

**VERIFICATION SURVEY  
OF  
PHASE II REMEDIAL ACTIONS  
ALBANY RESEARCH CENTER  
ALBANY, OREGON**

**Prepared by**

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**Prepared for**

**U.S. Department of Energy**

**INTERIM REPORT III**

**JUNE 1991**

**This report is based on work performed under contract number DE-AC05-76OR00033 with the U.S. Department of Energy.**

**This draft report has not been given full review and patent clearance, and the dissemination of its information is only for official use. No release to the public shall be made without the approval of the Office of Communication Resources, Oak Ridge Associated Universities.**



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Energy/  
Environment  
Systems Division

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June 20, 1991

Mr. James Wagoner, II  
FUSRAP Program Manager  
Decontamination and  
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Office of Environmental Restoration  
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U.S. Department of Energy  
Washington, DC 20545

Subject: INTERIM REPORT III: VERIFICATION SURVEY OF PHASE II  
REMEDIAL ACTIONS, ALBANY RESEARCH CENTER,  
ALBANY, OREGON

Dear Mr. Wagoner:

Enclosed are five copies of the Interim Report for the Verification Survey of Phase II Remedial Actions at the Albany Research Center. This Interim Report covers verification activities conducted by ORAU during the months of January and February 1991.

Should you have any questions, please do not hesitate to contact me at (615) 576-5073 or FTS 626-5073 or Michele Landis at (615) 576-2908 or FTS 626-2908.

Sincerely,

Timothy J. Vitkus  
Project Leader  
Environmental Survey and  
Site Assessment Program

TJV:jl

cc: A. Mitchell, OTS  
D. Adler, DOE/OR  
Site File: ARC/301

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**INTERIM REPORT  
VERIFICATION SURVEY  
OF  
PHASE II REMEDIAL ACTIONS  
ALBANY RESEARCH CENTER  
ALBANY, OREGON**

**INTRODUCTION**

The Albany Research Center (ARC), located in Albany, Oregon, was established in 1943 and operated by the U.S. Bureau of Mines. The initial site activities were to investigate innovative approaches for developing strategic mineral resources in the United States as well as manufacturing processes and other metallurgical research.

In addition to these activities, ARC conducted operations for the Atomic Energy Commission (AEC) and the Energy Research and Development Administration (ERDA), predecessor agencies of the Department of Energy (DOE) during the period 1948 to 1978. Operations involved the melting, machining, welding, and alloying of thorium. Research activities also included the separation, purification, and processing of limited quantities of uranium. Waste materials generated from these activities; containing low levels of thorium, uranium, and their associated decay products, were treated and placed into temporary storage and/or disposed on-site. In addition to the work performed for the DOE predecessors, ARC currently conducts work with radioactive materials under the jurisdiction of the Nuclear Regulatory Commission.

As a result of the research operations, portions of the ARC became radioactively contaminated. In 1978, Argonne National Laboratory (ANL) conducted radiological surveys and the site was subsequently designated for remedial action under the DOE's Formerly Utilized Site Remedial Action Program (FUSRAP).

In 1984, Bechtel National, Inc. (BNI), the Project Management Contractor for FUSRAP, conducted additional radiological surveys of areas identified by ANL, to define the locations and levels of above-guideline contamination. Remedial action to decontaminate identified areas was initiated by BNI in mid 1987 and completed in February 1988. Eleven structures were addressed in the 1987/1988 (Phase I) remedial action activities; they were Buildings 2, 4, 5, 17, 19, 23, 27, 28, 29, 30, and 31. During characterization and post-remedial action surveys, additional building surface areas, not previously considered under FUSRAP, were identified as having residual radioactive material contamination. The areas included in the Phase II remedial actions are in Buildings 1, 2, 3, 4, 5, 17, 23, 24, 25, 26, 27, 28, 29, 30, 31, 33 and 34 and the Lime Pit east of Building 31. Remedial action activities were initiated in these areas in August 1990 and are currently on-going.

It is the policy of DOE to perform independent verifications of the effectiveness of remedial actions conducted within FUSRAP. The Environmental Survey and Site Assessment Program of Oak Ridge Associated Universities (ORAU) was designated by DOE as the organization responsible for this task at the Albany Research Center. Verification of the Phase I remedial actions was conducted between August 1987 and April 1989 and is the subject of a separate report<sup>1</sup>. Verification work performed during September, October, November and December 1990 is discussed in two previous unpublished interim reports<sup>2,3</sup>. During the months of January and February 1991, an ORAU representative performed verification activities in Buildings 3, 4, 5, 17, 23, 26, 28 and 30. These activities, which are the subject of this report, included reviews of pertinent documents and independent radiological measurements and sampling of remediated areas. This interim report is presented for information purposes only.

## SITE DESCRIPTION

The ARC facility is located approximately 110 kilometers (70 miles) south of Portland, Oregon (Figure 1) on a 17-ha (42-acre) site of the former Albany College in Albany, Oregon. The site is bounded on the north by Queen Avenue, on the east by Liberty Street, on the south by a tennis club facility, and on the west by Broadway Street (Figure 2). The site consists of three main areas: ARC proper, the main research facility; the former Biomass Research Facility which consists of approximately 0.8-ha (2-acre), located south of the main facility; and a 5.7-ha (14-acre) undeveloped area, known as the "Back Forty", occupying the south end of the facility. There are 34 buildings and several smaller structures located at the ARC. Most of the buildings are currently being utilized. Several of these buildings are interconnected through adjoining hallways and rooms.

## PROCEDURES

### Objectives

The objectives of the verification were to confirm that the surveys, sampling, analyses, and associated project documentation performed by the project management contractor, provide an accurate and complete description of the radiological condition of the property. Based on the verification findings, the determination was made as to whether additional remediation was necessary or that remedial actions were effective in meeting established release criteria.

### Document Review

The characterization report developed by BNI was reviewed for general thoroughness and accuracy and to determine the current radiological status of the site.

## Survey Procedures

1. Verification activities were conducted in parallel with or immediately following remedial actions and post-remedial action monitoring, to minimize delays or interruptions in remedial action and restoration efforts. An ORAU representative conducted visual inspections, and independent measurements and sampling. Survey activities were conducted in accordance with current procedures in the ORAU ESSAP Survey Procedures Manual and the site specific survey plan. Verification activities during January and February were in the following locations: Building 3 - Rooms 102 and 103; Building 4 - Rooms 103, 105 and 106, and Exterior South Wall; Building 5 Plumbing Shop and Machine Shop; Building 17 - First Floor Men's Room and Second Floor Storage Area; Building 23 - Lab 1, Thorium Room and Crusher Room; Building 26 - Room 103; Building 28 - Basement; Building 30 - Fabrication Room.
2. Independent measurements and sampling were typically performed in 25 to 50% of the total area remediated. The actual fraction of the remediated area selected for independent survey was area specific and was based on such factors as the historical use of radiological materials at the site, decontamination procedures, and post-remedial action monitoring data. Based on findings as the work progressed, the scope of the survey was altered as necessary.
3. Verification measurements and sampling locations were referenced to the existing BNI grid system where possible. When necessary, a reference grid was established by ORAU. The size of the gridblocks varied according to the size of the area remediated or the size of the room. Typically, the grid

consisted of either 1 m<sup>2</sup> or 4 m<sup>2</sup> gridblocks. Gridblocks were established on floors and lower walls (up to 2 m) in areas designated for remediation. The upper walls, ceilings, and remediated areas less than 10 m<sup>2</sup> were not gridded. Measurements made on these surfaces were referenced to prominent building features.

4. Surfaces of selected remediated areas were scanned in order to identify any residual contamination. Indoor building surfaces were scanned for elevated gamma radiation levels and for alpha and/or beta-gamma contamination, as appropriate. In some cases, dependent upon the history of radiological material usage, areas were scanned up to 100%. Areas of elevated activity, identified by the scans, were brought to the attention of BNI for further investigation and when necessary, remediation.
5. Five-point and single-point alpha and/or beta-gamma activity measurements were performed in two buildings. Particular attention was given to cracks, beams, piping, ledges, ducts, drains, and other surfaces where material might settle or accumulate. In gridded areas, five-point direct measurements for total alpha and beta-gamma activity were systematically performed at the center and at four points, midway between the center and the grid block corners. For remediated areas smaller than 10 m<sup>2</sup> and upper walls and ceilings, single-point measurements for total activity were performed. Smears for removable alpha and beta activity were collected at the highest direct measurement location in each grid block and at suspect single-point measurement locations. Refer to Figures 3 through 57 for measurement locations. Some locations were scanned then verified by review of contractor post-remedial action survey measurements.

6. Soil samples were collected from locations where remedial actions resulted in the exposure of underlying soils.

As the ORAU representative completed each verification survey, a preliminary verification survey form was provided to BNI and ARC representatives. The form provided a permanent on-site record of the current radiological status of each remediated area as determined from the verification survey. Surface activity survey results were compared to the U. S. Department of Energy Guidelines for Residual Radioactive Material at Formerly Utilized Sites, Remedial Action Program and Surplus Facilities Management Program Sites (Revision 2, March 1987).

#### **DATA INTERPRETATION AND SAMPLE ANALYSIS**

Samples and direct measurement data were returned monthly to the Oak Ridge, TN laboratory for analysis and interpretation. Data developed by the independent verification surveys was compared with the established remedial action guidelines to assure that remediation had been effective in meeting these guidelines.

#### **FINDINGS AND RESULTS**

##### **Surface Scans**

Surface scans identified areas of elevated beta-gamma activity in the following locations: Building 4, Room 105, east and west pits (Figure 8); Building 5, roof eaves (Figures 16 and 17); Building 17, Men's Room valve pit and the north truss of the Second Floor Storage Room (Figures 19 and 22); Building 23, Lab 1, Trenches 1, 2, 17

and 18, north floor and upper north wall, and the Conical Mill #38562 located in the Crusher Room (Figures 25-27, 31, 32, 34, and 39); Building 30, Fabrication Room, the east floor, and parts of a disassembled shear #33988 (Figures 45 and 56).

#### Measurement of Surface Activity

Surface activity measurements collected from Buildings 3, 4, 5, 17, 23, 26, 28 and 30 are summarized in Table 1. The highest grid block averages for total activity were 98 dpm/100 cm<sup>2</sup> for alpha and 1300 dpm/100 cm<sup>2</sup> for beta-gamma. Total activity measurements ranged from <62 to 1800 dpm/100 cm<sup>2</sup> for alpha and <410 to 24,000 dpm/100 cm<sup>2</sup> for beta-gamma.

Removable activity ranged from <6 to 15 dpm/100 cm<sup>2</sup> for alpha and <13 to 19 dpm/100 cm<sup>2</sup> for beta.

#### Radionuclide Concentrations in Soil

Concentrations of Th-232 in soil samples collected from remediated areas in Buildings 4, 5, 17 and 26 are presented in Table 2. Concentration ranged from 0.7 to 1.6 pCi/g.

### COMPARISON OF SURVEY RESULTS WITH GUIDELINES

Listed below are the DOE surface contamination guidelines for residual radioactive material at a "Formerly Utilized Sites Remedial Action Program" (FUSRAP) site. The

primary contaminant on building and equipment surfaces at ARC is thorium-232. The applicable guidelines are:

- 1000 dpm/100 cm<sup>2</sup>, averaged over 1 m<sup>2</sup> area
- 3000 dpm/100 cm<sup>2</sup>, maximum in a 100 cm<sup>2</sup> area
- 200 dpm/100 cm<sup>2</sup>, removable

The guideline for thorium in soil is as follows:

- 5 pCi/g      averaged over the first 15 cm of soil  
below the surface
- 15 pCi/g      averaged over 15 cm thick layers of soils  
more than 15 cm below the surface

Several areas surveyed; where gridblock measurements were not performed, have single-point direct measurement activity which exceed the 1000 dpm/100 cm<sup>2</sup> guideline, but are less than 3000 dpm/100 cm<sup>2</sup>. Further investigation of these areas determined that the average activity across contiguous 1 m<sup>2</sup> areas were within release criteria. These locations include the following: Building 4, Room 103 Drains; Building 5, Machine Shop Conduit.

Locations which either exceeded the maximum guideline or were not averageable and required additional remediation prior to release include the following: Building 5, exterior roof eaves; Building 17, second floor storage area; Building 23, Lab 1 Trench #4 and the north floor and lower wall; Building 30, Fabrication Room Portable Rolling Mill #52544.

Soil samples collected from areas which exhibited elevated contact radiation in the floors of the pits in Building 4, Room 105 and Building 17, Men's Rom Valve pit showed radionuclides were at acceptable release concentrations.

The PMC has been notified of additional locations which exceed criteria and will require additional remediation. These areas, which will be addressed in the final report, include Building 23, Lab 1 the upper north wall; Building 30, Fabrication Shop east floor area and a disassembled shear.

The PMC has initiated hazard assessments for equipment and trenches which exceed criteria. These are as follows: Building 23, Lab 1, Trenches 1, 2 and 18 and Building 30, Fabrication Room, the HPM Hydraulic Press #34469. The Conical Mill #38563, which is located in the Building 23, Crusher Room, was reported as exceeding criteria in Interim Report II. Additional remediation was attempted during this report period and proved to be unsuccessful. As a result, small areas of fixed contamination remain on the unit.

#### SUMMARY

During the months of January and February of 1991, a representative from ORAU's Environmental Survey and Site Assessment Program performed verification measurements at the Albany Research Center in Albany, Oregon. Data collected during these surveys indicate that most areas remediated by the PMC during this period are within the established guidelines. Several areas will require additional remediation prior to final verification measurements and sampling.

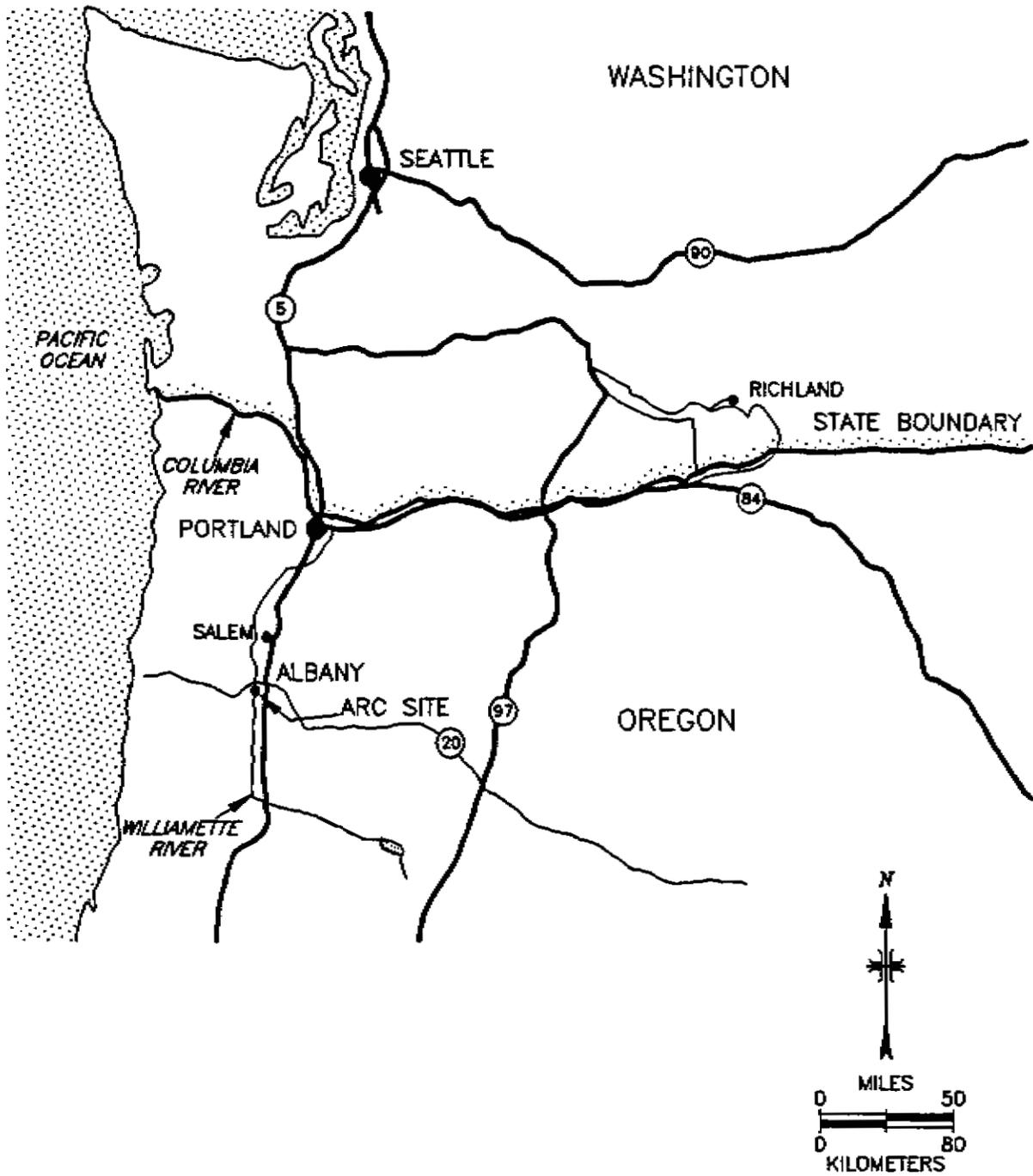


FIGURE 1: Location of the Albany Research Center

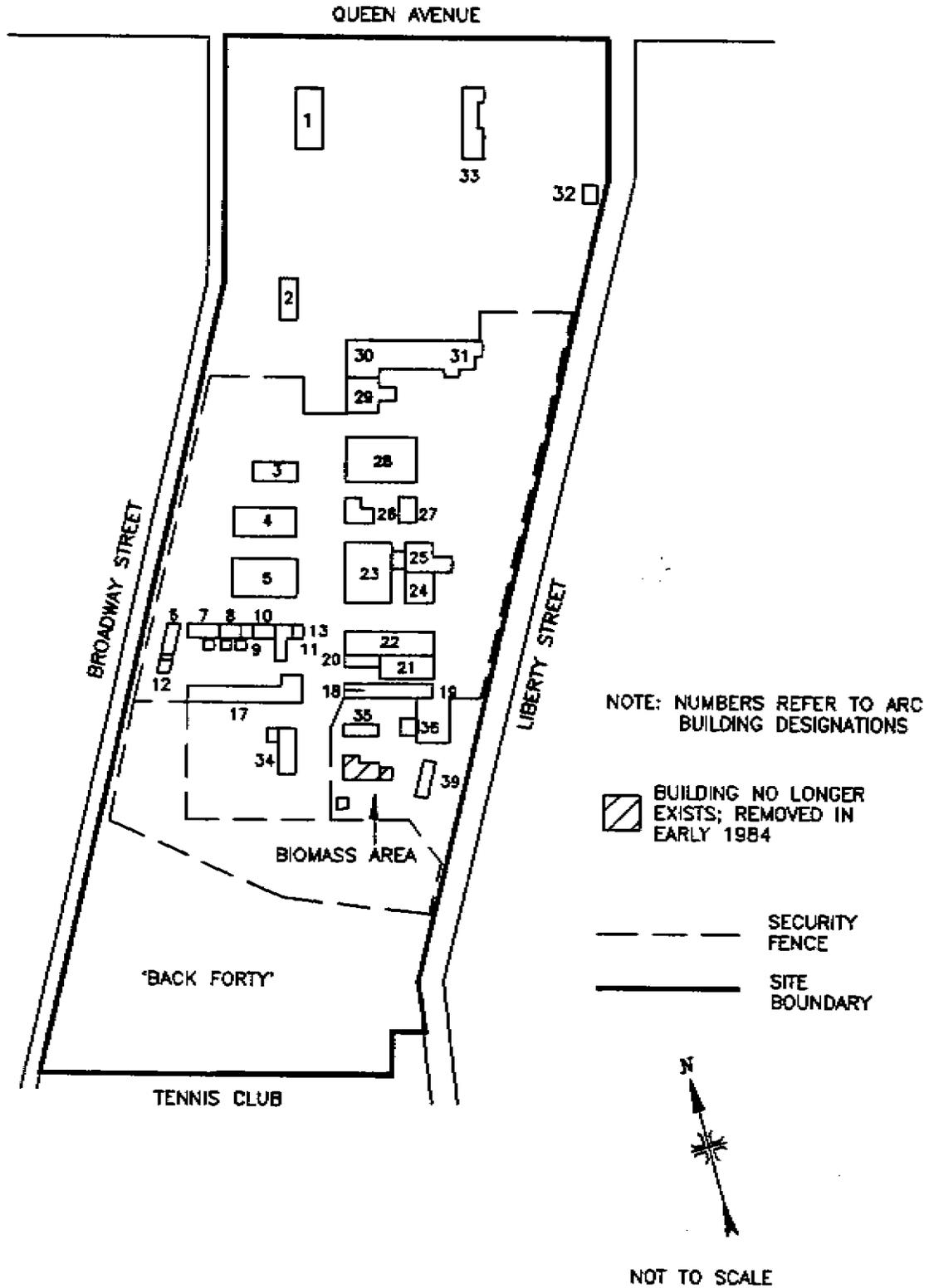


FIGURE 2: Plot Plan of the Albany Research Center

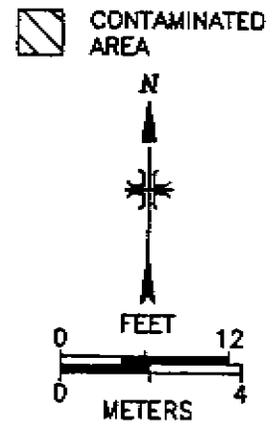
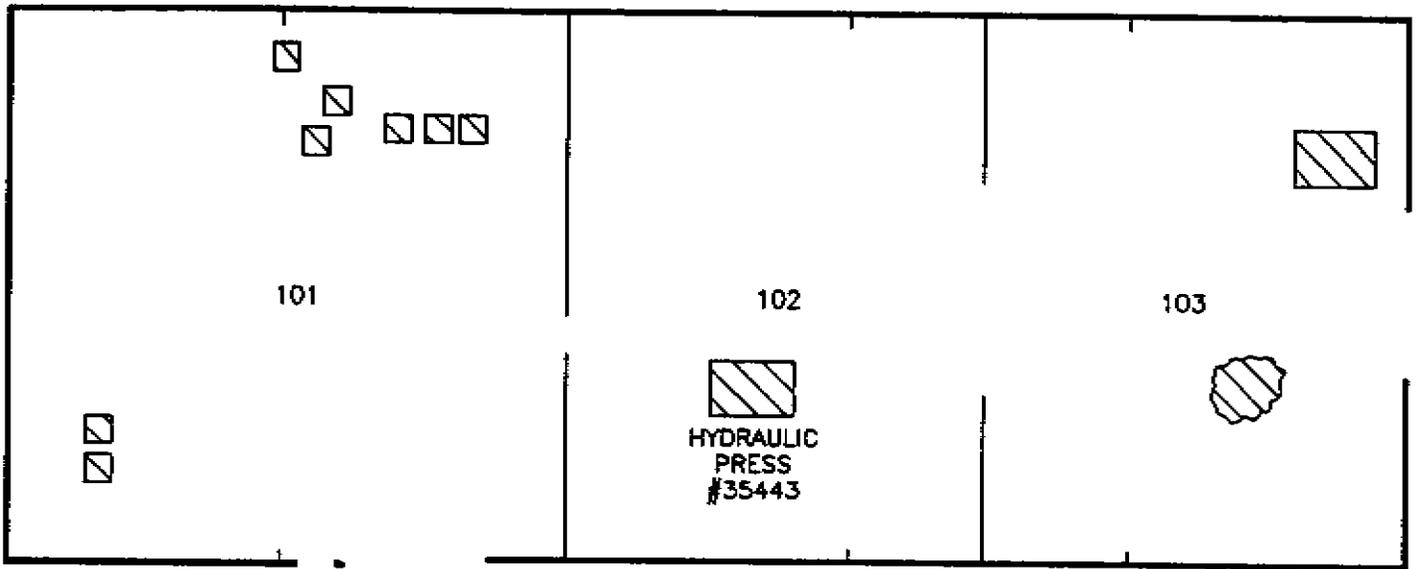


