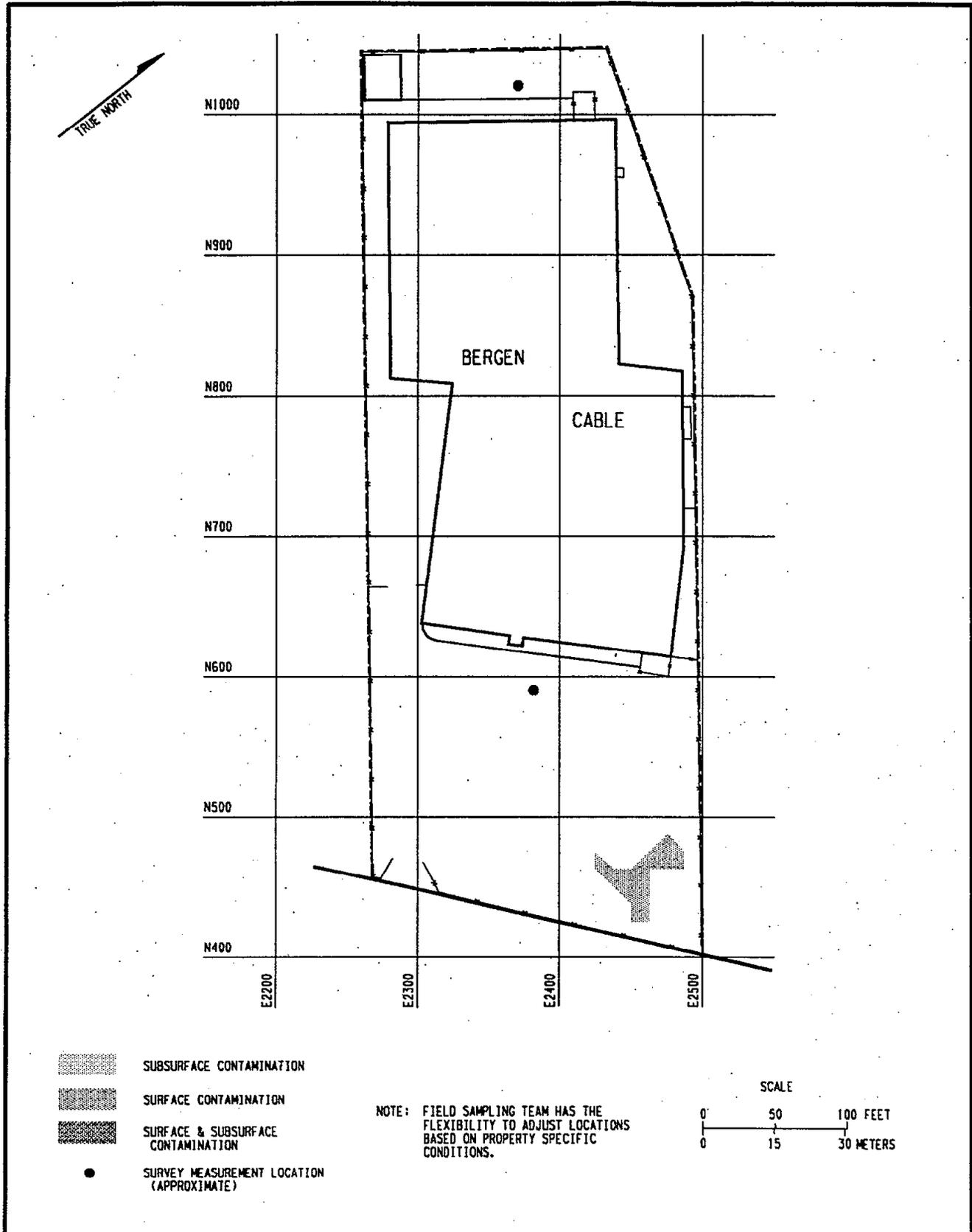
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Figure 2-15
 Areas of Contamination at the DeSaussure Property