FIGURE 3: Building 3 Plot Plan

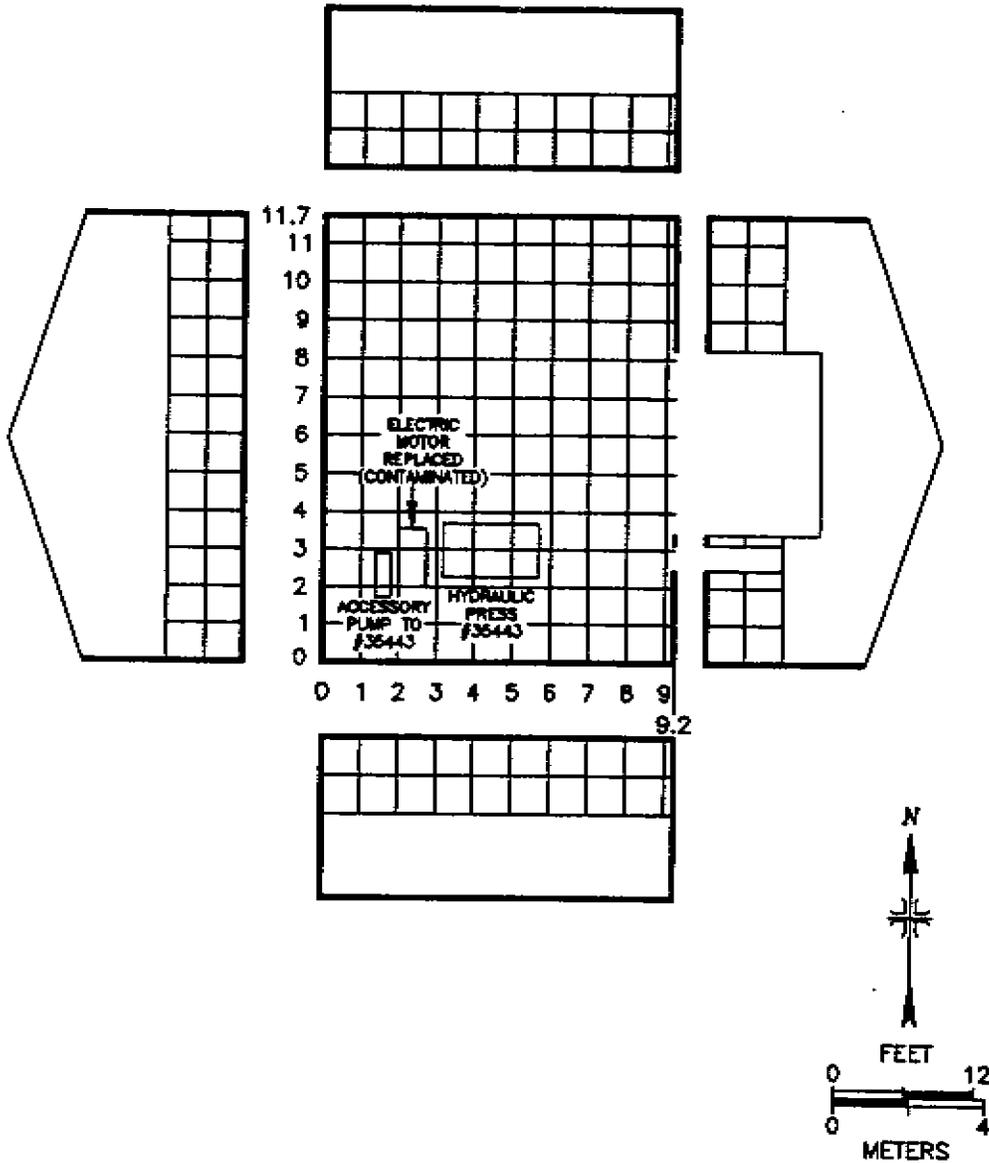


FIGURE 4: Building 3, Room 102, Indicating Location of Hydraulic Press #35443

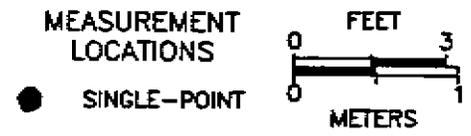
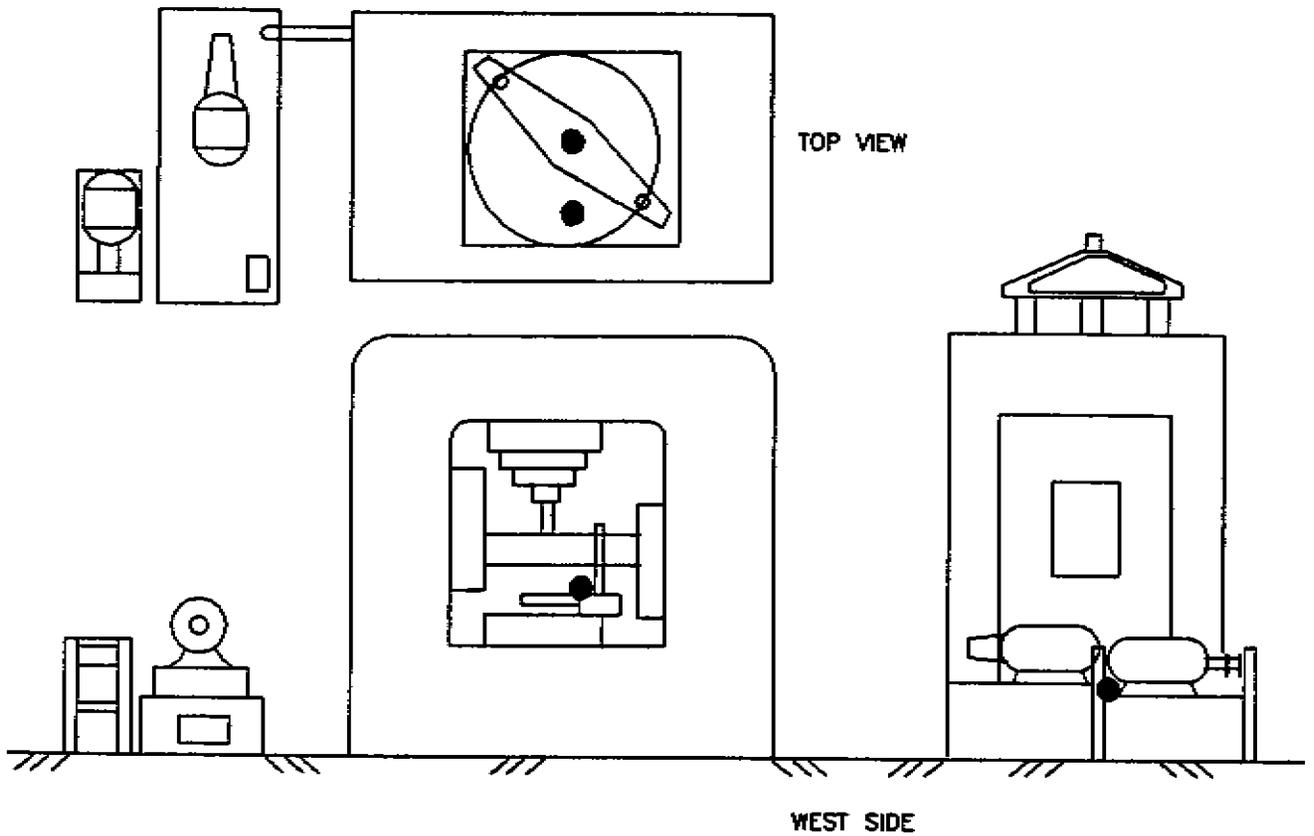
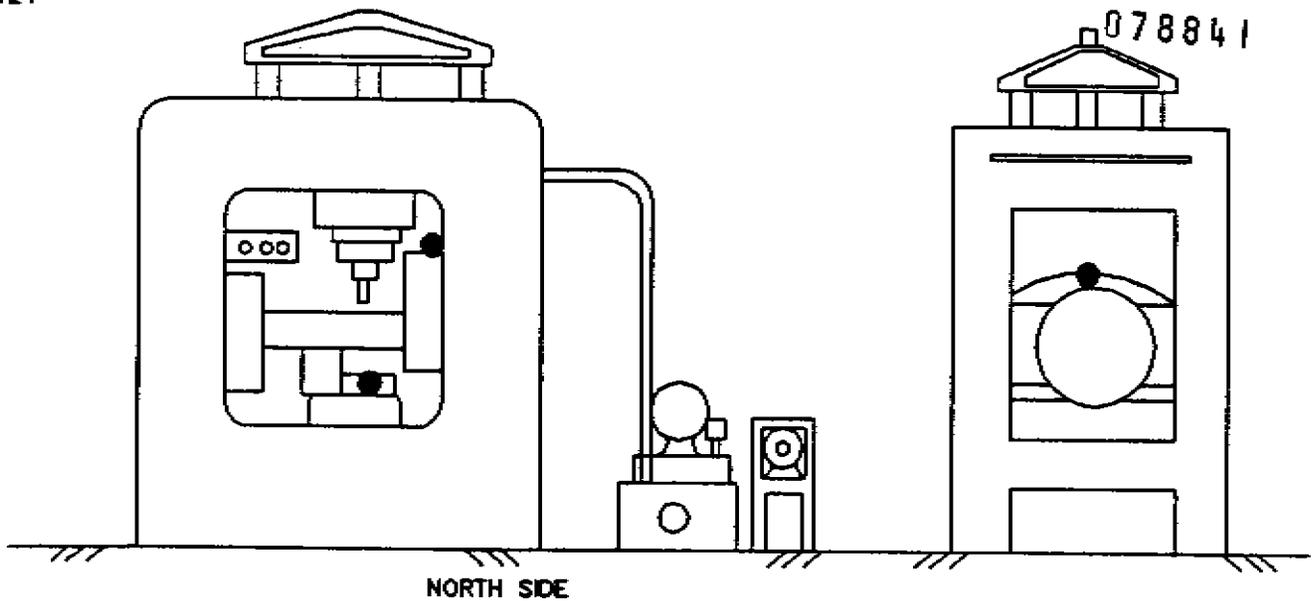


FIGURE 5: Building 3, Room 102, Hydraulic Press #35443, Indicating Measurement Locations

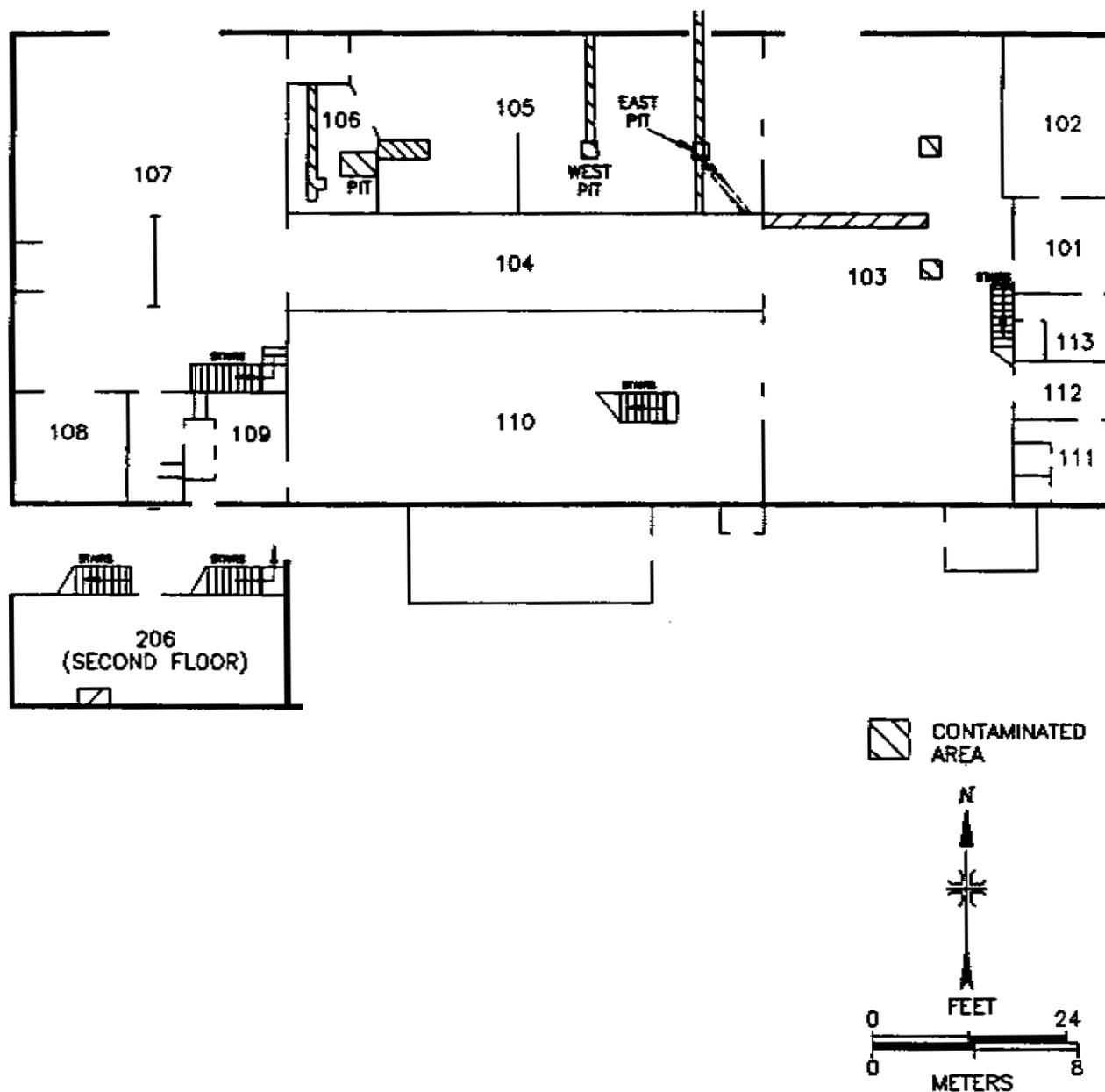


FIGURE 6: Building 4 Plot Plan, First and Second Floors

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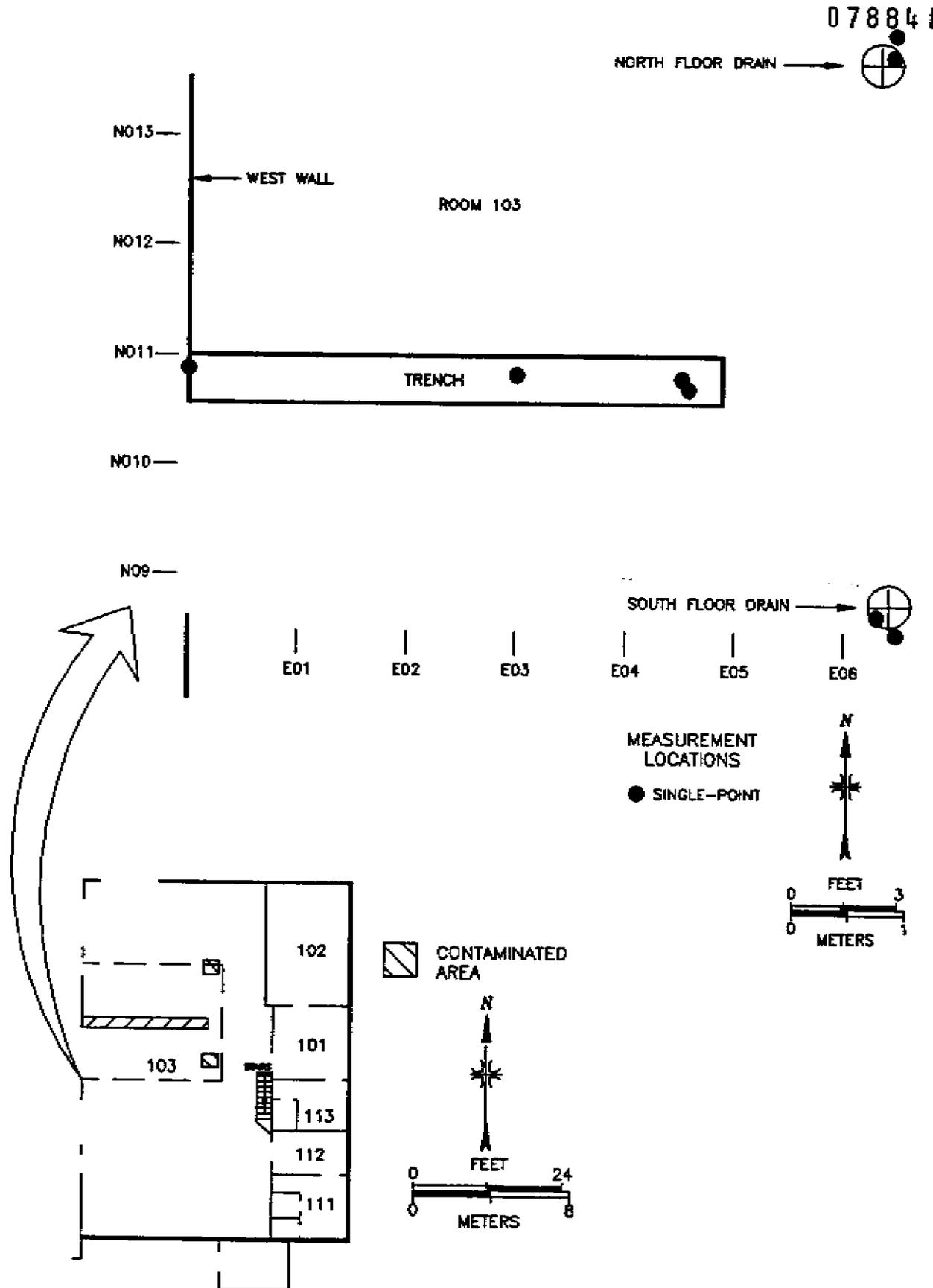


FIGURE 7: Building 4, Room 103, Indicating Measurement Locations

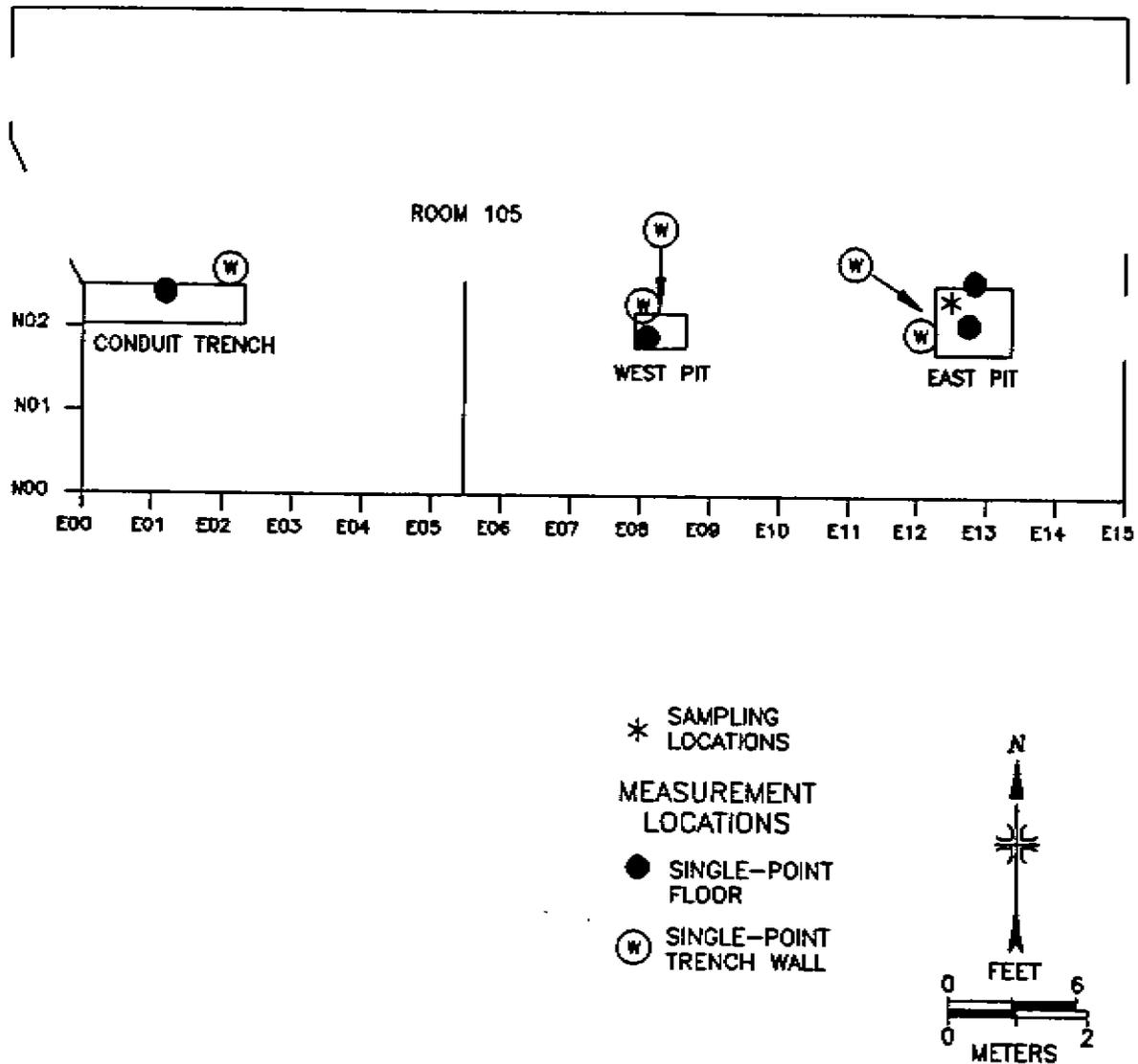


FIGURE 8: Building 4, Room 105, Indicating Measurement and Sampling Locations

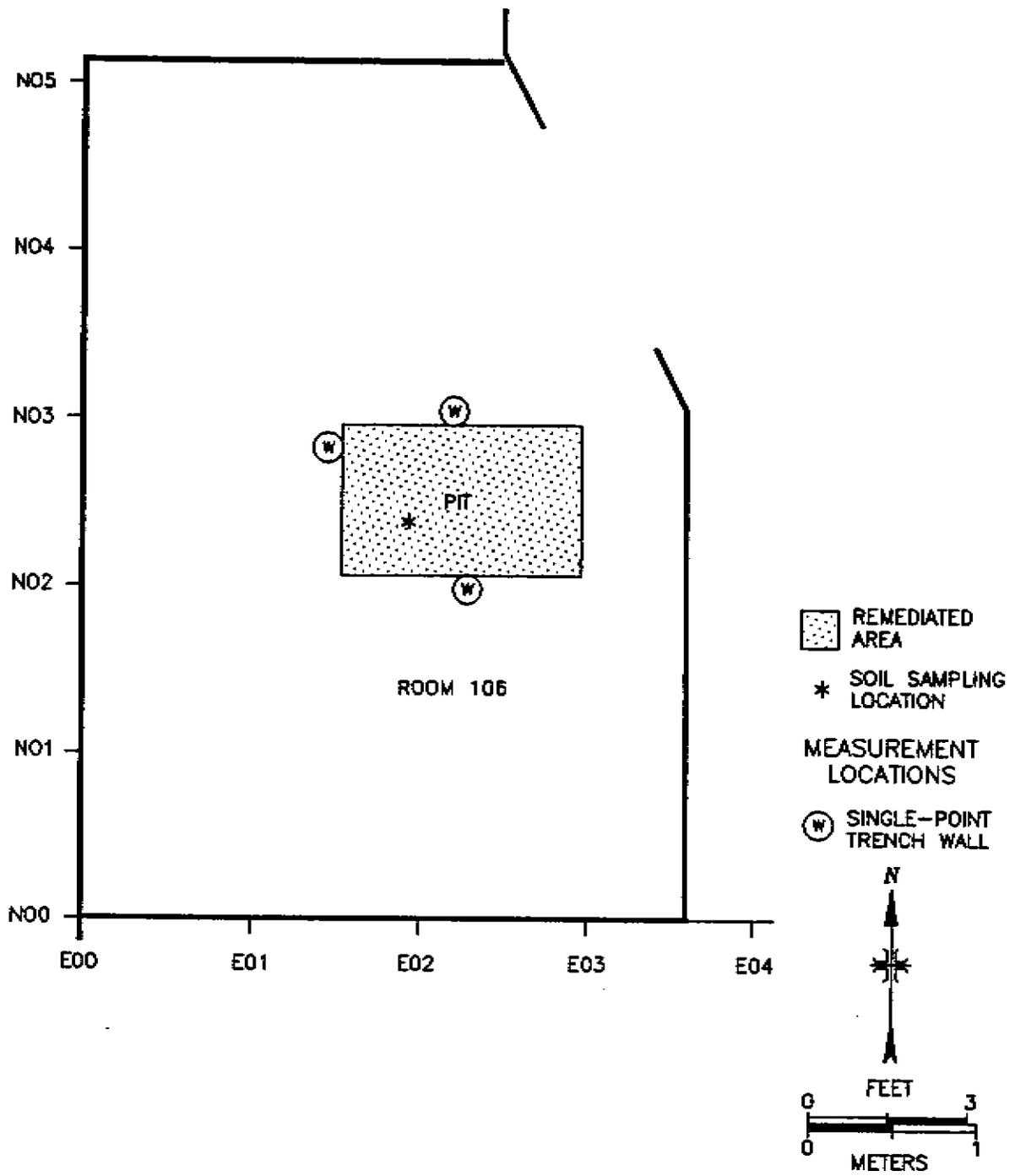


FIGURE 9: Building 4, Room 106 Pit, Indicating Measurement and Sampling Locations

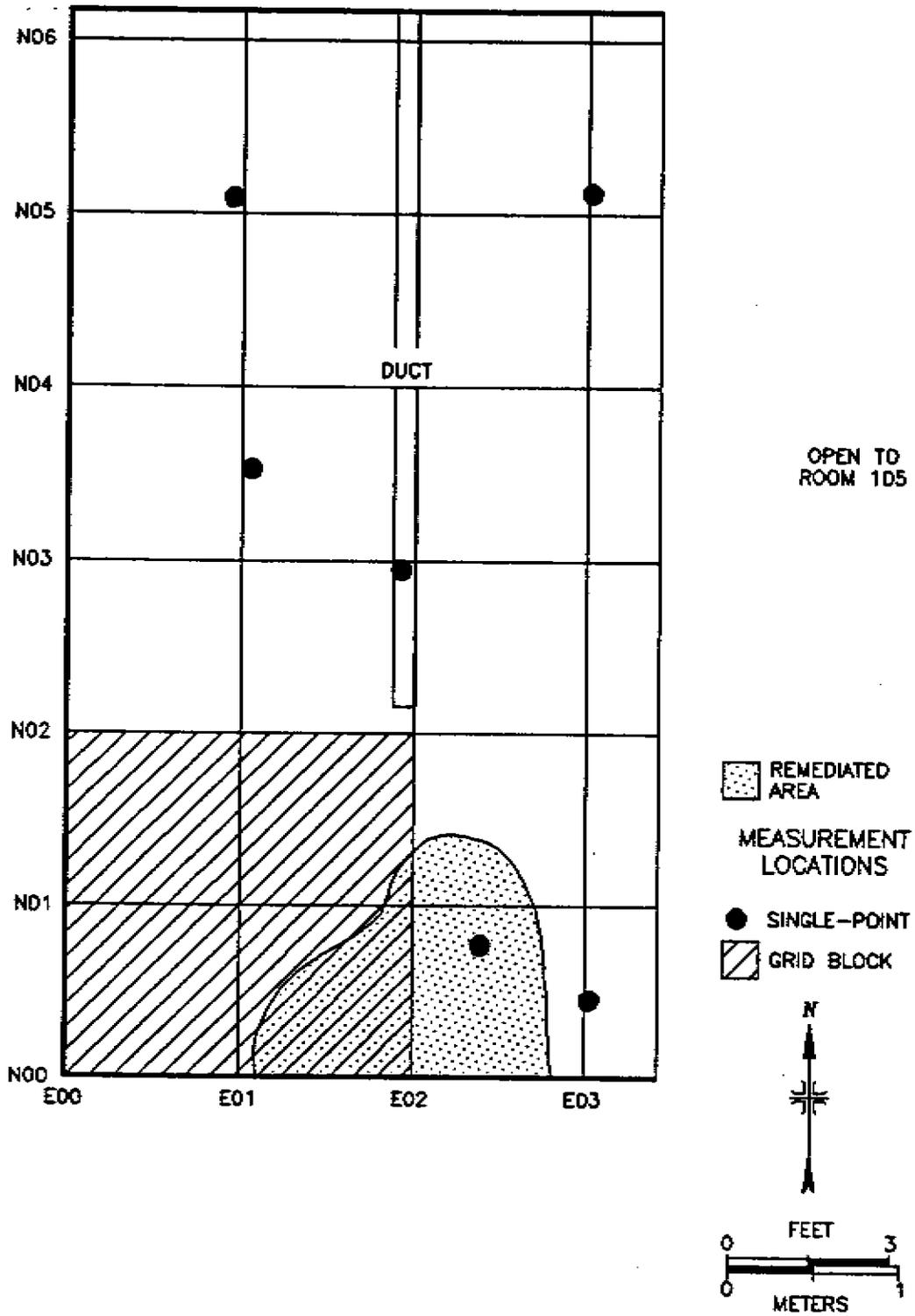


FIGURE 10: Building 4, Room 106 Mezzanine, Indicating Measurement Locations

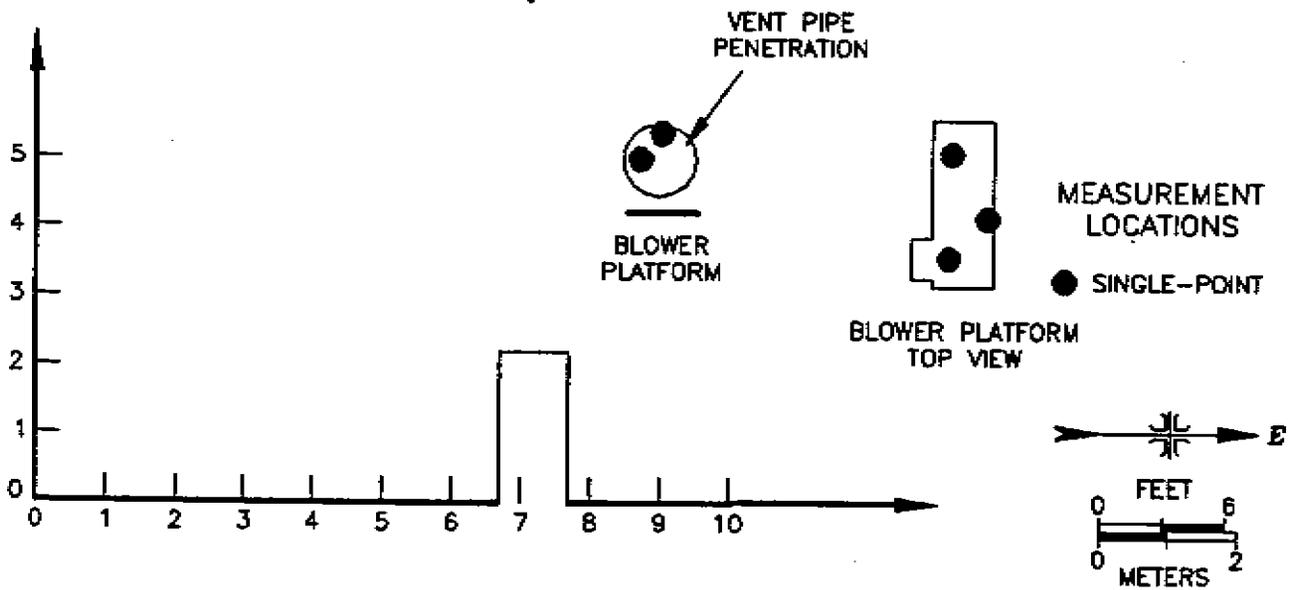
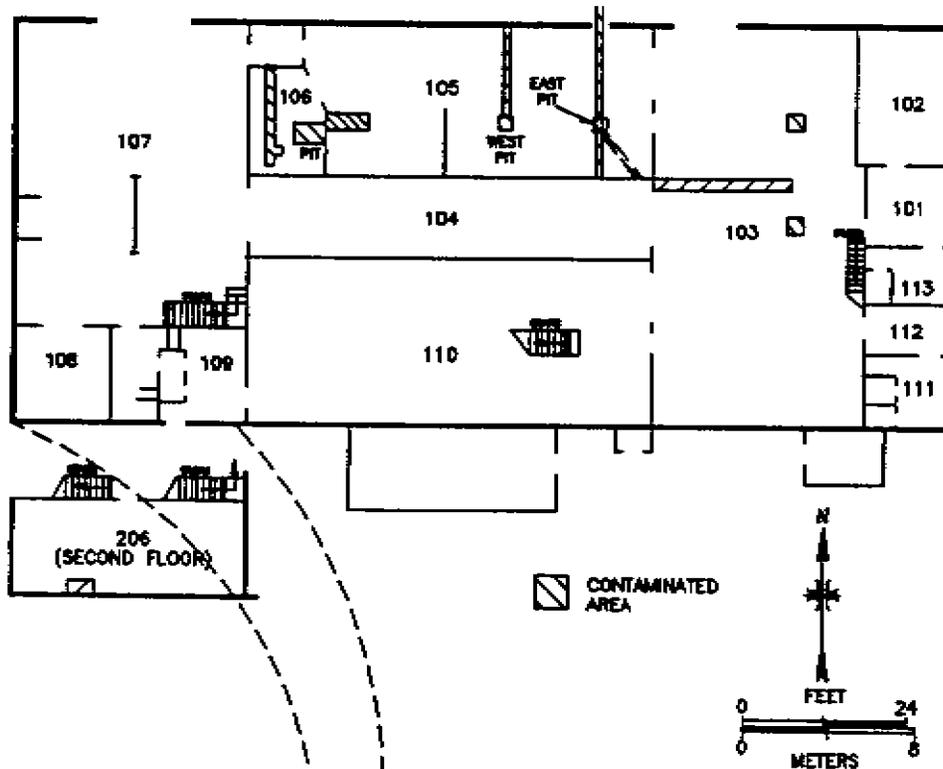
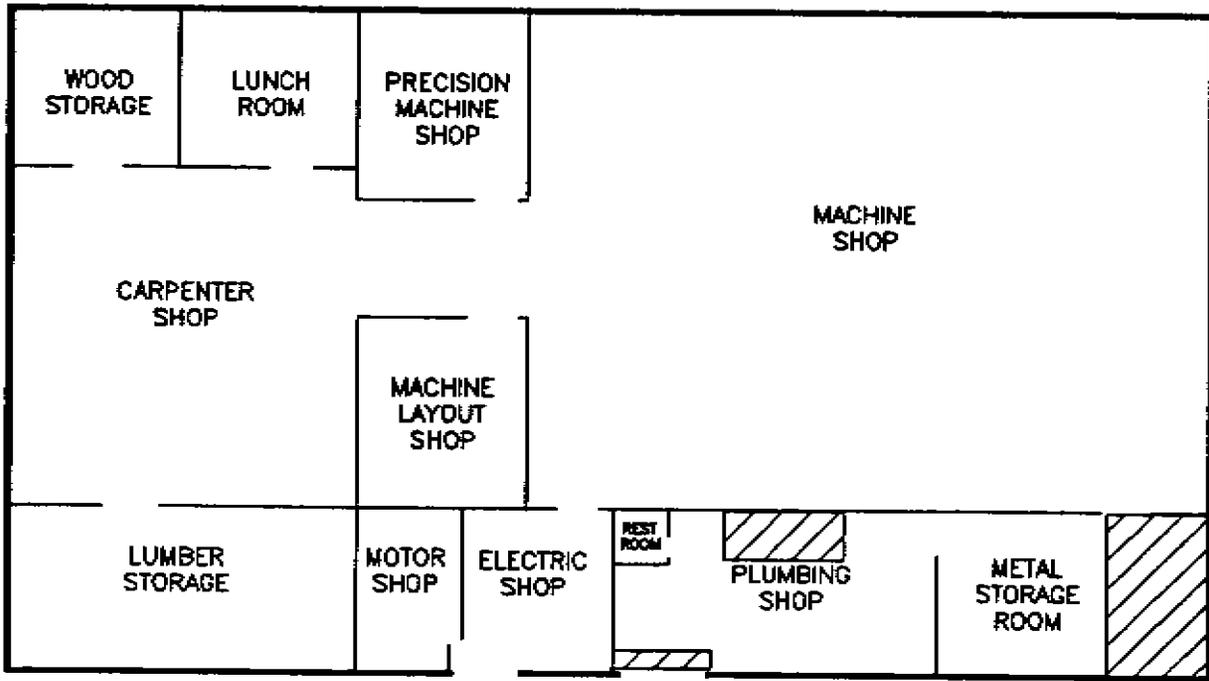


FIGURE 11: Building 4, Outside South Wall, Blower Platform, Indicating Measurement Locations



 CONTAMINATED AREA

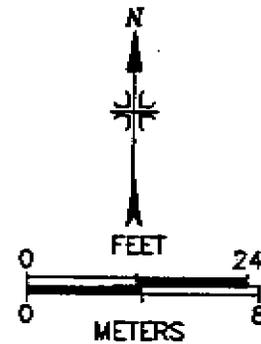


FIGURE 12: Building 5 Plot Plan

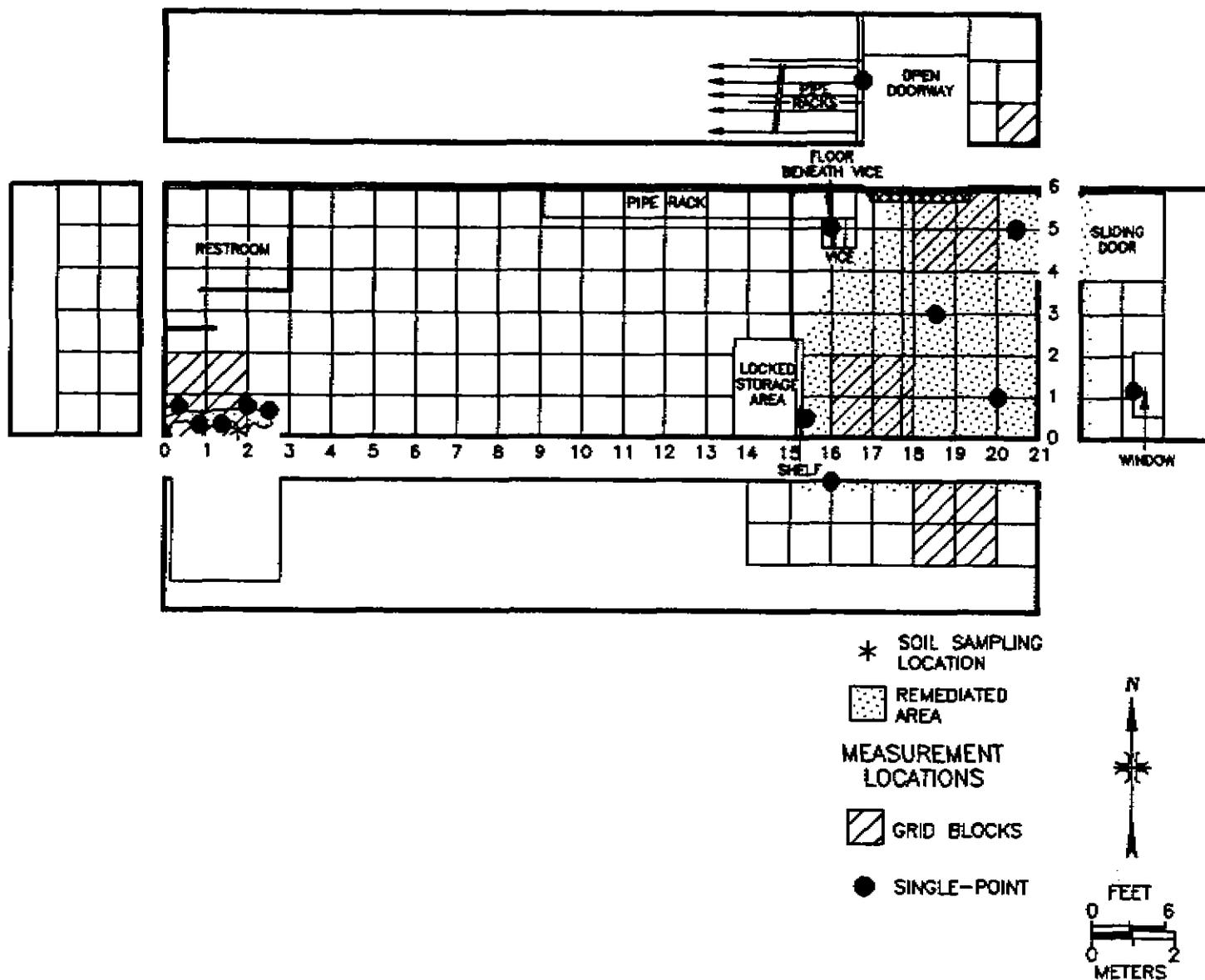


FIGURE 13: Building 5, Plumbing Shop, Indicating Measurement and Sampling Locations on Floor and Lower Walls

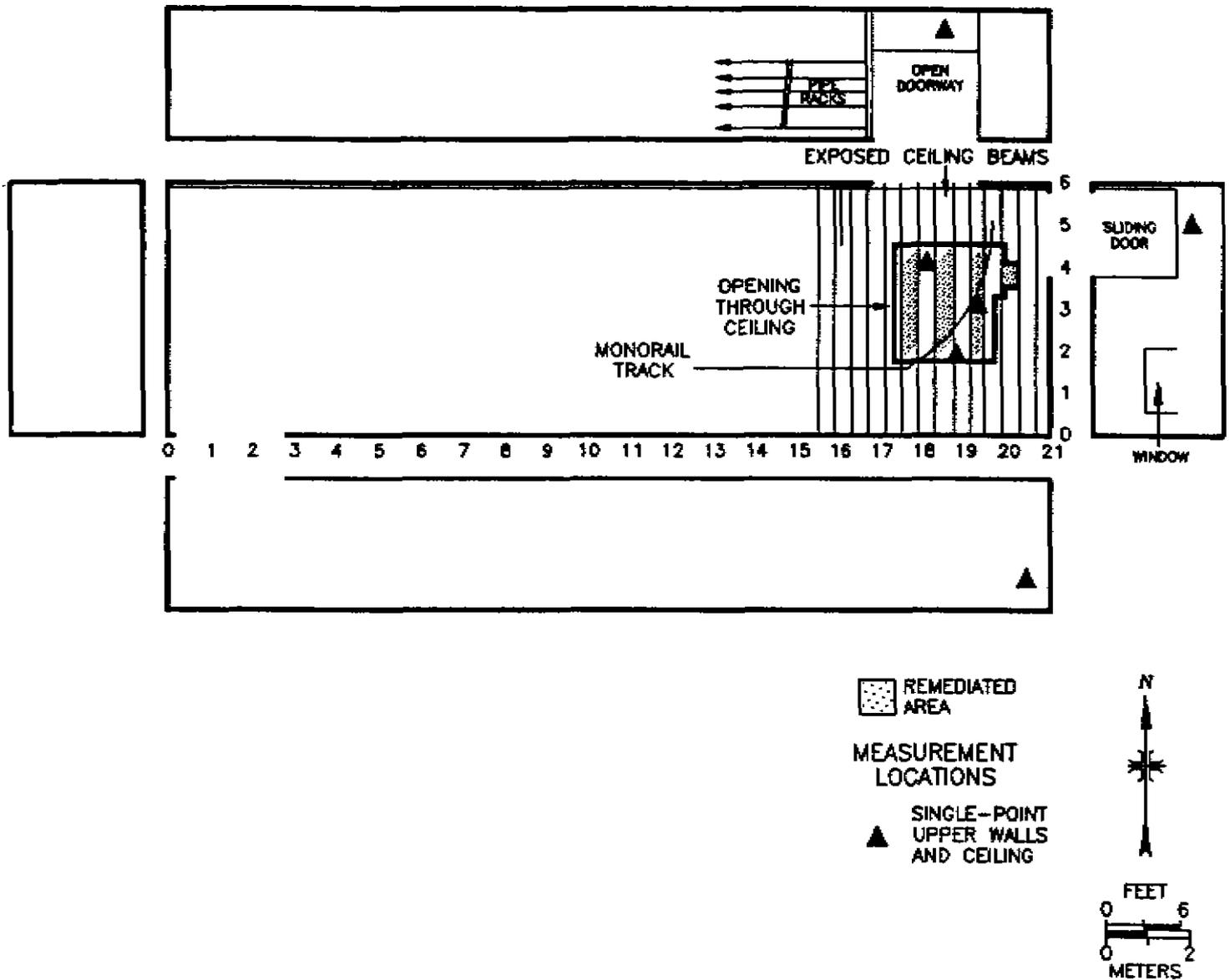


FIGURE 14: Building 5, Plumbing Shop, Indicating Measurement Locations on Ceiling and Upper Walls

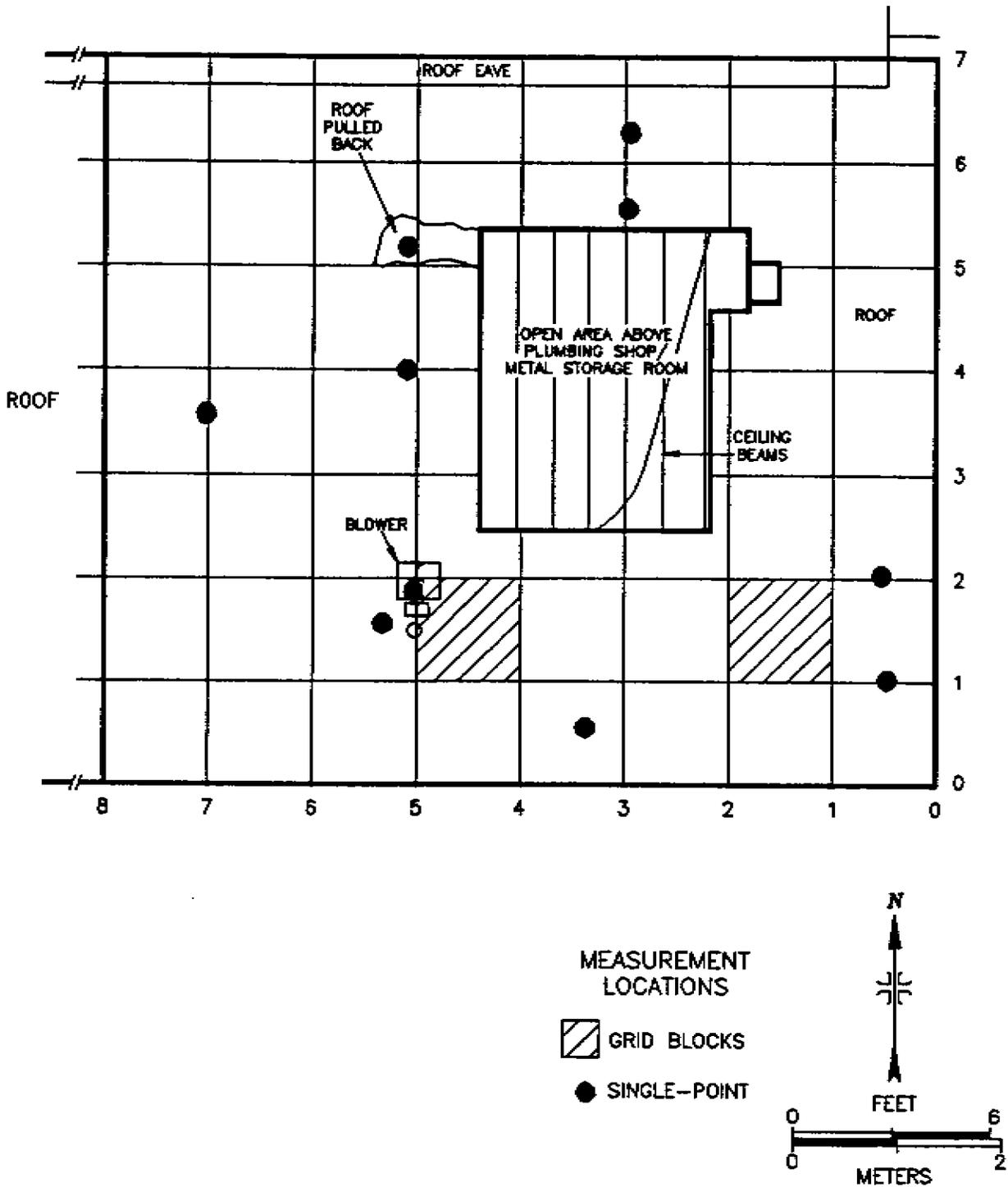


FIGURE 15: Building 5, Roof, Southeast Corner Above Plumbing Shop/Metal Storage Room, Indicating Measurement Locations