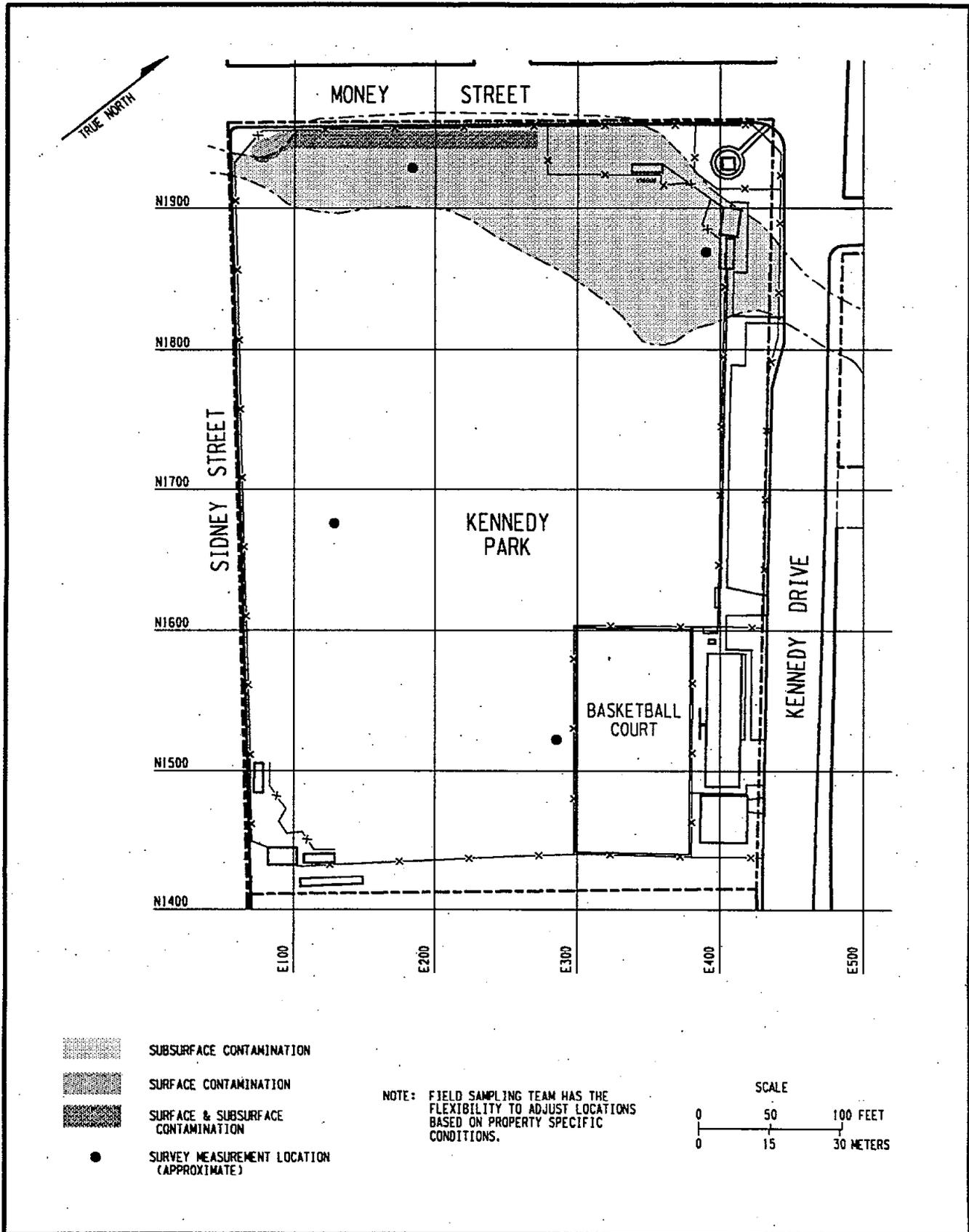
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Figure 2-16
Areas of Contamination at the Stepan Property