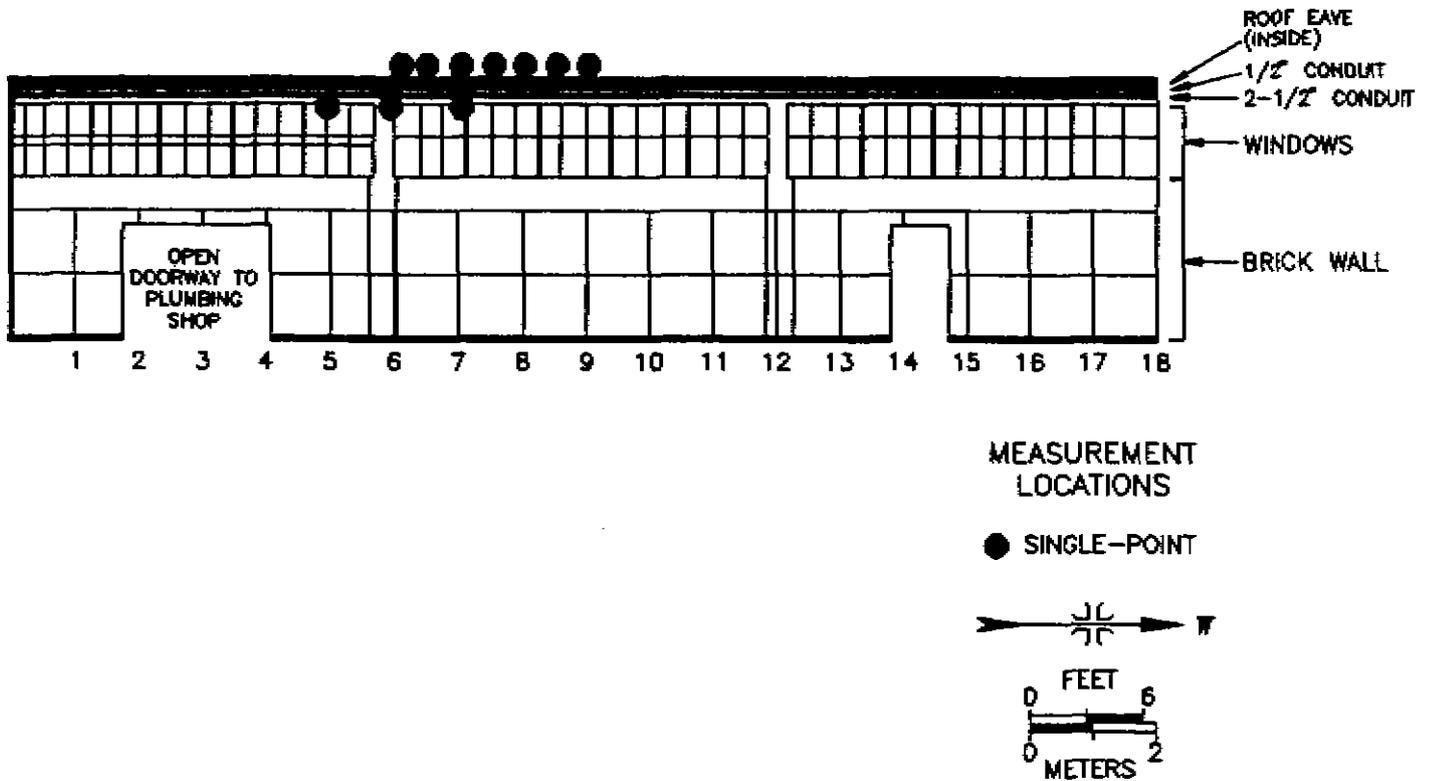


FIGURE 16: Building 5, Machine Shop, South Wall, Indicating Measurement Locations on Conduits and Roof Eave

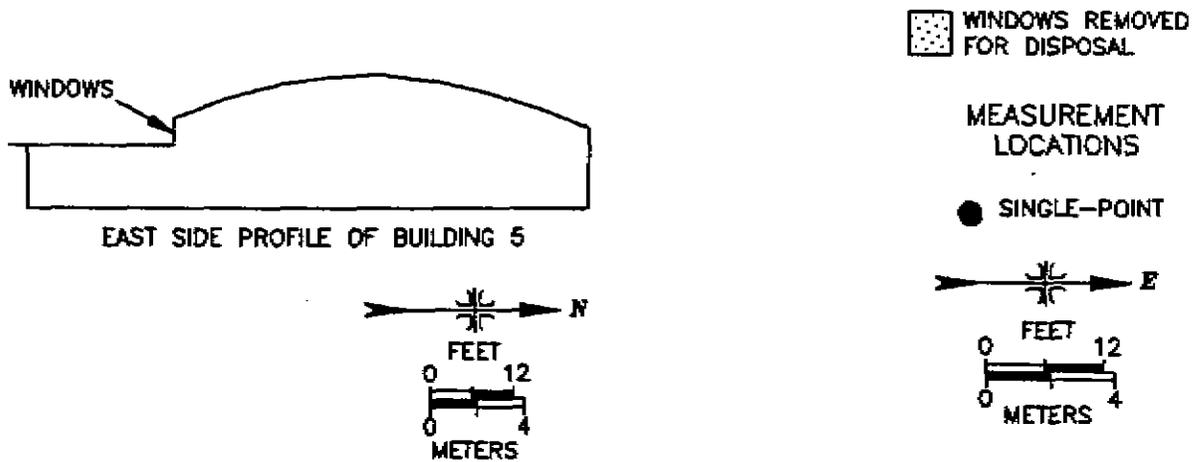
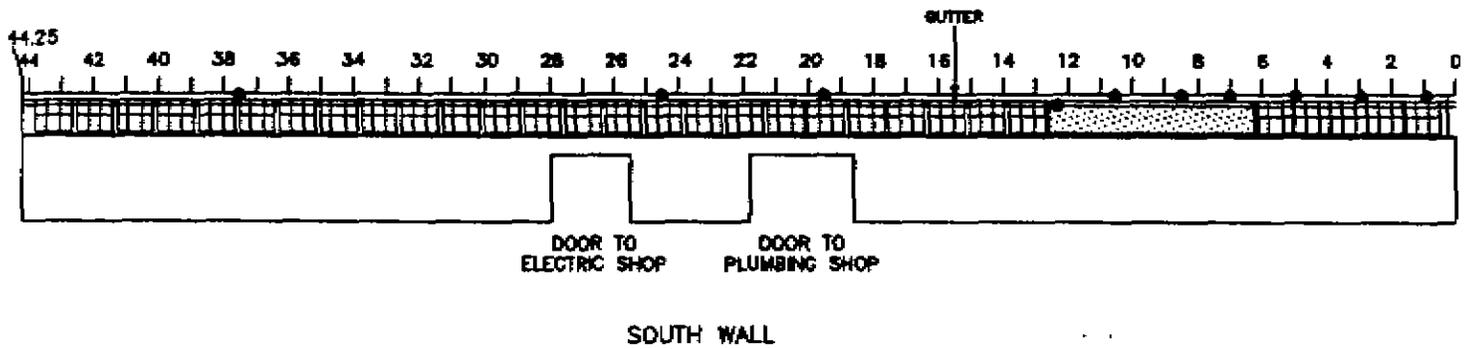


FIGURE 17: Building 5, East Side Profile with Detail of South Side Windows Indicating Measurement Locations

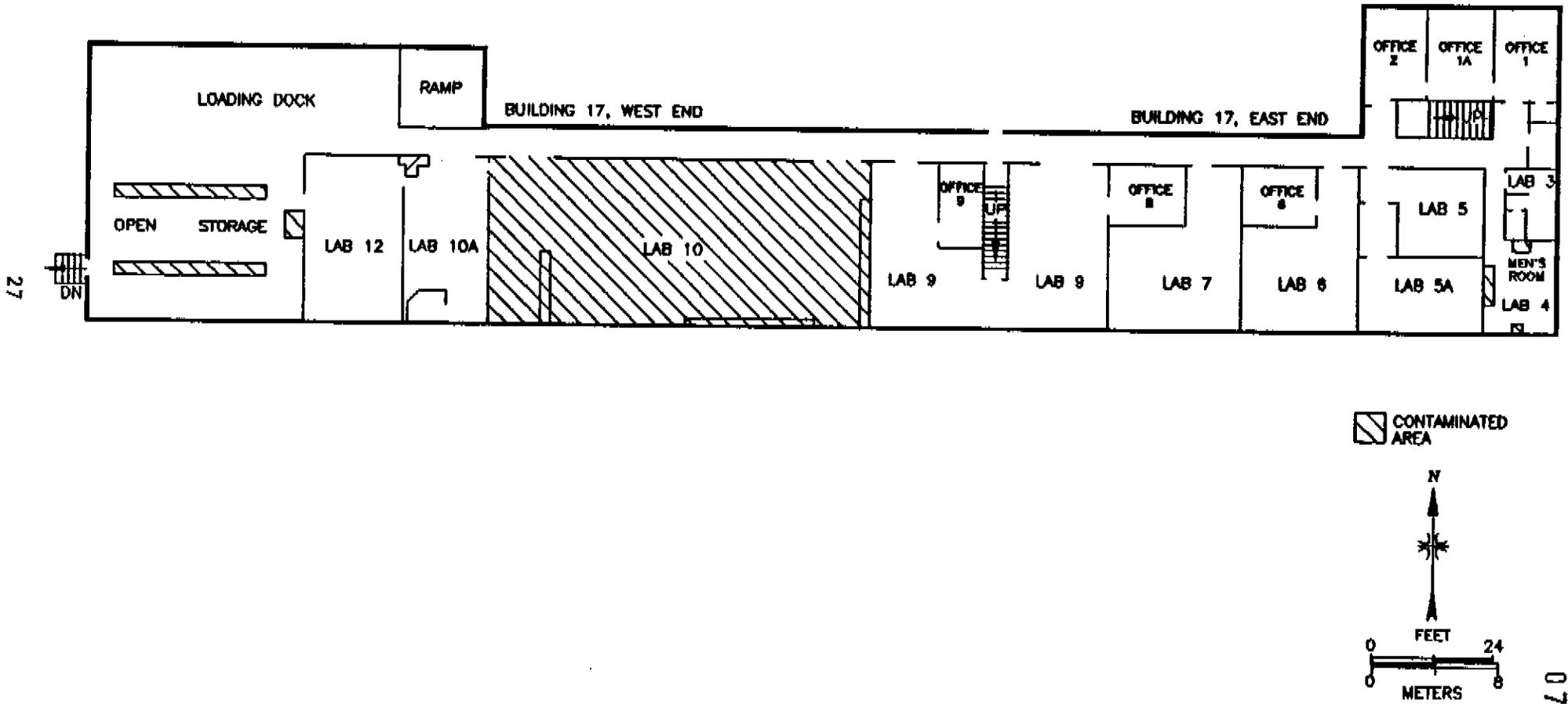


FIGURE 18: Building 17 Plot Plan

078841

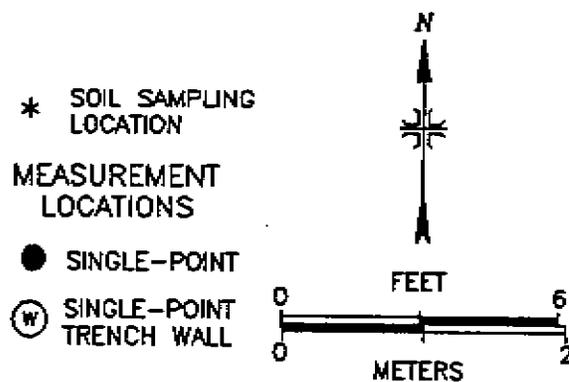
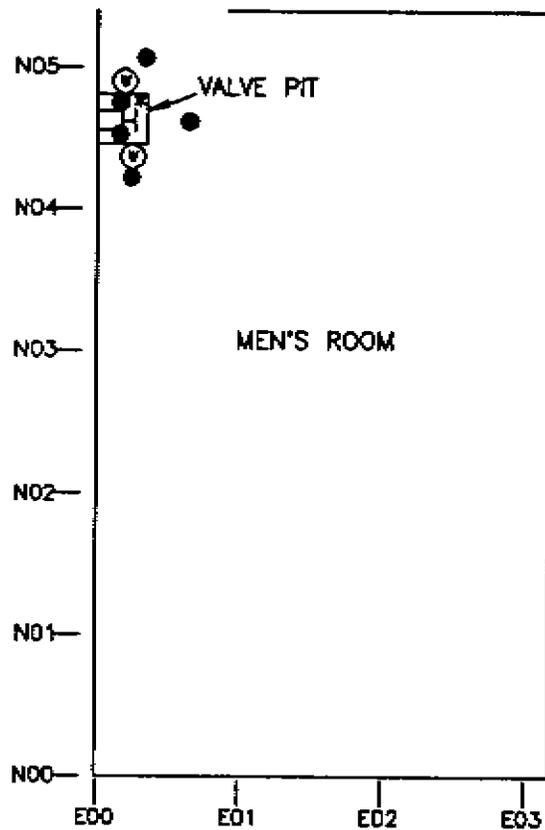


FIGURE 19: Building 17, First Floor Men's Room, Valve Pit, Indicating Measurement and Sampling Locations

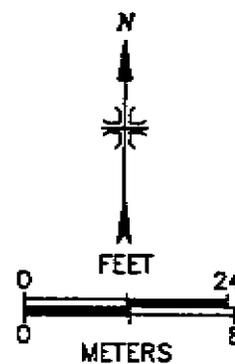
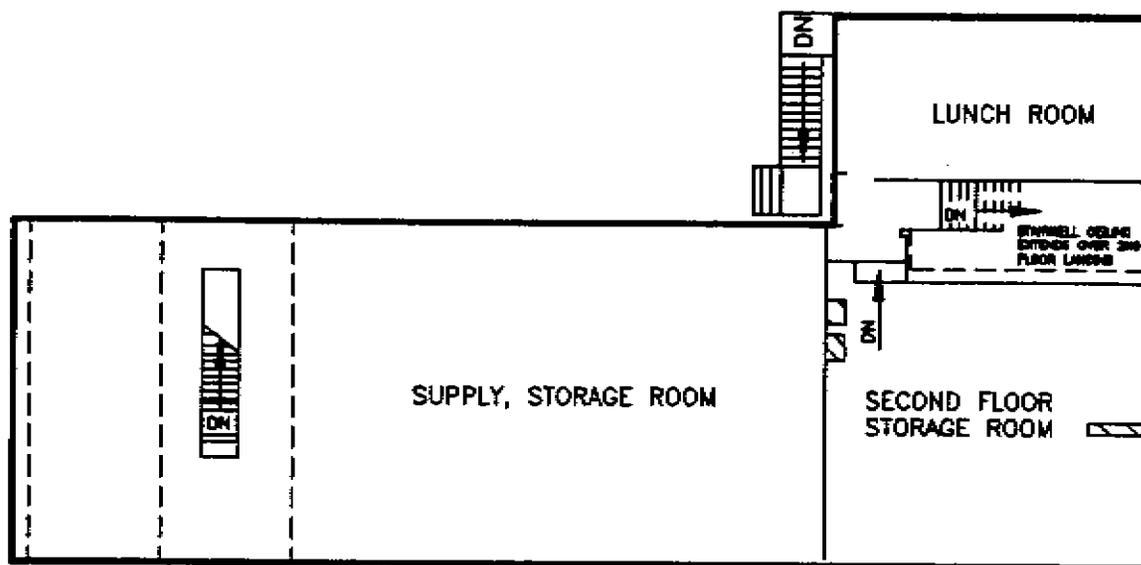


FIGURE 20: Building 17, Plot Plan of Second Floor

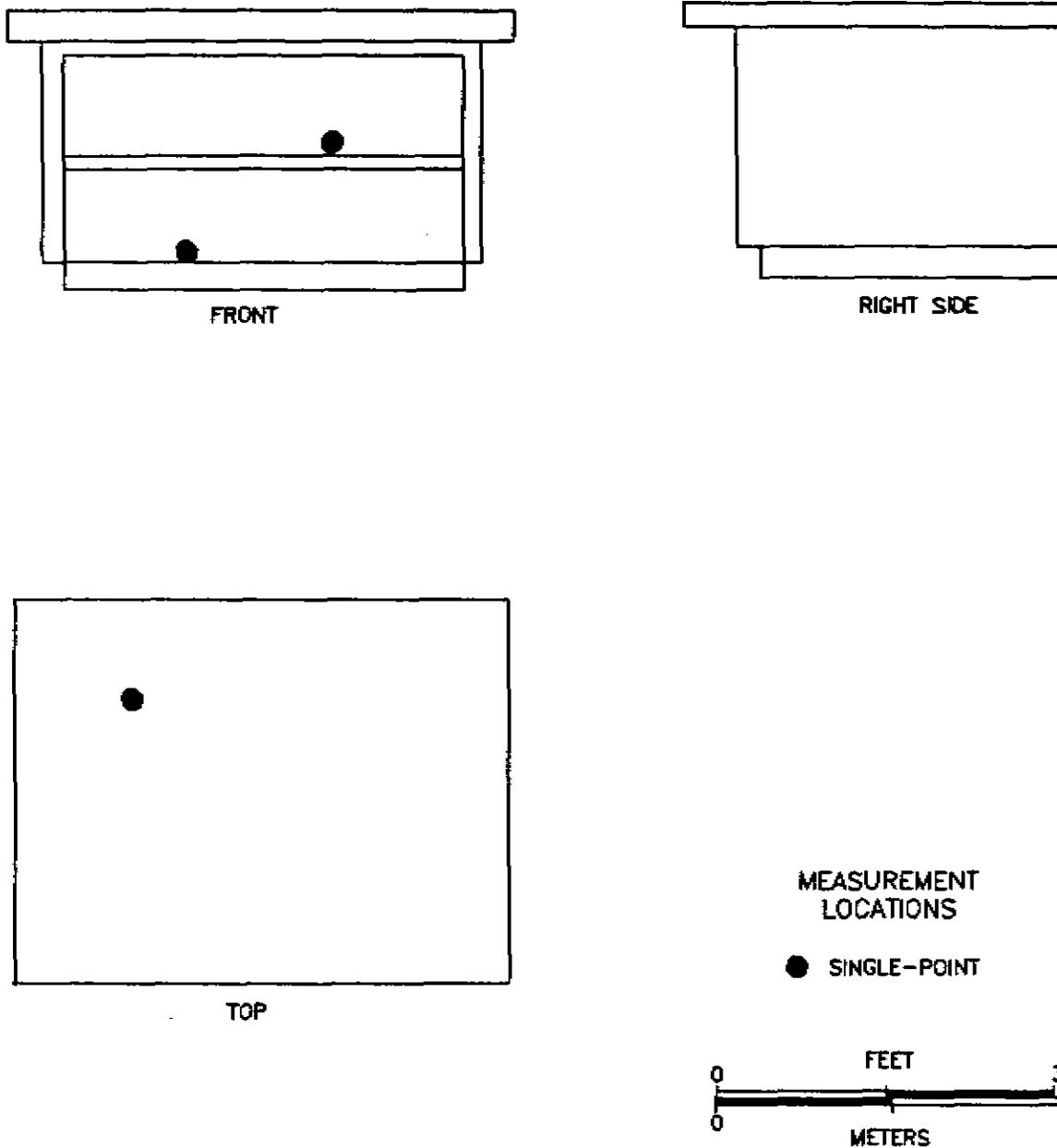


FIGURE 21: Building 17, Second Floor, East Storage Area Cabinet, Indicating Measurement Locations

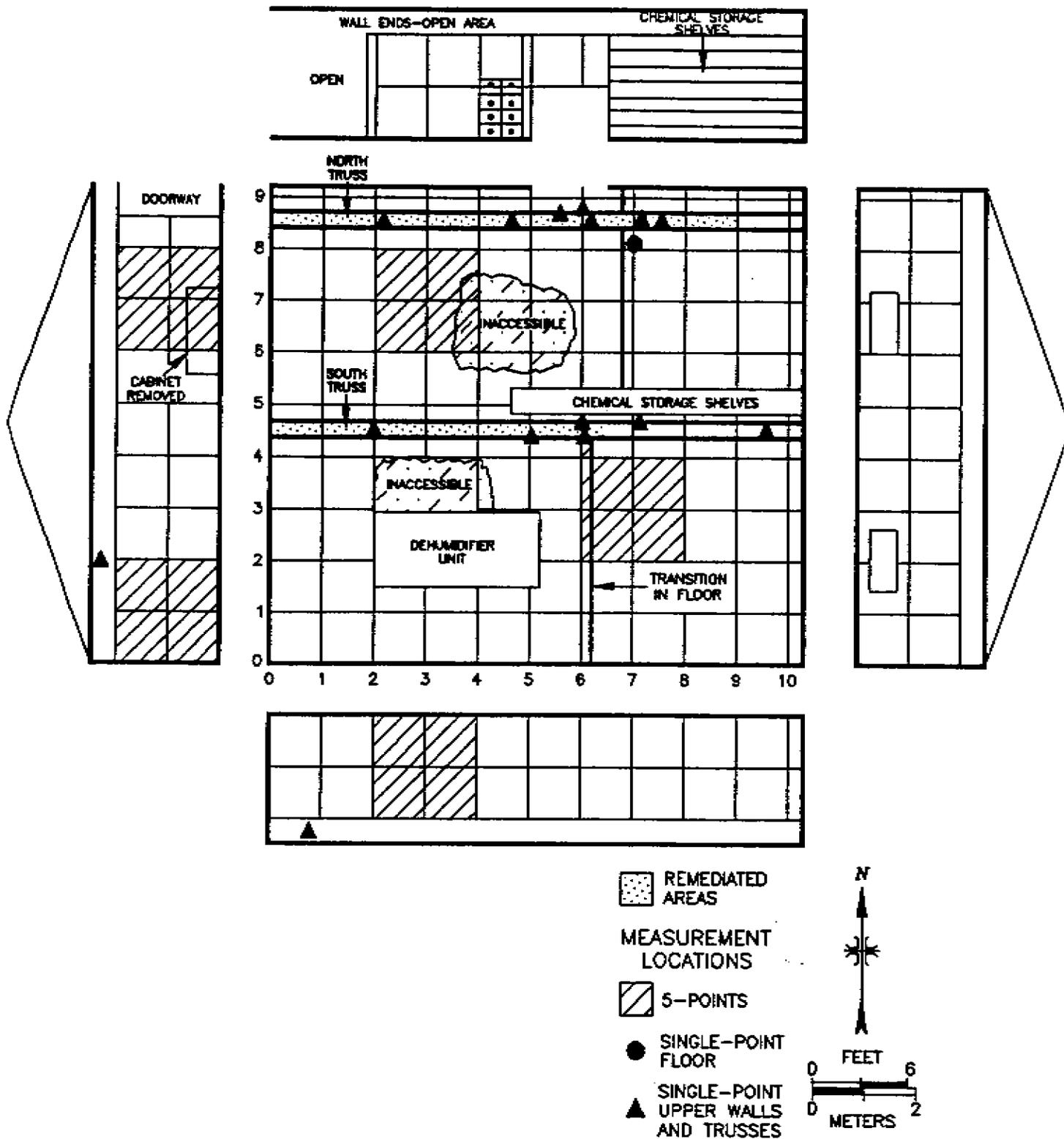


FIGURE 22: Building 17, Second Floor Storage Area, Indicating Measurement Locations

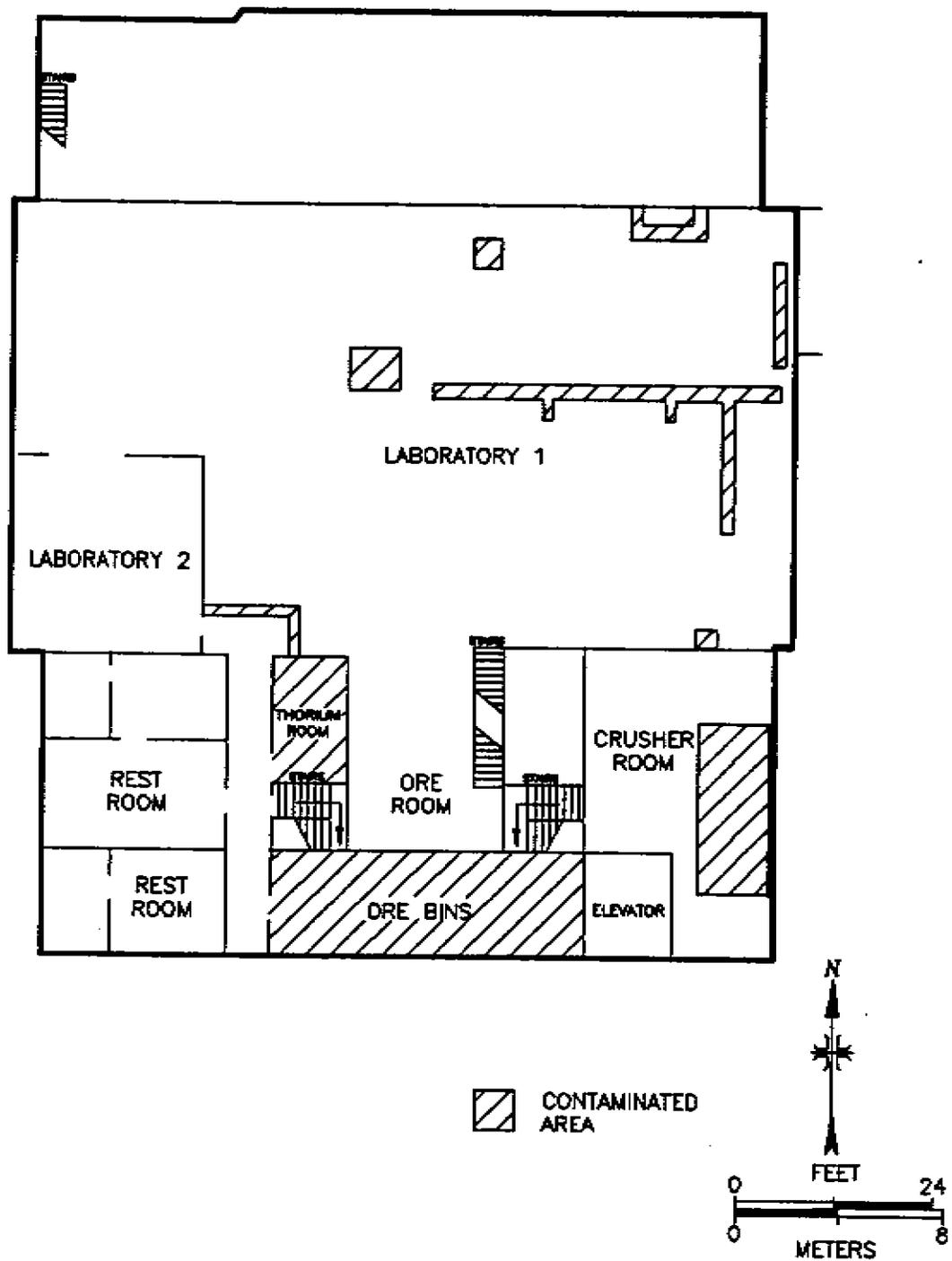


FIGURE 23: Plot Plan of Building 23, First Floor

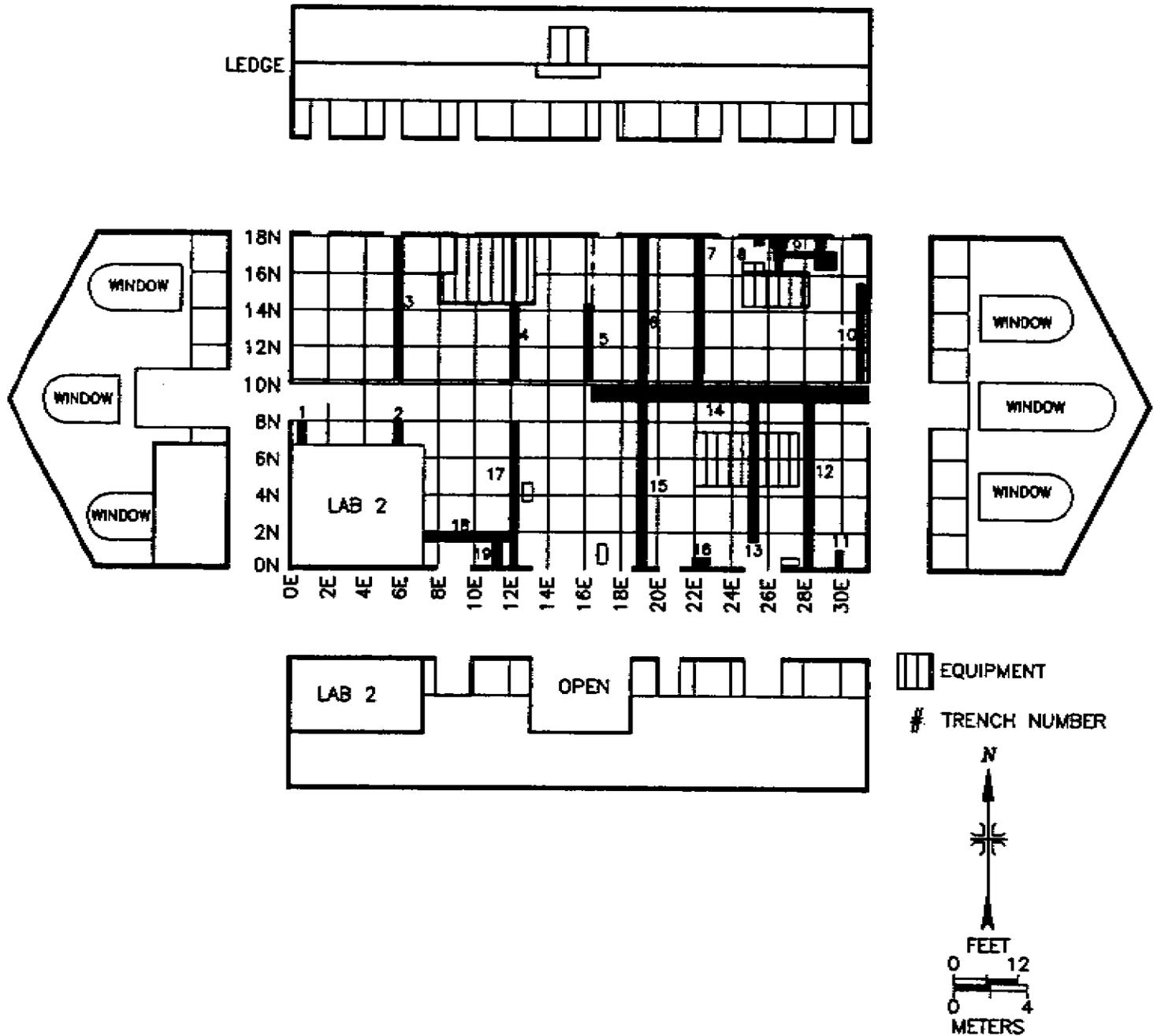


FIGURE 24: Building 23, Lab 1, Indicating Reference Grid and Trench Locations

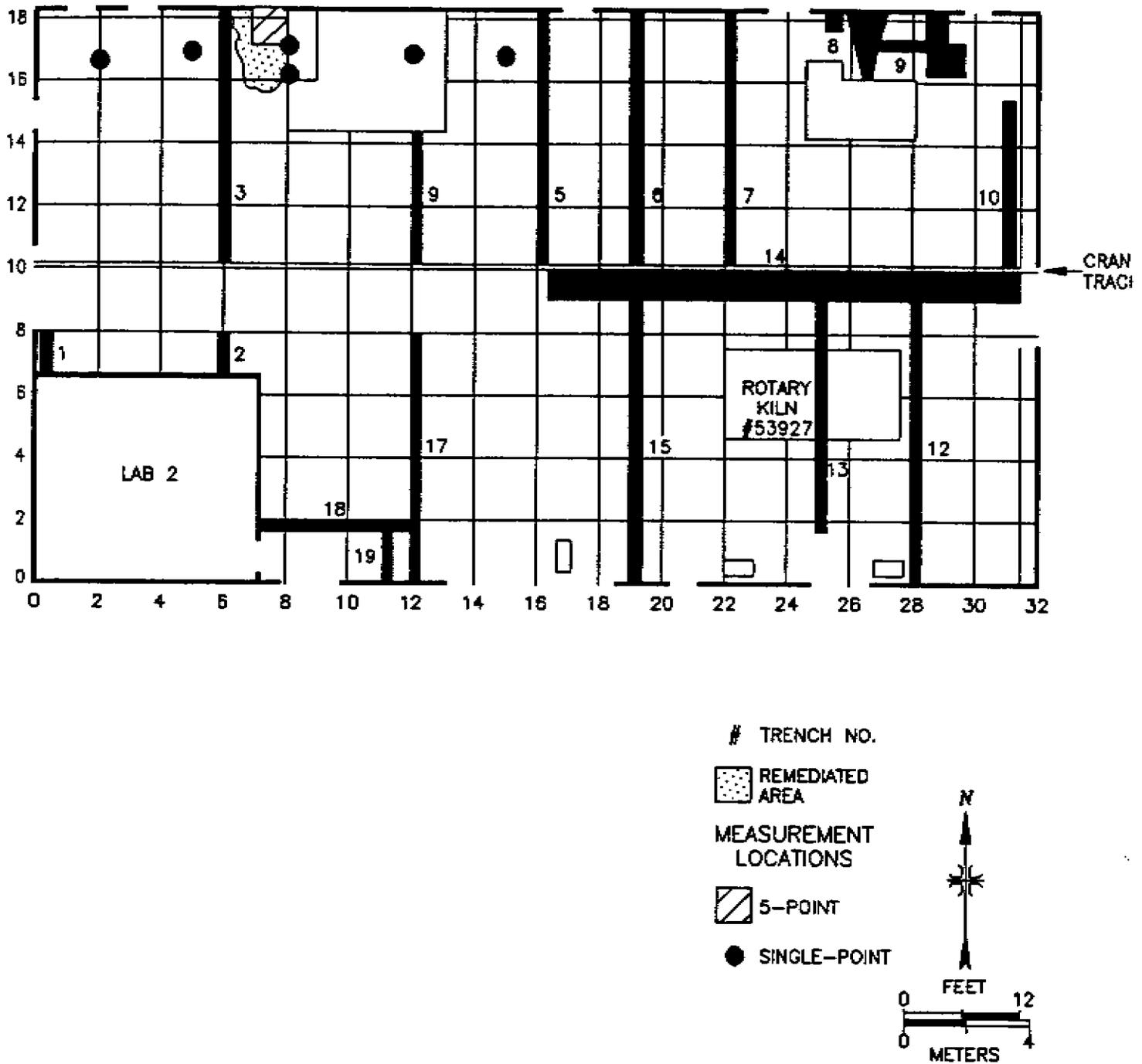


FIGURE 25: Building 23, Lab 1, Indicating Measurement Locations on the North Floor

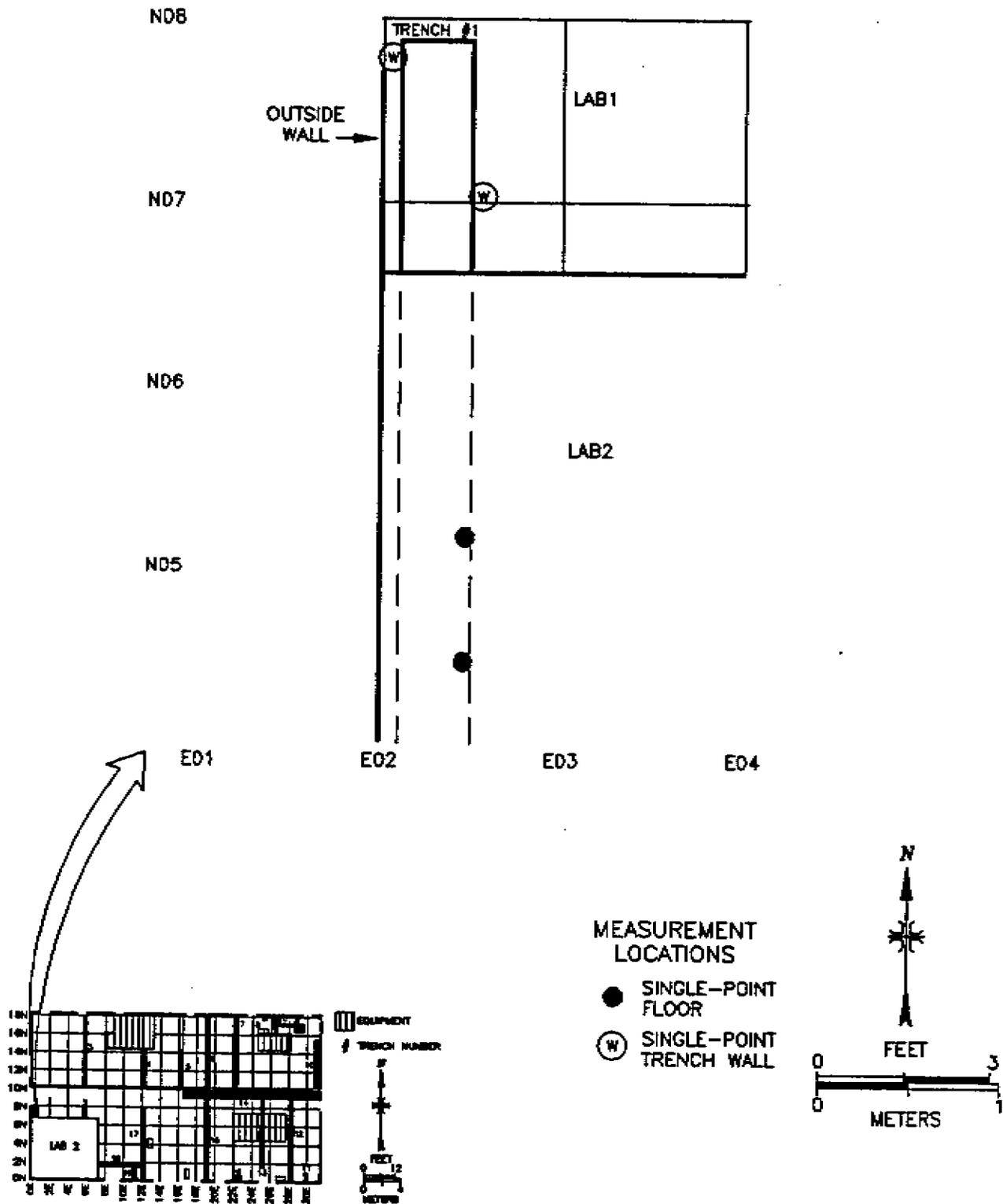


FIGURE 26: Building 23, Lab 1, Trench 1, Indicating Measurement Locations

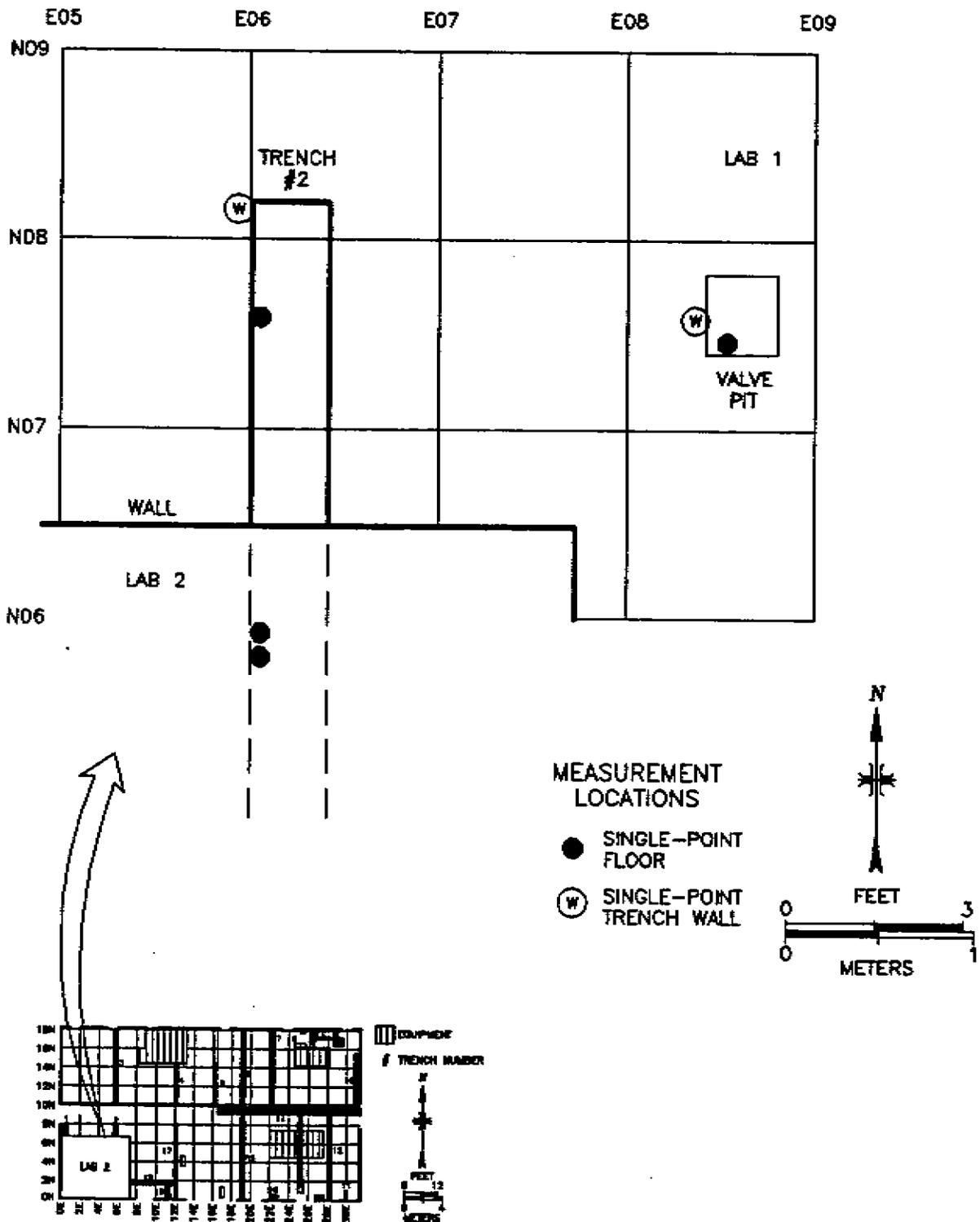


FIGURE 27: Building 23, Lab 1, Trench 2 and Valve Pit, Indicating Measurement Locations