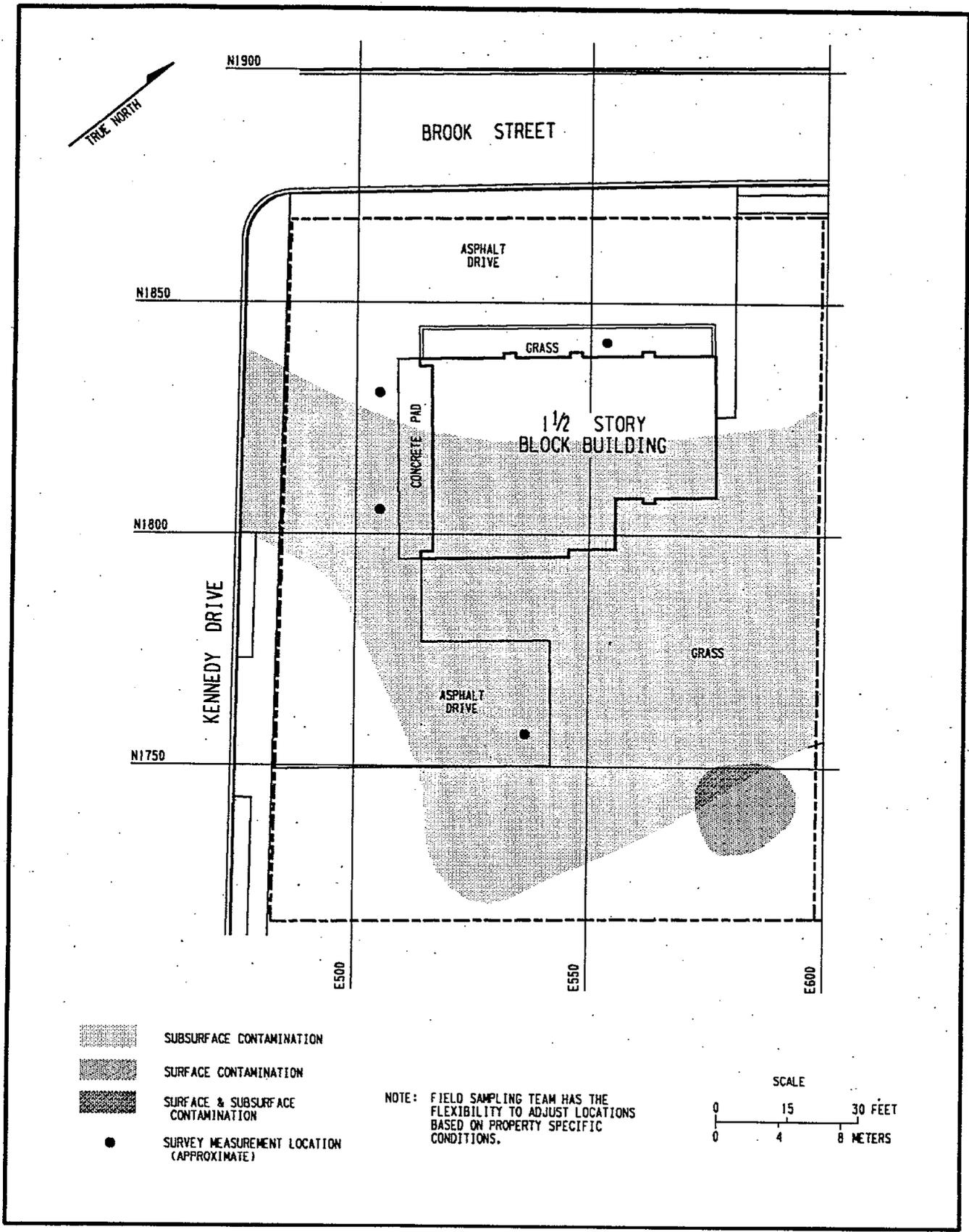
R43F017.DGN 1/3/94

Figure 2-17
 Area of Contamination at the Bergen Cable Property



R43F018.DGN 1/3/94

Figure 2-18
Areas of Contamination at Kennedy Park



R43F019.DGN 1/3/94

Figure 2-19
Areas of Contamination at Fire Station No. 2

Gamma exposure rate measurements will be taken as follows:

- The radiological support subcontractor (RSS), in coordination with appropriate Bechtel National, Inc. (BNI) personnel, will determine the exact locations for the measurements, using the locations shown in Figures 2-1 through 2-19 as a guide.
- The RSS is responsible for verifying the operational status of the PIC and field instrumentation. (The PIC must be charged for 24 hours before being used in the field.) Response to a known reference source and background will be checked for all instruments before they are used. The PIC background will be compared to the field instrument used and documented on a gamma exposure rate survey form (Figure 2-20).
- The RSS will determine the number of survey locations required to adequately survey an area. To make this determination, the RSS will use judgment and will consider factors such as the size of the area, obstacles encountered, and contaminants known or suspected to be present. All decisions pertaining to the adequacy of surveys will be discussed with the TMA/Eberline Oak Ridge project office and BNI personnel. All such determinations will be thoroughly documented in the RSS manager's logbook.
- For indoor areas, all measurements will be performed 1. m (3 ft) above the floor surface.
- All exposure rate survey data will be recorded on a gamma exposure rate survey form (Figure 2-20).
- Survey locations will be recorded on survey maps (if available) or hand-drawn grid maps.

2.1.2 Objective 2: Determine Indoor Radon Concentrations

A screening level measurement for indoor radon concentrations will be performed at all 19 commercial properties using 3-in. activated charcoal absorption canisters (AC). ACs are passive devices that require no power to function and allow continual absorption and desorption of radon. All the exposed charcoal canisters will be analyzed for radon-222. Because radon-220 has such a short half-life (55 seconds), it is assumed that most of it will decay before it diffuses into the building. To verify this assumption, analysis for radon-220 will also be conducted on a limited number of the exposed canisters.

Before the deployment of any radon detectors, the radon measurement specialist will contact each property owner and request an appointment to install the detectors. In addition to requesting an appointment, the specialist will inform the property owner of the desired building conditions before and during the measurement event. The desired building conditions are:

- To the extent reasonable, the radon measurement should be made under closed-building conditions. All windows, outside vents, and external doors should be closed (except for normal entrance and exit). External doors should not be left open for more than a few minutes.
- Internal - external air exchange systems (other than a furnace) such as high-volume attic and window fans should not be operating during measurements and for at least 12 hours before measurements are initiated.
- For the four-day AC measurements, closed-building conditions should be maintained for 12 hours before the initiation of the measurement. [This is not a requirement for the alpha track (AT) measurements.]

NOTE: DOE has no control over building conditions before or during the radon testing. However, DOE will attempt to obtain agreement from the property owners to abide by the building test conditions listed above.

The number of canisters to be placed at each property will vary depending on the size of the building and the number of habitable, frequently used rooms in the building. The following criteria will be used to determine the number and locations of rooms to be tested:

- One testing device will be used for every 2,000 ft² of ground-floor area. For large open areas, one testing device will be used for every 5,000 ft². The minimum number of detectors to be placed at each property is shown in Table 2-1.
- Additional testing devices will be placed in basement-level rooms; one device will be used for every 2,000 ft² of floor area.
- Testing devices will be placed in lower-level rooms that have penetrations such as a pipe chase or floor vent to the soil underneath.
- Rooms will be selected to ensure that testing is performed as uniformly as possible throughout the building.

In addition, locations of testing devices will be indicated on a floor plan for each building to aid in the evaluation of analytical results.

Placement of the testing devices will be in accordance with the guidance listed below (EPA 1992 and NJDEP 1988):

- Canisters will be placed at least 2 ft (0.6 m) from the floor and at least 1 ft (0.3 m) from the ceiling. The testing device should be as close to the breathing zone as possible, approximately 5 ft (1.5 m) above the floor.
- Canisters will be placed in open areas where occupants actually perform work (i.e., not in a closet or cabinet).
- Canisters will be placed away from external walls.