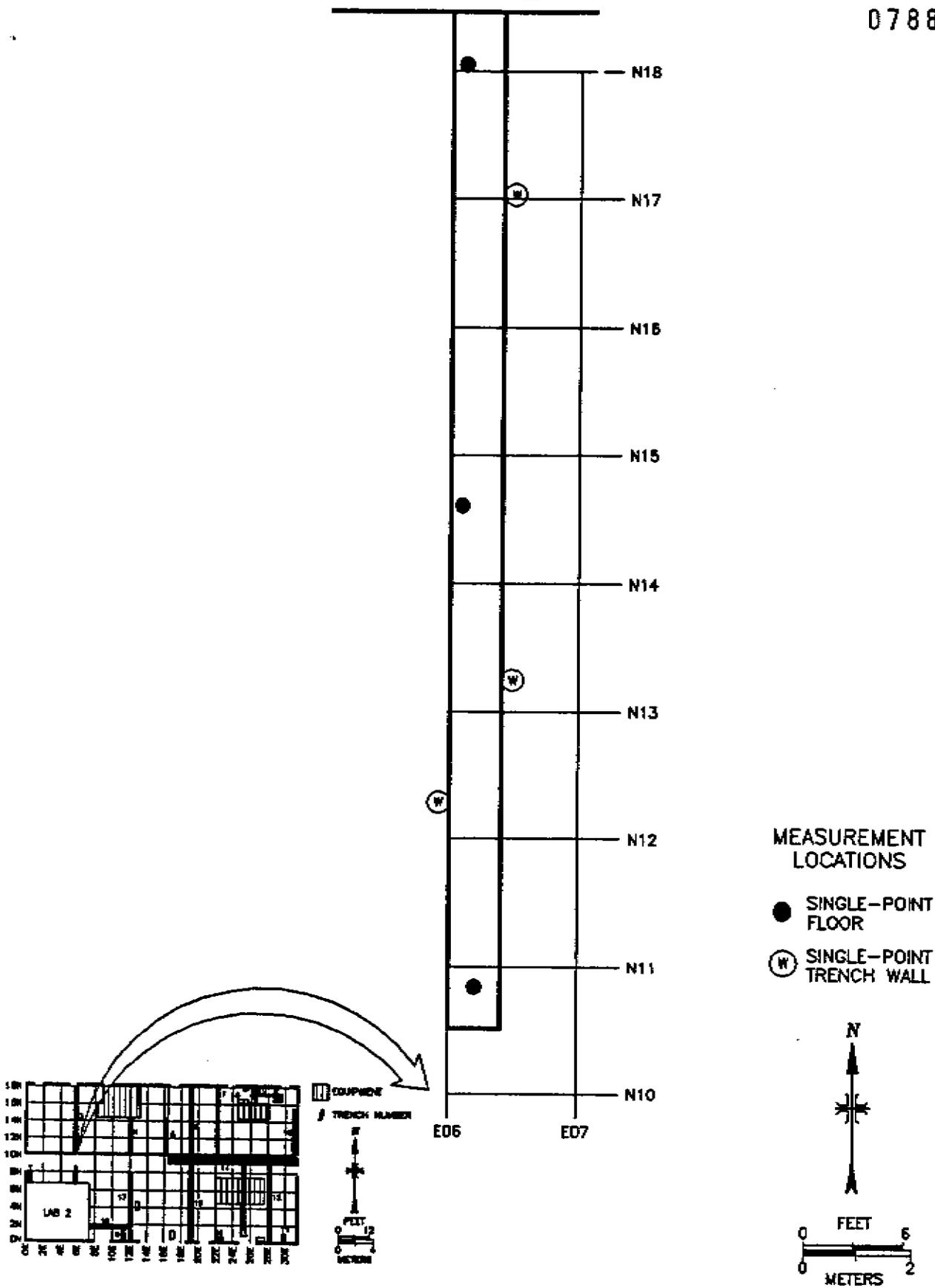


FIGURE 28: Building 23, Lab 1, Trench 3, Indicating Measurement Locations

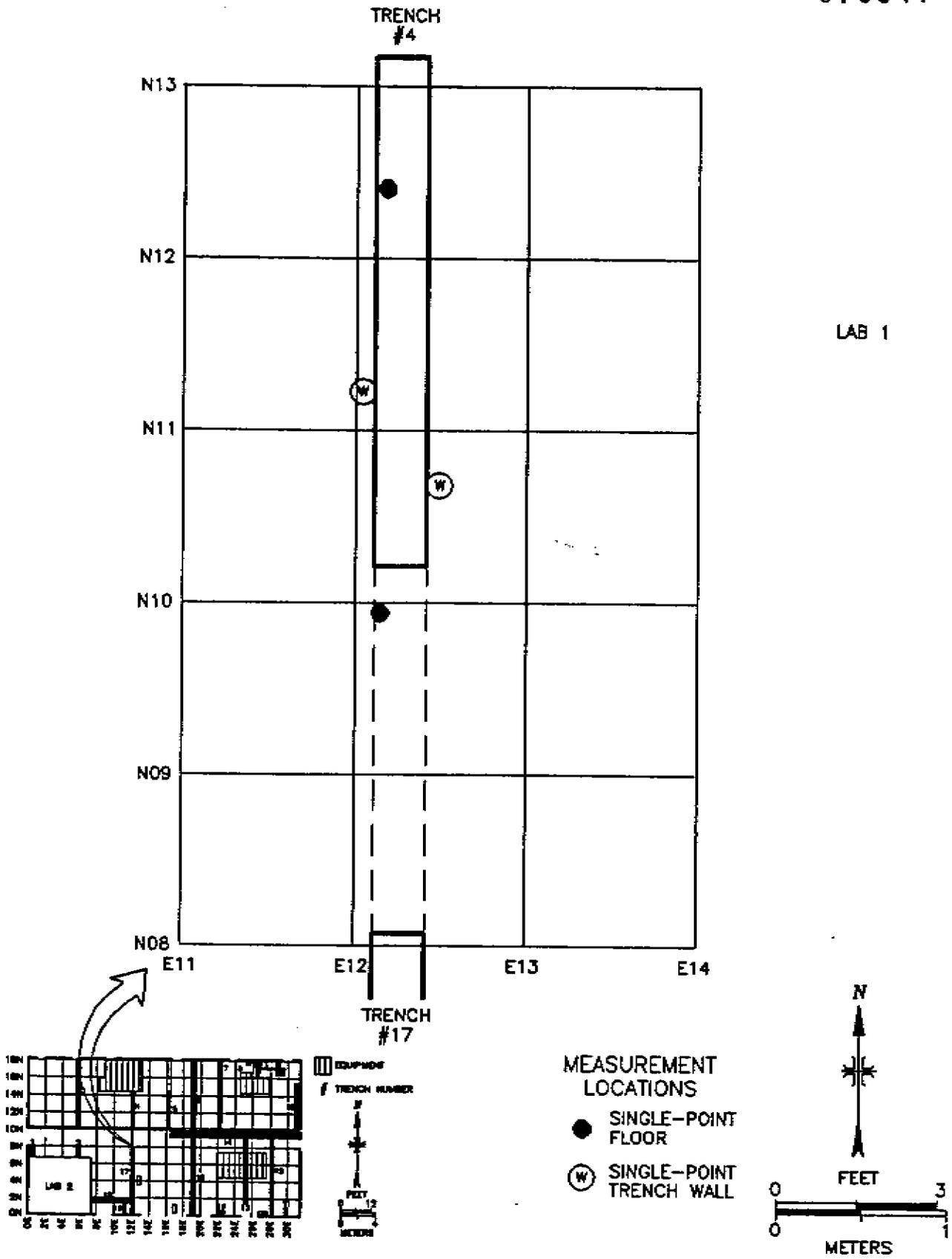


FIGURE 29: Building 23, Lab 1, Trench 4, Indicating Measurement Locations

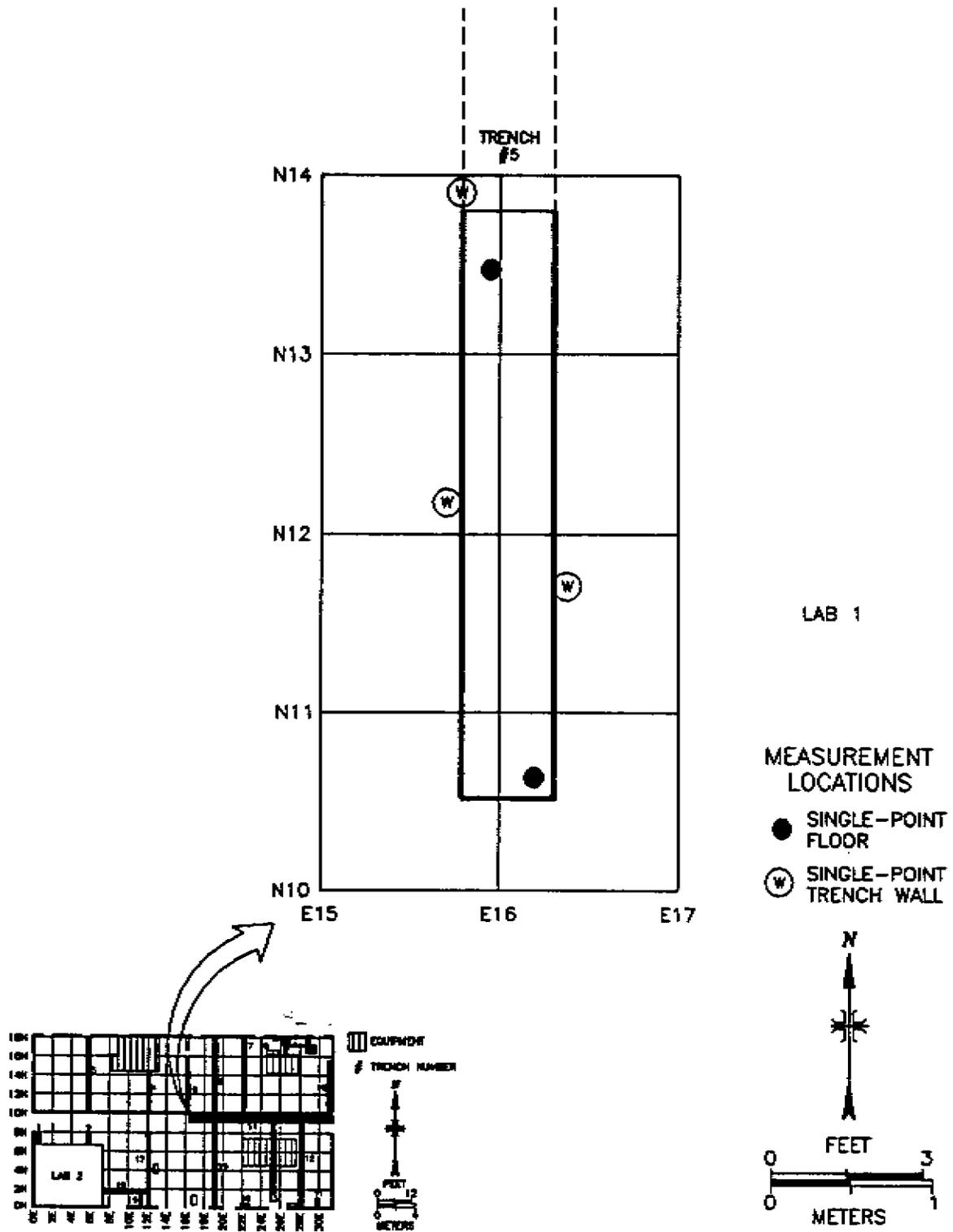


FIGURE 30: Building 23, Lab 1, Trench 5, Indicating Measurement Locations

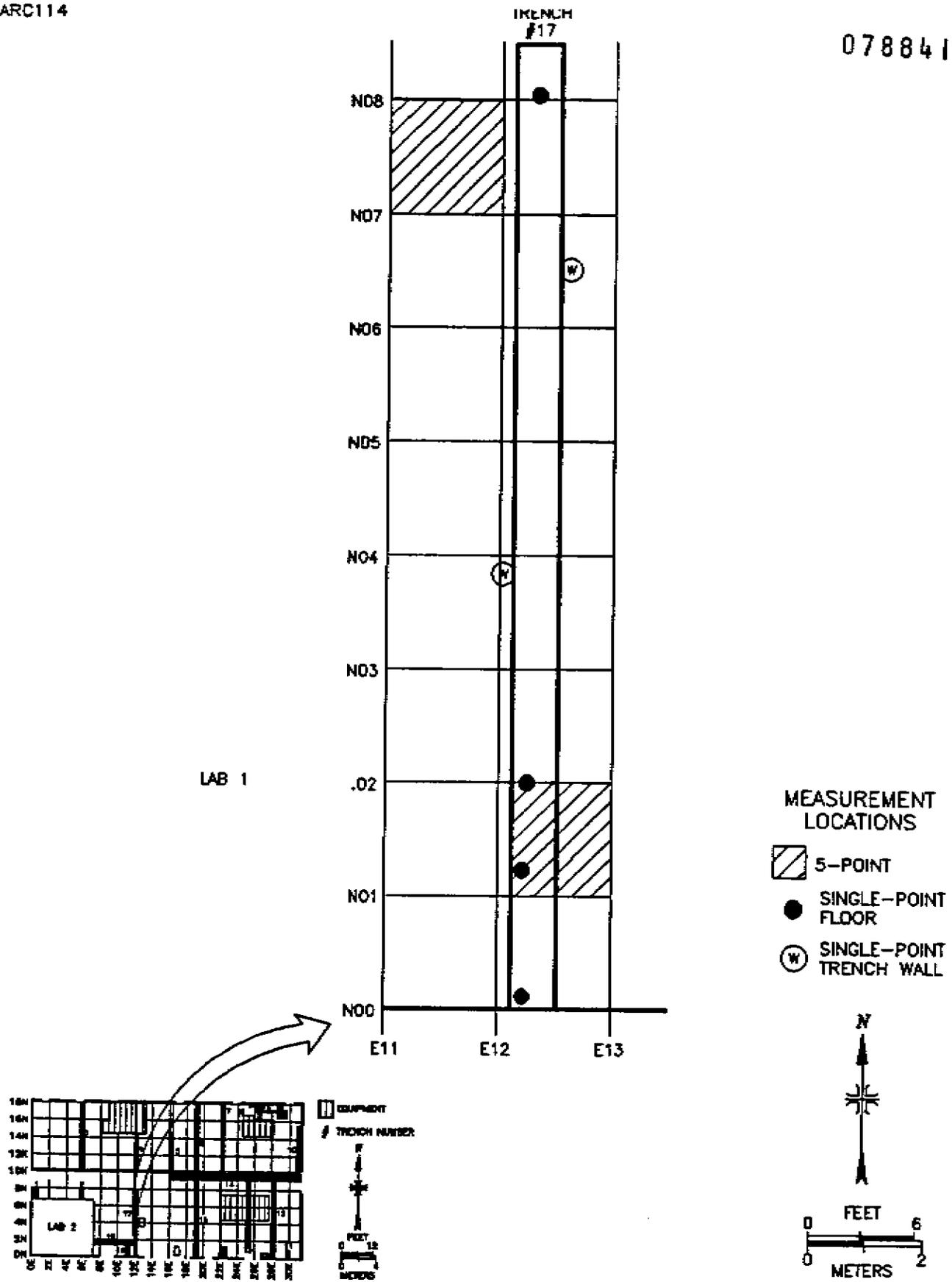


FIGURE 31: Building 23, Lab 1, Trench 17, Indicating Measurement Locations

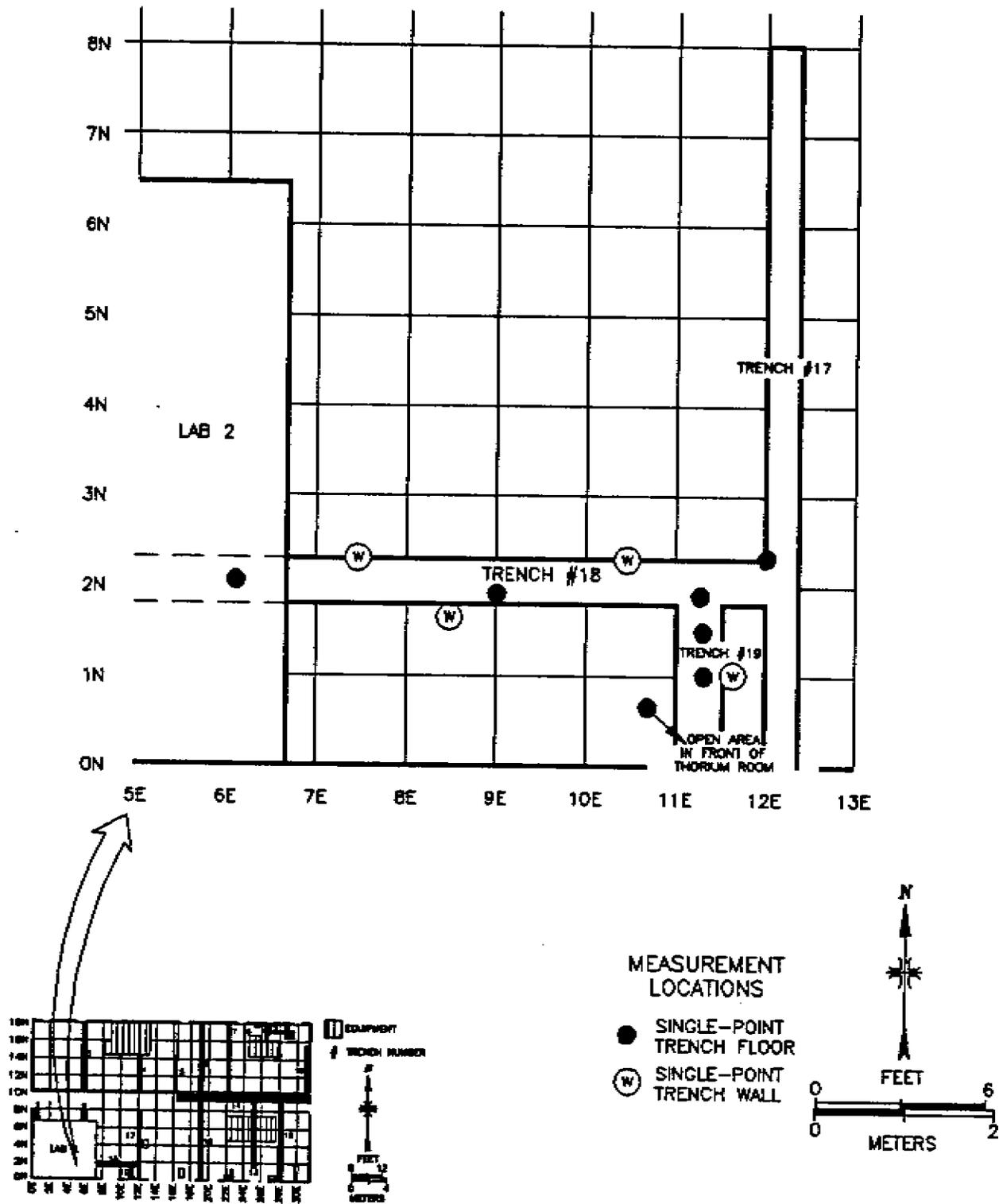


FIGURE 32: Building 23, Lab 1, Trench 18 and 19, Indicating Measurement Locations

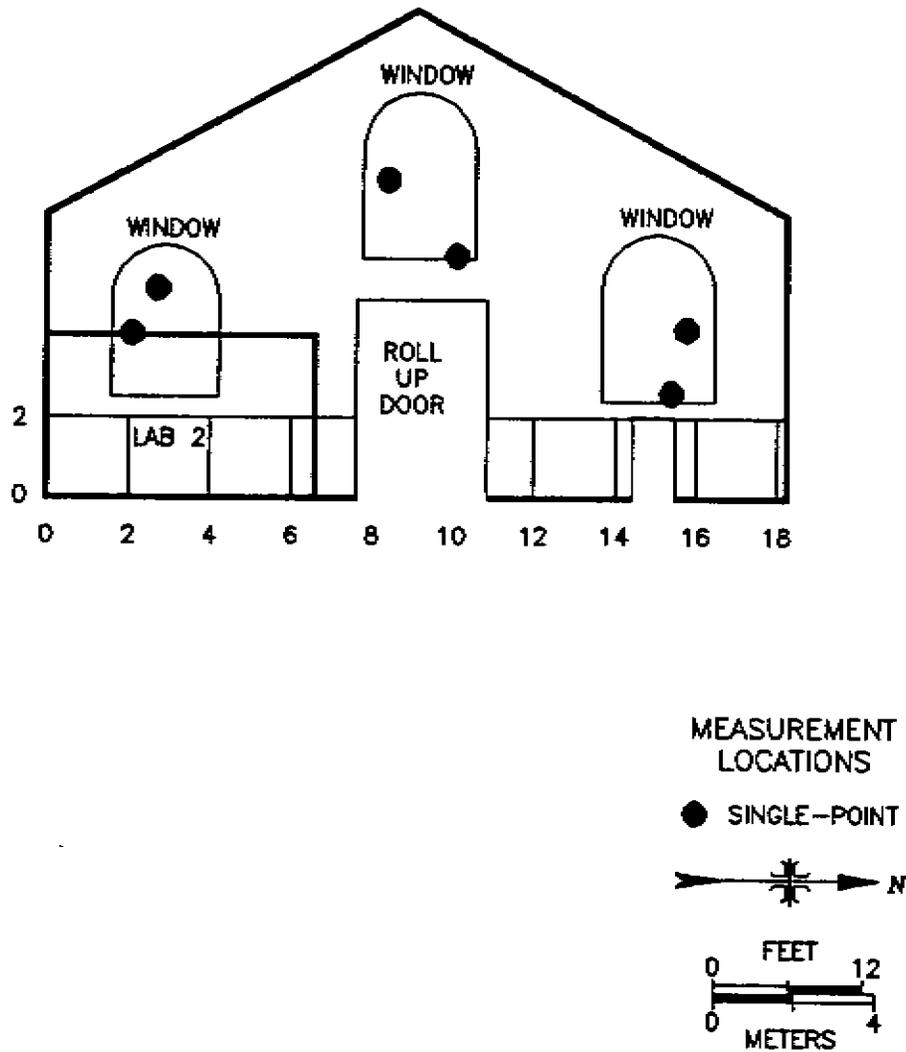


FIGURE 33: Building 23, West Wall, Indicating Measurement Locations on Windows

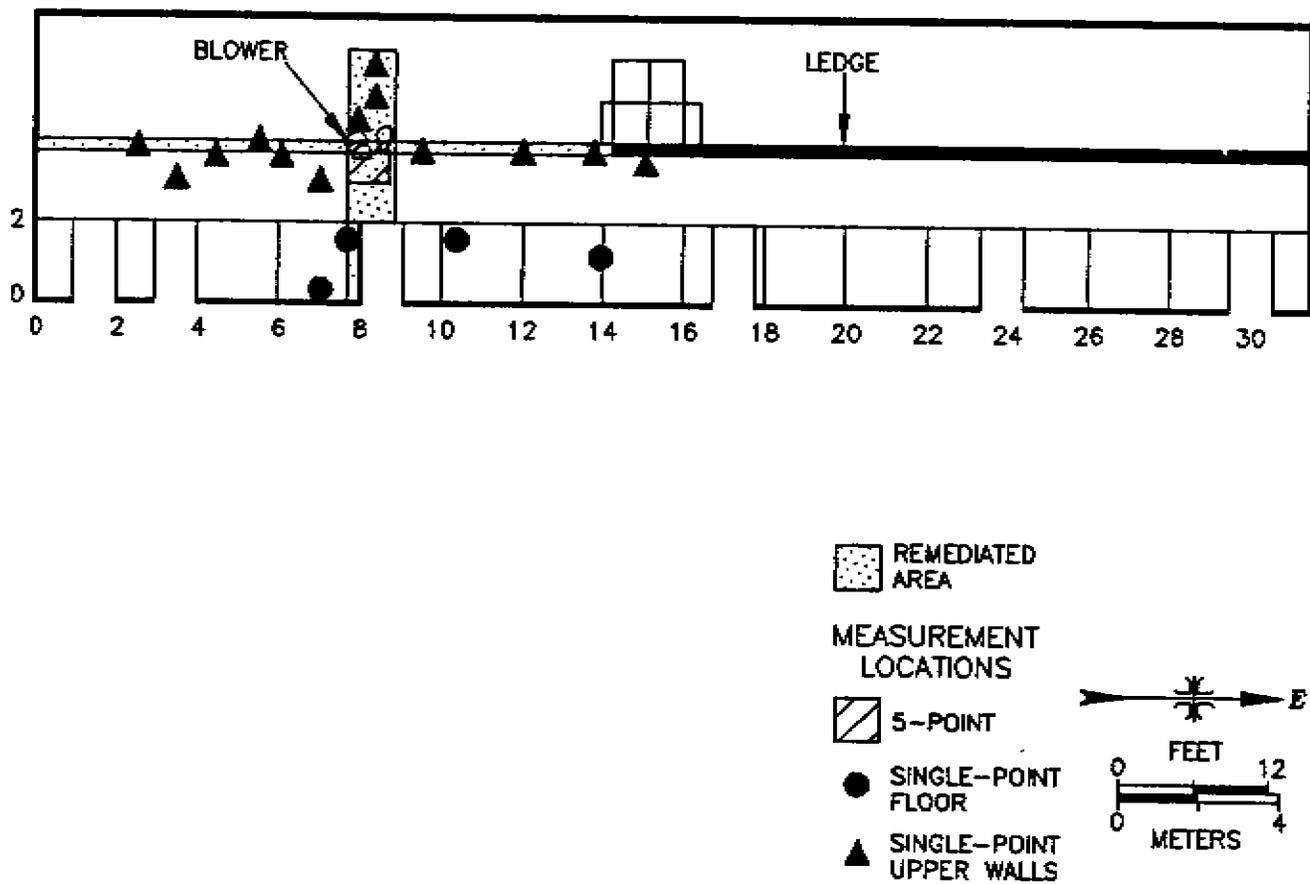


FIGURE 34: Building 23, Lab 1, North Wall, Indicating Measurement Locations

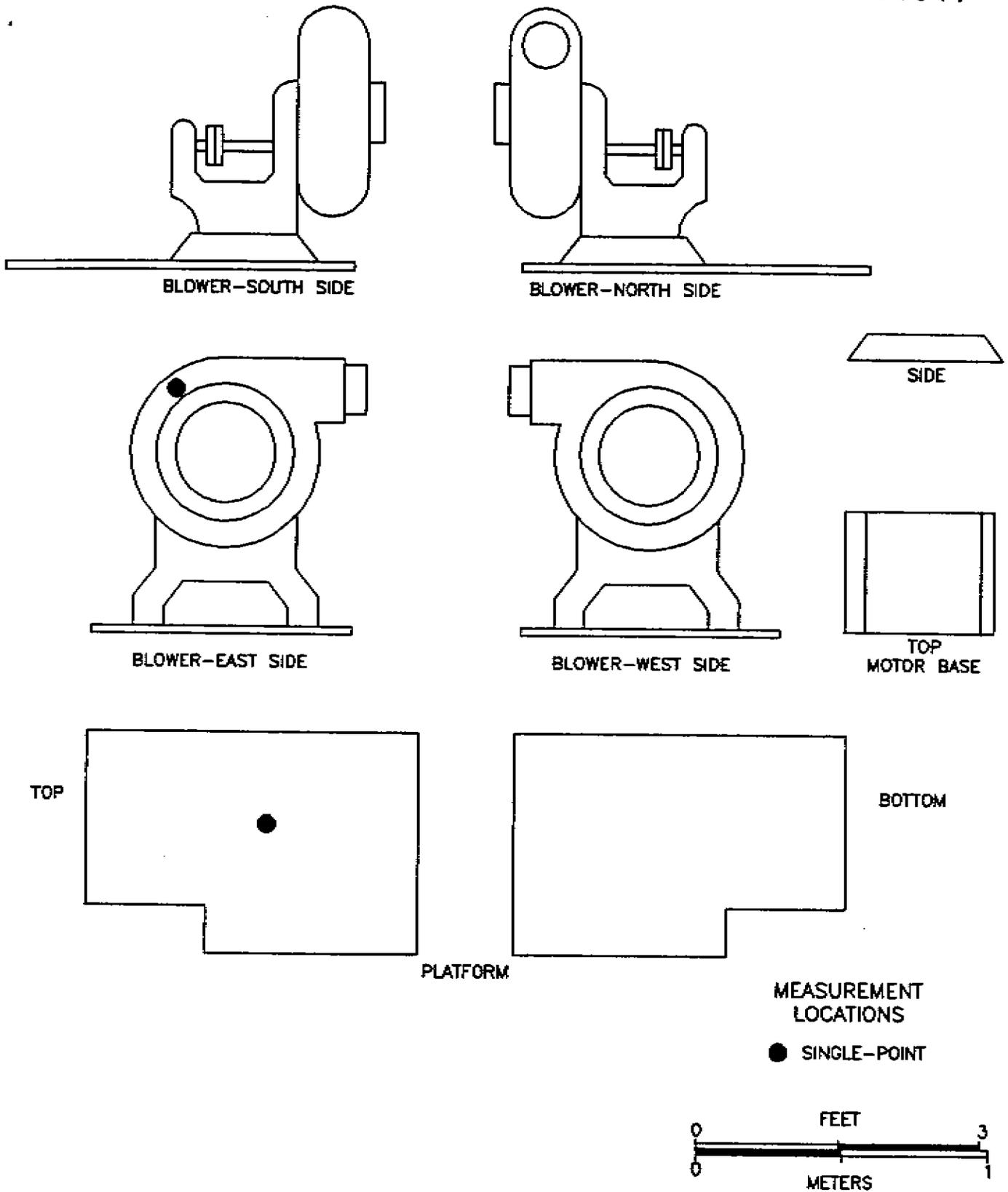


FIGURE 35: Building 23, Lab 1, North Wall Blower, Indicating Measurement Locations