Table 2-1
Minimum Number of Detectors

Company	Building Size (ft²)	Minimum Number of Detectors
New Jersey Vehicle Inspection Station	23,000	12
National Community Bank, Lodi	23,000	11
Hunter Douglas	105,000	21
Sunoco	800	2
Federal Express	17,000	9
Myron Manufacturing	105,000 and 18,000	19
Joseph Muscarelle	6,000	3
Sears Truck Repair Center	30,000	6
Airco Medical	20,000	10
Appleton Electric (Heather Hill)	23,000	12
Flink Ink	41,000	9
National Community Bank, Maywood	18,000	9
Sears Distribution Center	320,000	64
Gulf Station	800	2
DeSaussure	40,000	8
Stepan	53,000	11
Bergen Cable	57,000	12
J. F. Kennedy Park		2
Fire Station No. 2	3,800	2

- Canisters will not be placed near doors, heating ventilation units, fans, and other equipment or areas where drafts may influence test results.
- Canisters will be placed where it is unlikely that they will be tampered with or disturbed.
- Canisters will not be placed near or on top of devices or equipment that emit excessive heat.
- If contamination extends beneath the building, as shown in some of the figures (Figures 2-1 through 2-19), some of the canisters will be placed in the building above the contaminated areas. The number of canisters placed above contaminated areas will be proportional to the contaminated area under the building. For example, if 20 percent of the building is above contaminated areas, then 20 percent of the canisters should be placed in these areas of the building.

Testing devices will be left in place for four days. (At the request of property owners, canisters may be left in place for seven days if field work would disrupt operations at the commercial property. However, a test period of four days is preferred.) At the end of that time, the canisters will be collected and delivered for radon analysis to Teledyne Brown Engineering Environmental Services, Westwood, New Jersey, a laboratory certified by the State of New Jersey. All canisters will be analyzed for radon-222, and the analysis will be performed in accordance with EPA 520 methods. Two canisters or 10 percent of the total number (whichever is smaller) from properties where contamination extends beneath the building will be analyzed for radon-220. Because a standard EPA method does not exist for radon-220 analysis, the laboratory will determine a radon-220 concentration by measuring the concentration of lead-212. All data will be evaluated to determine the exposure to occupants or workers at each property. Results of the testing program will be provided to each property owner, the NJDEPE case manager for the site, and the EPA remedial project manager.

Charcoal canisters will be placed according to the following procedure:

- Record all appropriate information on the canister identification label (shown in Figure 2-21) including the site name or client name, address, sampling location, start date, and start time immediately before the sampling period begins. A certification number showing that Bechtel is a certified radon measurement business will be displayed on each canister.
- Remove adhesive tape and canister lid. This will allow air and any radon gas (and daughter products) present in the air to diffuse into the canister, where it will be absorbed by the activated charcoal.
- Place the canister, screen-side up, in the desired sampling location and note the location on a sketch of the room.
- Leave the canister in place and undisturbed for four days.
- At the end of the sampling period, remove the canister, replace the lid, and seal the canister with adhesive tape to trap radon and daughter products.
- Record stop date and time on the canister identification label.
- Complete a field sample collection form (shown in Figure 2-22).
- Package the canister(s) for analysis along with the field sample collection form(s). (Note: Original field sample collection forms must accompany the canisters in each shipping container.) All canisters collected in a day will be delivered by field personnel to the laboratory at the end of the day.

2.1.3 Objective 3: Determine the Need for Followup Radon Measurements

AT detectors will be placed in the same rooms where radon levels of 3 pCi/L above background or greater were determined by the charcoal canister measurements. In addition,

Lab Reference Number(s)	
Lab Ref. Number	Placement Location
Date Canister(s) Opened	

Date Canister(s) Closed	

Date Canister(s) Mailed	

Weather Conditions	

**Figure 2-21
Radon Canister Label**

TMA/EBERLINE
FIELD SAMPLE COLLECTION FORM
SITE ACTIVITY SAMPLES

Site WBS _____ Site Name _____ Activity Support (Job) # _____ Sampler(s) _____

Sample ID Sample Grid Point	Sample Type (1)	Sample Time	Date of Sample	Preserved With	Purpose (2)	Depth cm [] ft []	Analysis Required	Remarks

SAMPLE TYPE (1)	Purpose (2)
Surface Soil SS	Rad Character RC
Bias Soil BS	Verification YR
Profile Soil PS	Quality Control QC
Sediment Silt SD	Hot Spot HS
Other OR	Resample RS
Vegetation VE	Background BG
Ground Water GW	Routine RT
Surface Water SW	Special SP

"This package conforms to the conditions and limitations specified in 49 CFR 173.421 for excepted radioactive material, limited quantity, n.o.s., UN 2910"

CHAIN OF CUSTODY

REASON	RELQ BY	REC'D BY	DATE	TIME

Recorded By _____

Date/Time _____

No. of Samples in this box

Total No. of samples in this shipment

Total No. of Boxes in this shipment

Shipper:

Ship to:

Figure 2-22
Field Sample Collection Form

AT detectors will be placed in rooms adjacent to rooms with elevated radon levels. Placement of the AT detectors will be based on the same criteria as those used for the charcoal canisters (Section 2.1.2). AT detectors consist of a small piece of film or plastic enclosed in a container with a filter-covered opening that excludes radon decay products. AT detectors are passive devices that require no power to function and measure the average radon concentration over the exposure period.

The AT detectors will be left in place for three months. At the end of that time, they will be collected and packaged for shipment to Landauer, Inc., Glenwood, Illinois, for analysis. The data will be used to determine whether remedial action is required to reduce radon levels. Results of the tests will be provided to the property owner, the NJDEPE case manager, and the EPA remedial project manager.

2.2 FIELD NOTES AND DOCUMENTATION

Field sampling and measurement information is documented daily on appropriate forms and in a TMA/E field sampling log. Samplers record sampling locations, sample identification numbers, depth of sample, type of sample, analysis required, data collected, and name of sampler. Examples of this documentation are included in the quality assurance project plan (BNI 1992b).

Field sampling team members will be responsible for maintaining and documenting appropriate chain-of-custody procedures. These procedures are also described in the quality assurance project plan.

All field notes, chain-of-custody records, drawings, and files created during field activities will be forwarded to the BNI Oak Ridge office and entered into the project document control center. The document control center will retain the records in a computerized database system until the end of FUSRAP, at which time the records will be transferred to DOE.

Sample analysis results returned from the radiological laboratories will also be submitted through the project document control center. The document control center will retain the originals and submit copies of the data to the appropriate environmental specialist for verification and evaluation.

Data verification activities conducted by the environmental specialist are described in the quality assurance project plan. These activities include checking data completeness and quality assurance/quality control (QA/QC) sample results. When these checks are complete and the validity of the results is verified, data will be released for evaluation and use.

3.0 QUALITY CONTROL

The purpose of the QA/QC program is to ensure that the data gathered are scientifically sound and of known precision. QA/QC requirements are described in detail in the quality assurance project plan (BNI 1992b). Additional QA/QC requirements are delineated in *Indoor Radon and Radon Decay Product Measurement Device Protocols* (EPA 1992). EPA protocol calls for the use of field controls (blanks) and duplicate (collocated) detectors. Field control detectors will consist of a minimum of 5 percent of the devices that are deployed or 25 devices, whichever is smaller. Field control detectors will be kept sealed and in a low-radon environment. Duplicate radon measurements (collocated) will be side-by-side measurements made in at least 10 percent of the total number of measurement locations, or at 50 locations, whichever is smaller. A duplicate PIC measurement will be made every 20 measurements.

QA/QC activities for radiological field measurements and sampling procedures are described in the procedures manual used by TMA/E personnel, including procedures on instrument response checks, calibration confirmation, duplicate sampling/surveys, and data review required to measure field and laboratory performance (TMA/E 1989).

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