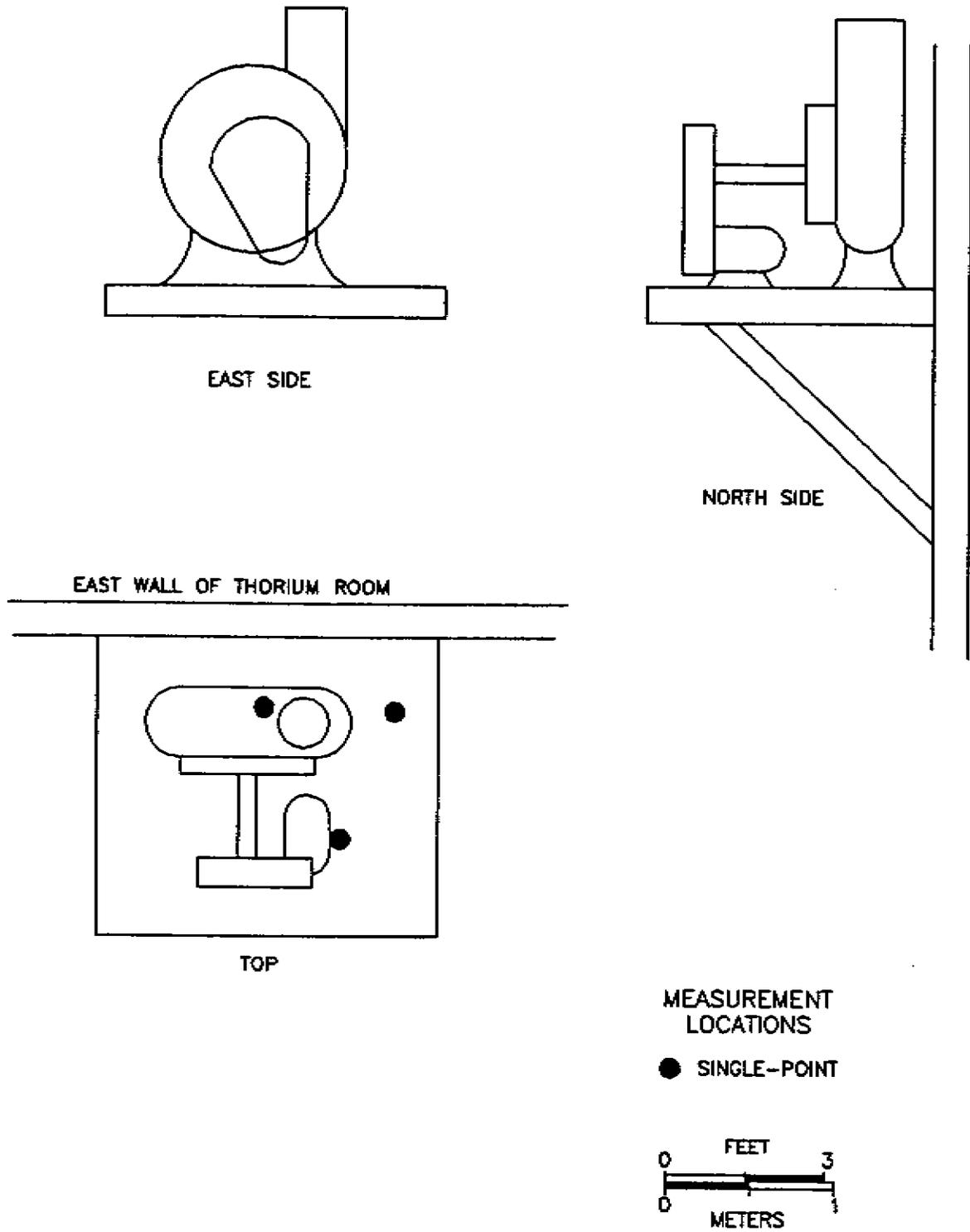


FIGURE 36: Building 23, Lab 1, Blower Outside East Wall of Thorium Room, Indicating Measurement Locations

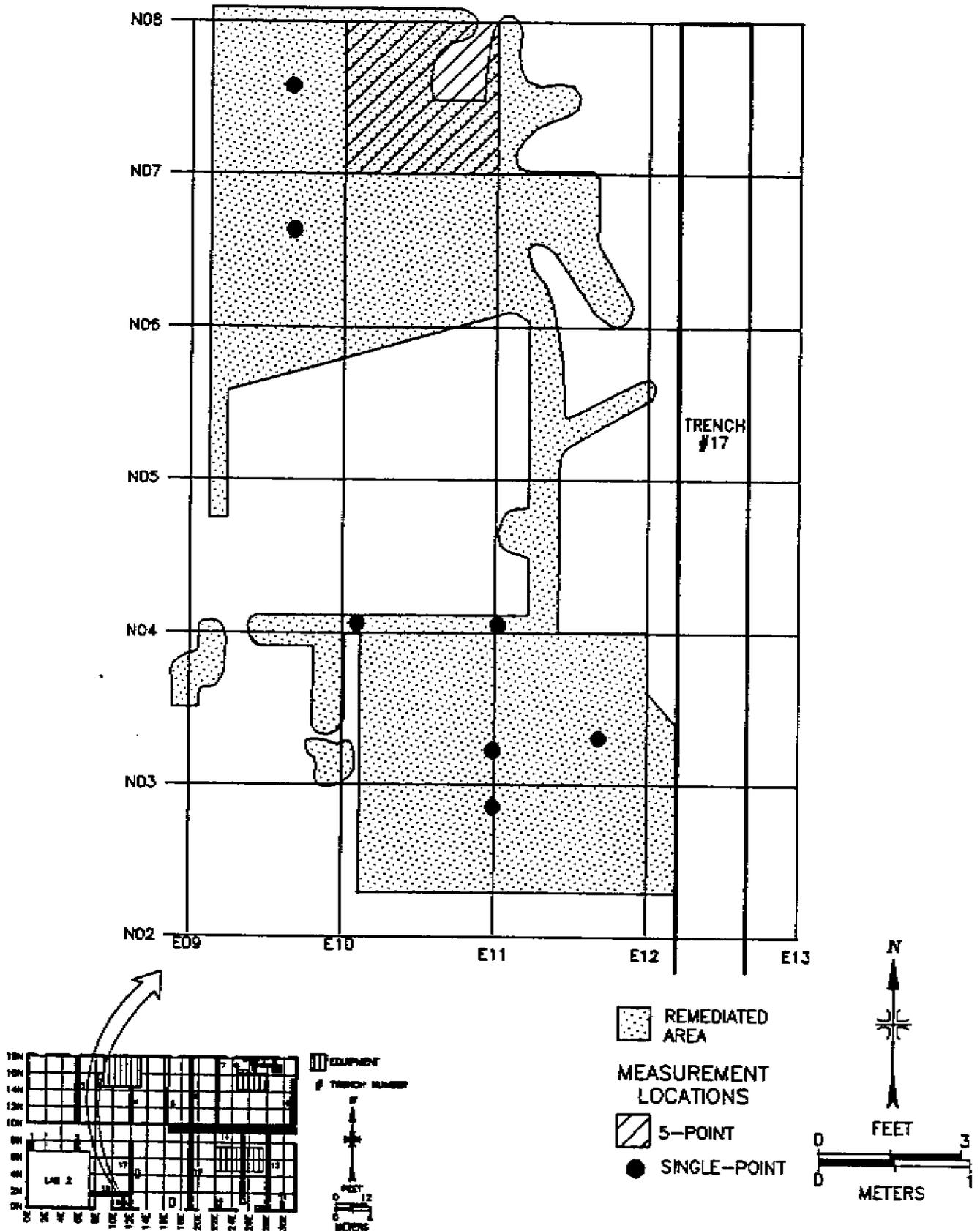


FIGURE 37: Building 23, Lab 1, Floor North of Thorium Room, Indicating Measurement Locations

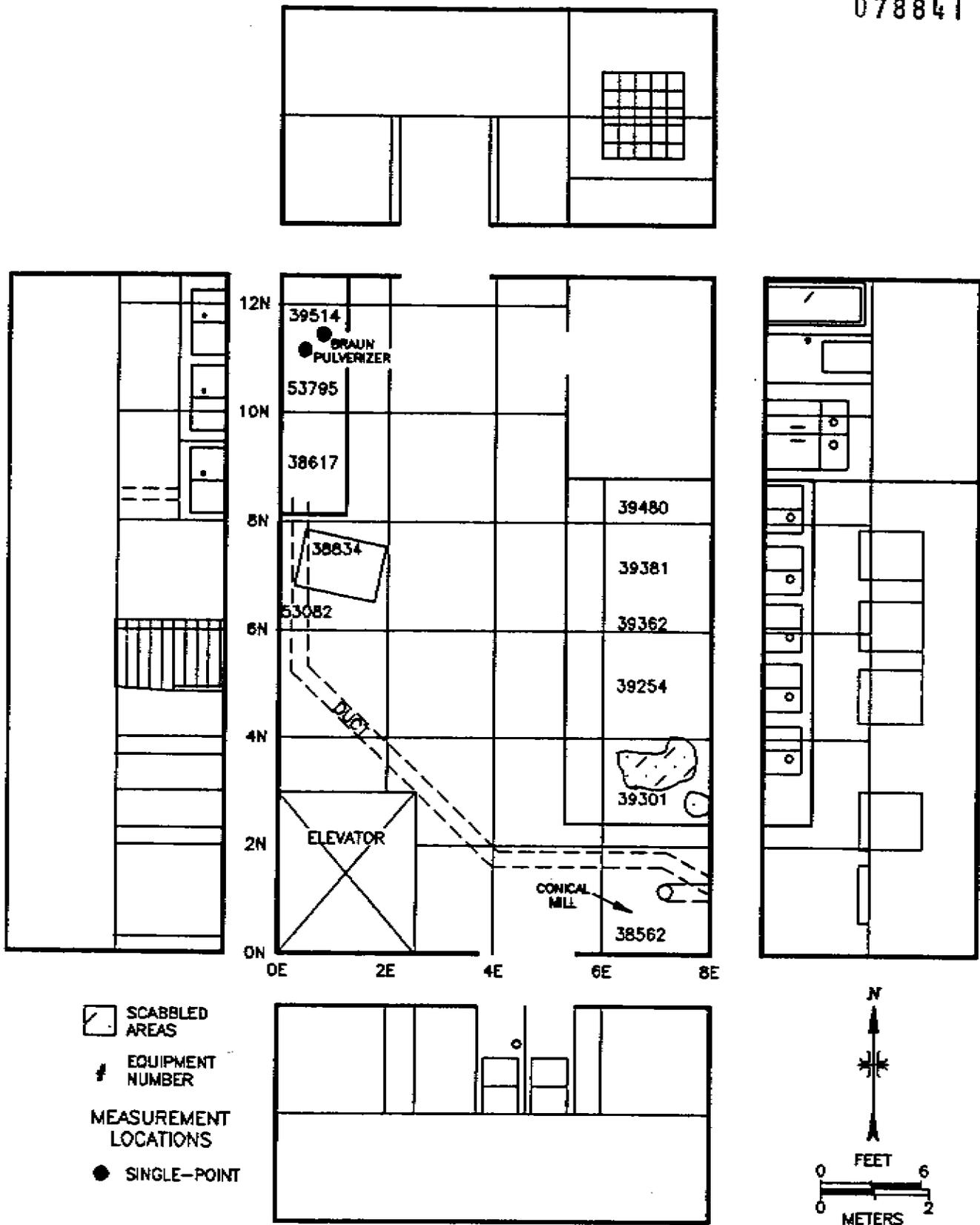


FIGURE 38: Building 23, Crusher Room, First Floor, Indicating Measurement Locations

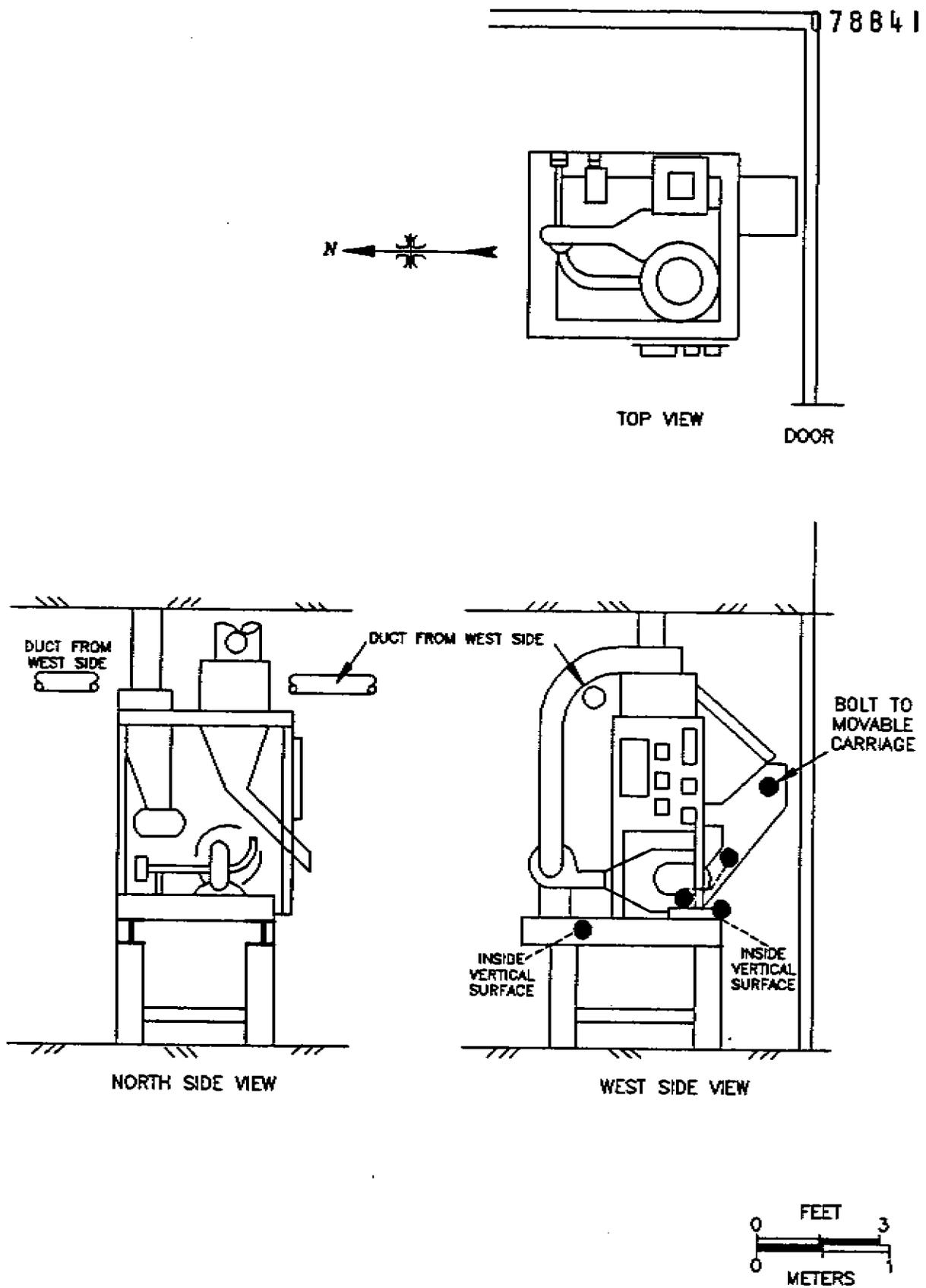


FIGURE 39: Building 23, First Floor, Crusher Room, Conical Mill #38562, Indicating Measurement Locations

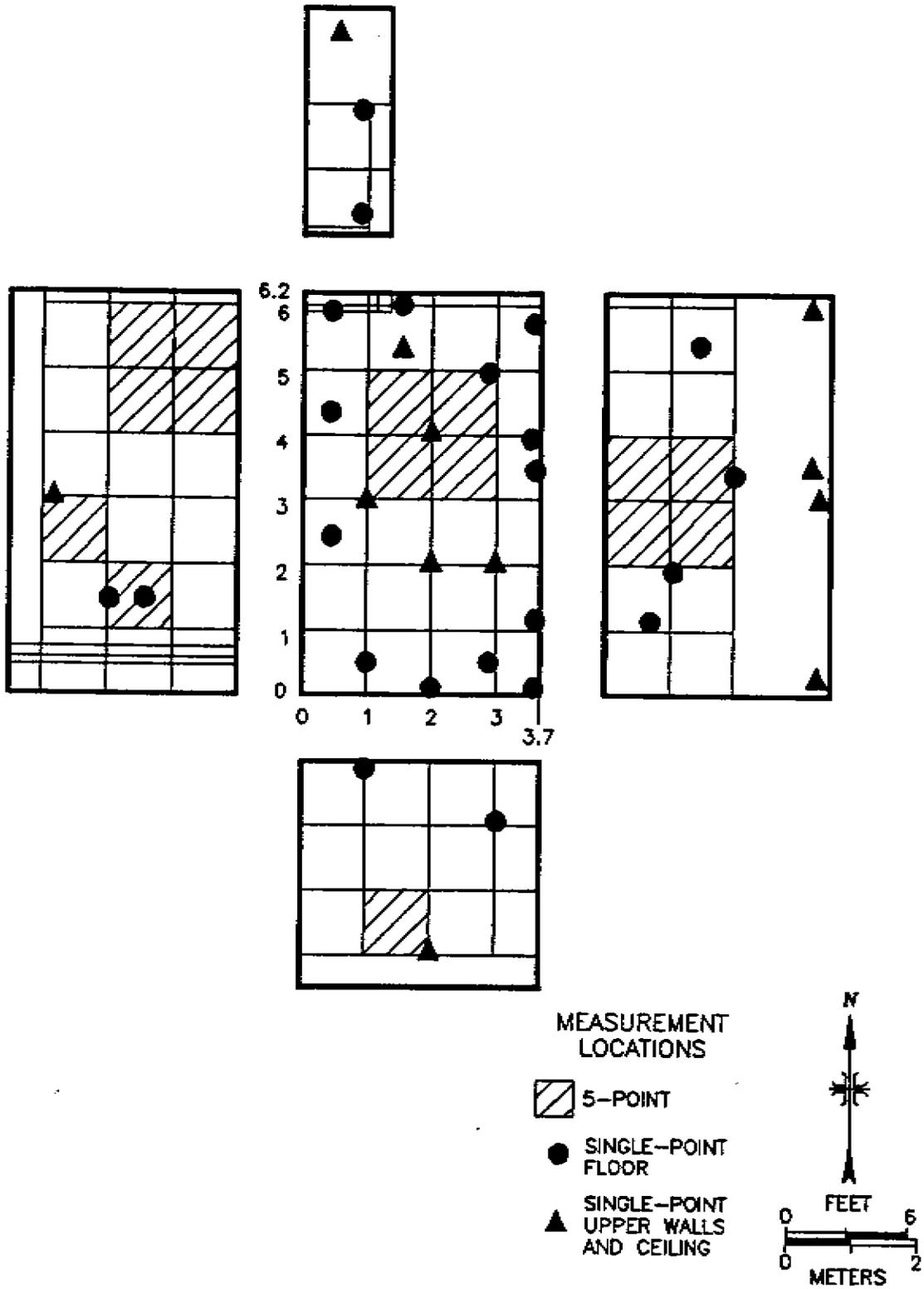


FIGURE 40: Building 23, Thorium Room, Indicating Measurement Locations

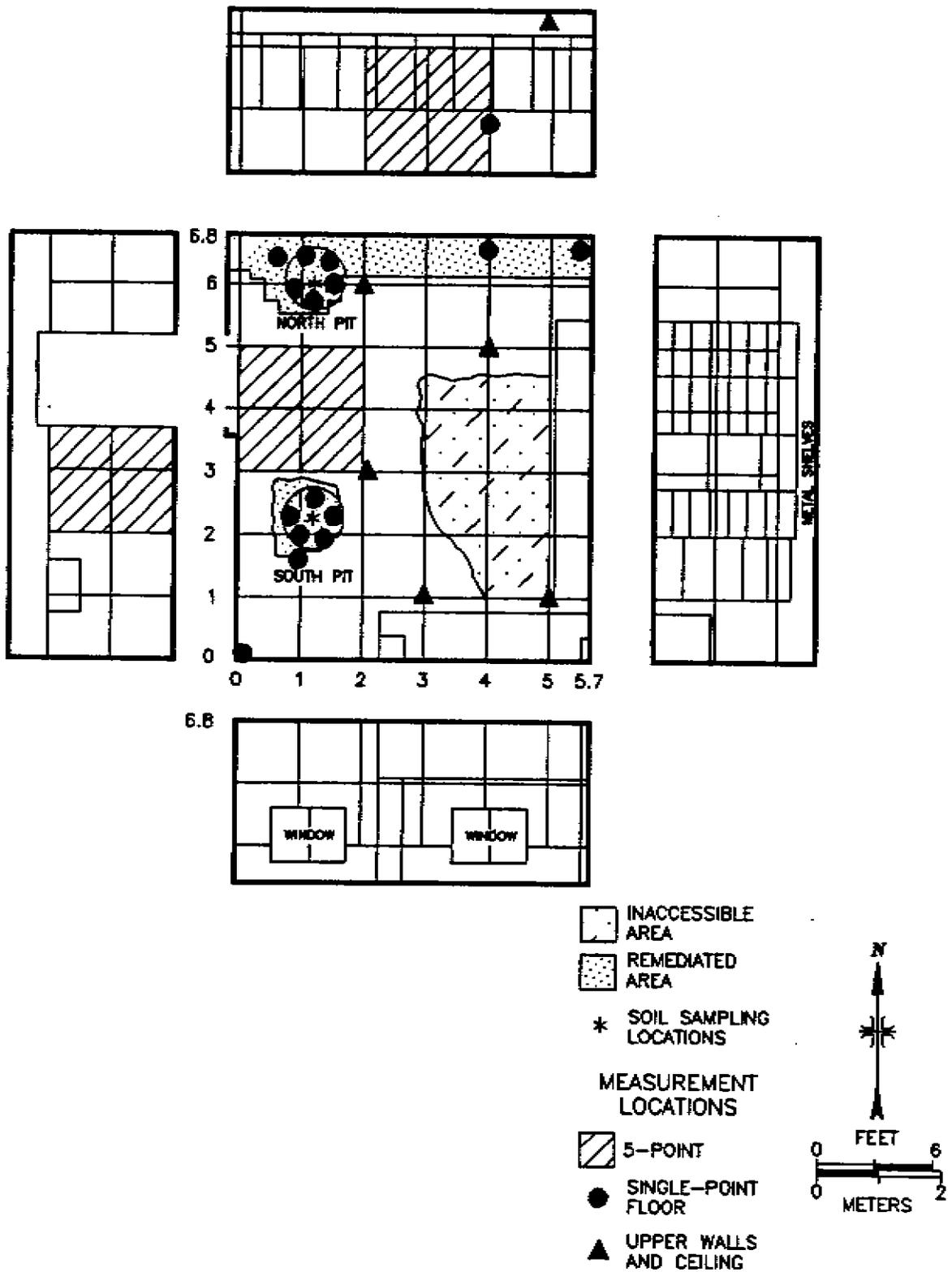


FIGURE 41: Building 26, Room 103, with North and South Pits, Indicating Measurement and Sampling Locations

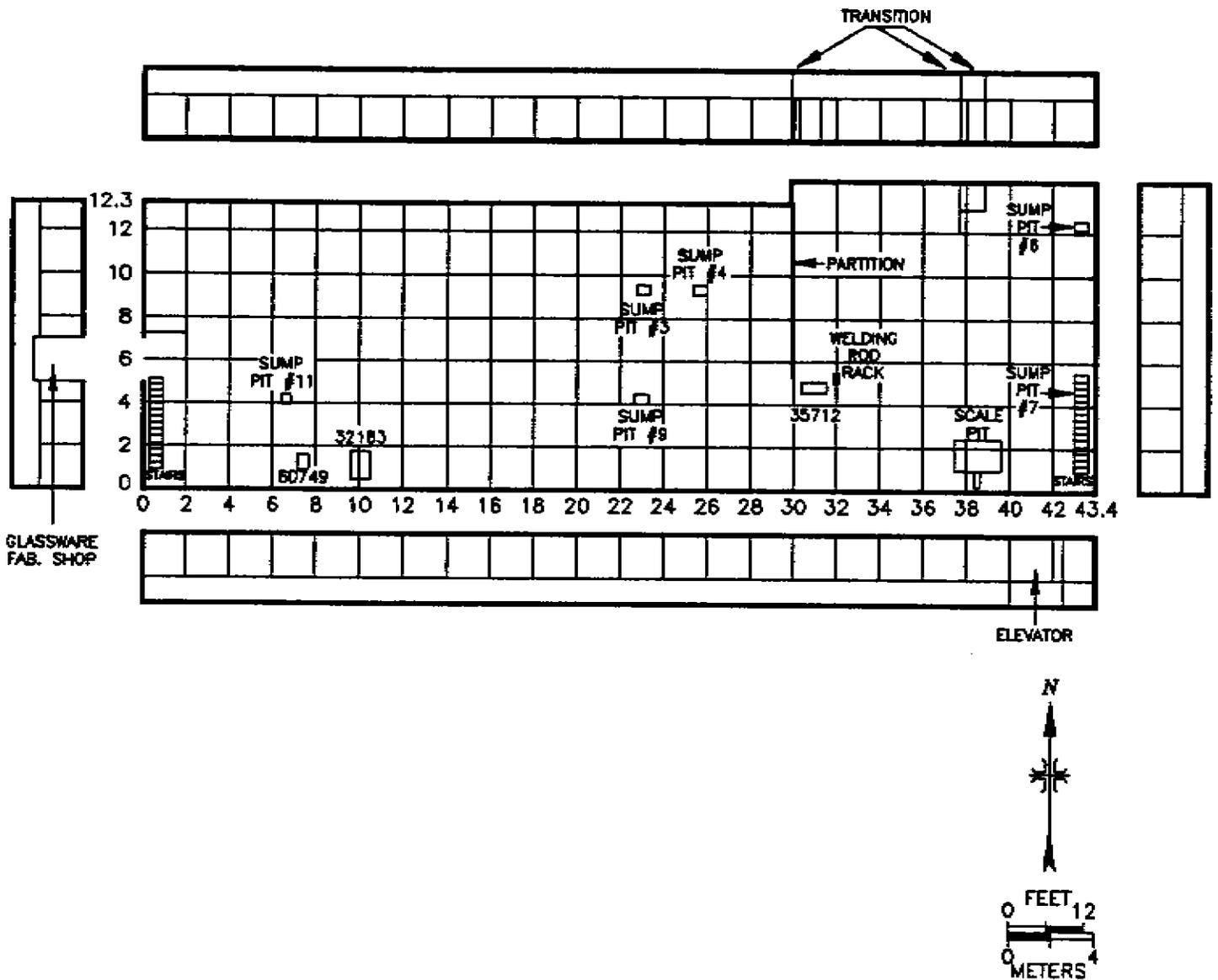


FIGURE 42: Building 28, Basement, Indicating Reference Grid

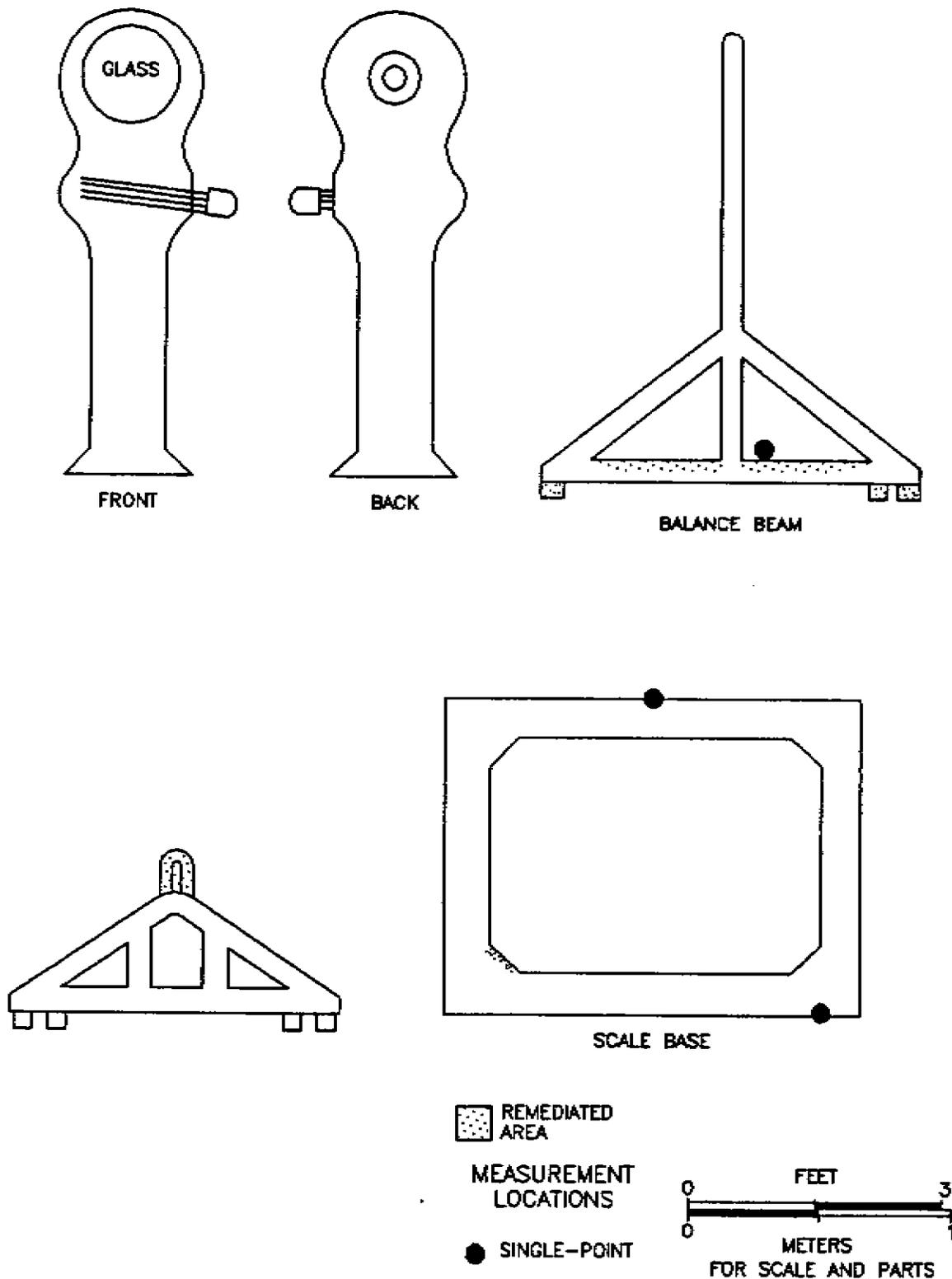


FIGURE 43: Building 28, Basement, Toledo Scale #31155 (Disassembled) Indicating Measurement Locations

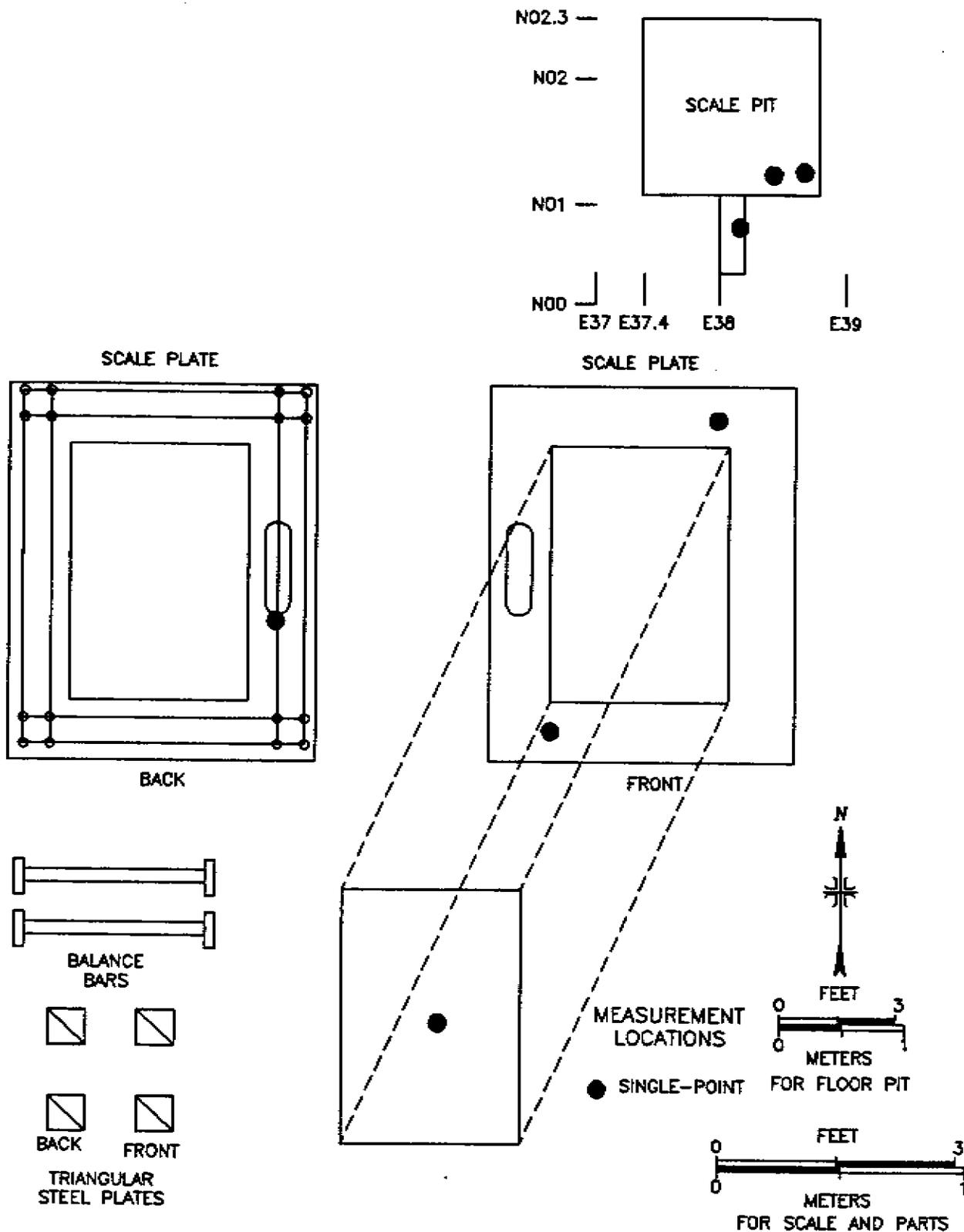


FIGURE 44: Building 28, Basement, Toledo Scale #31155, Indicating Measurement Locations

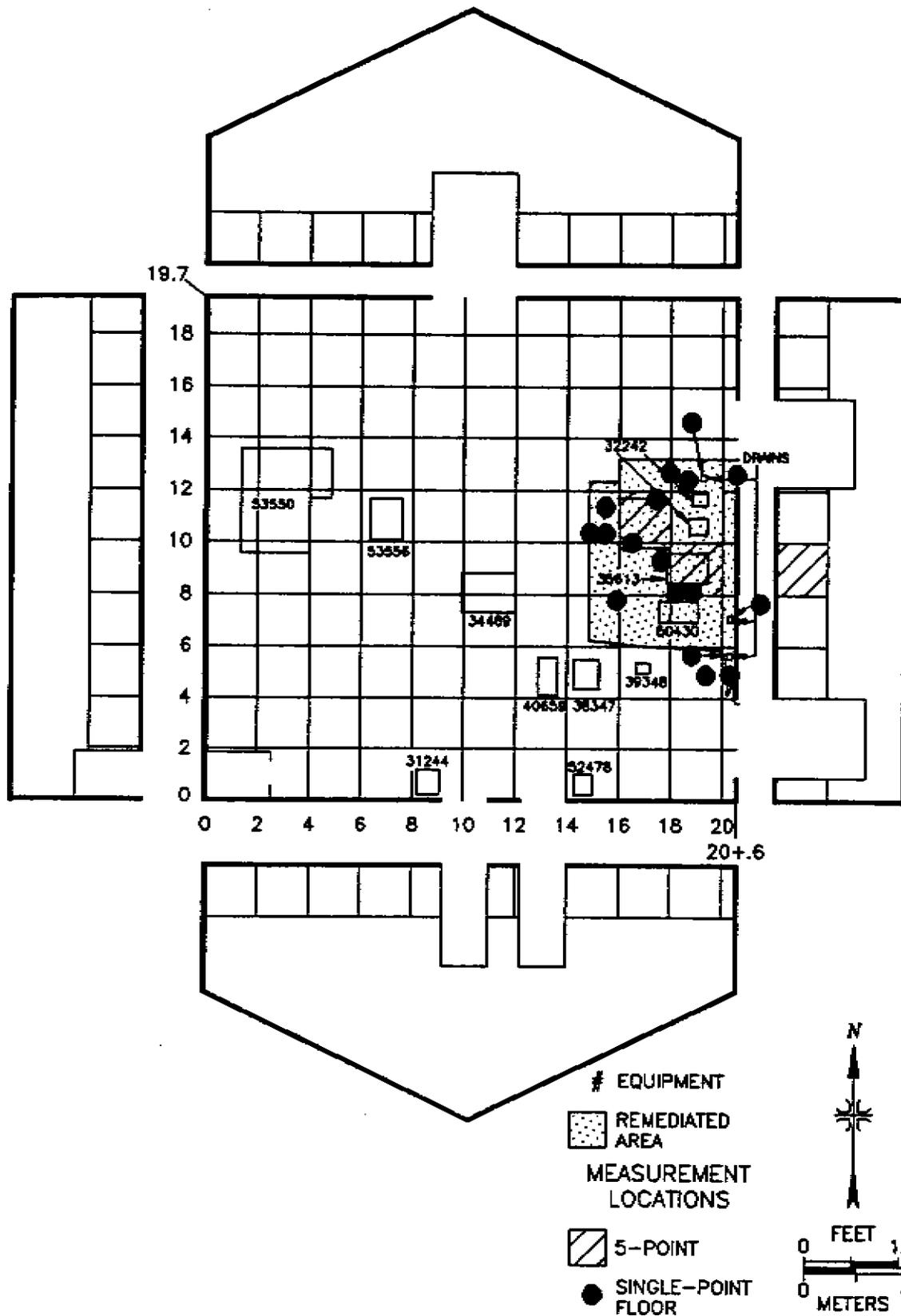


FIGURE 45: Building 30, Fabrication Room, Indicating Equipment Locations and Measurement Locations of East Floor

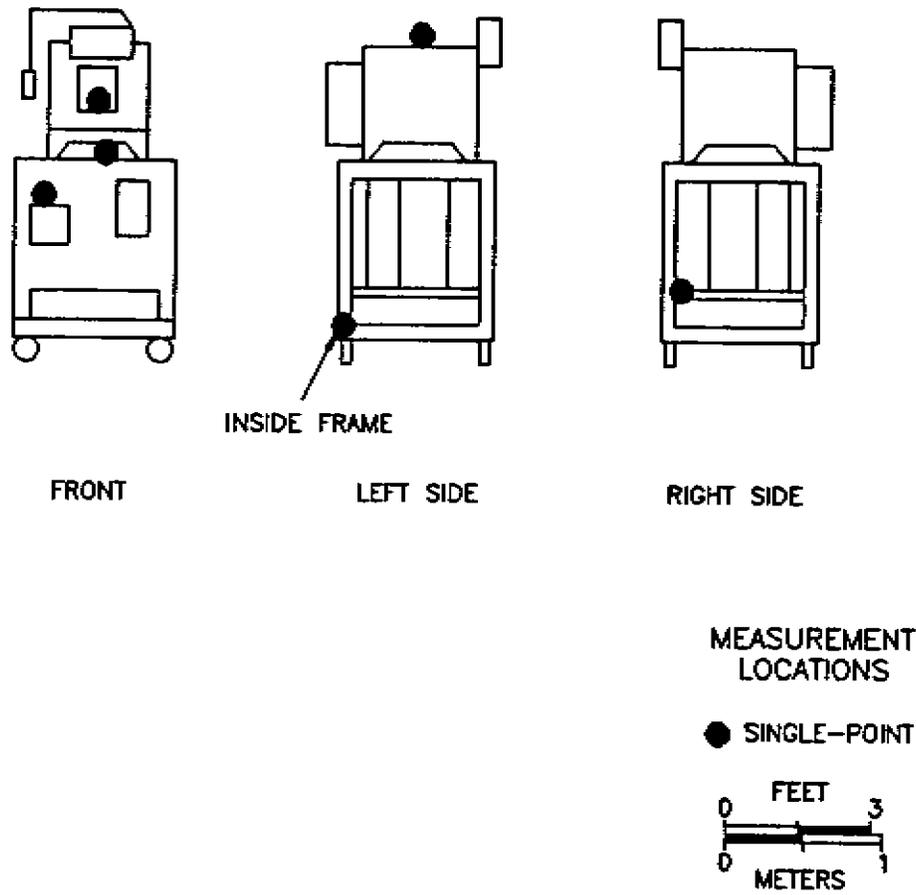
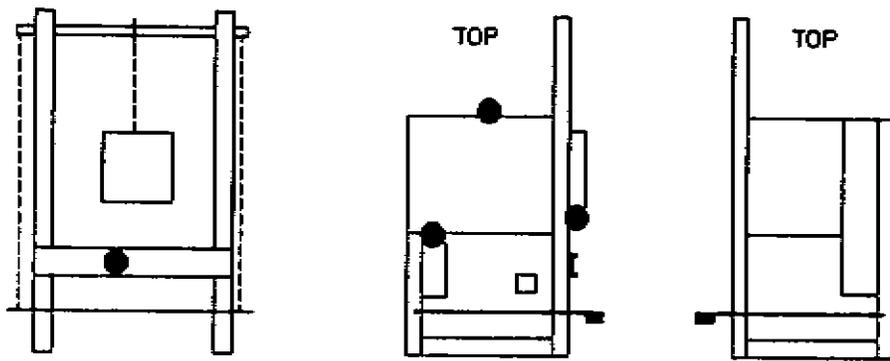


FIGURE 46: Building 30, Fabrication Room  
Portable Electric Oven #34830,  
Indicating Measurement Locations



FRONT

LEFT SIDE

RIGHT SIDE

MEASUREMENT  
LOCATIONS

● SINGLE-POINT

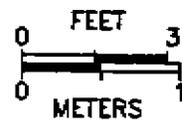
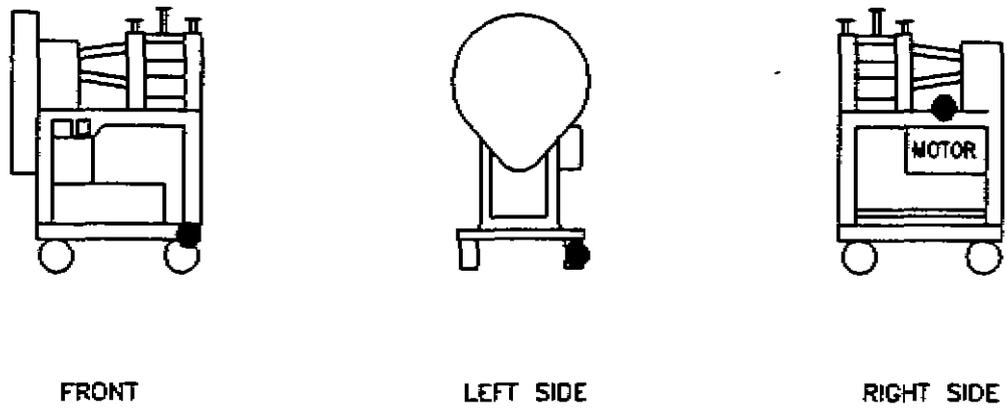


FIGURE 47: Building 30, Fabrication Room,  
Hoskins Furnace #39242,  
Indicating Measurement Locations



MEASUREMENT LOCATIONS

● SINGLE-POINT

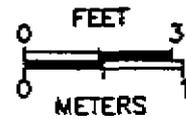


FIGURE 48: Building 30, Fabrication Room, Portable Rolling Mill #52544, Indicating Measurement Locations

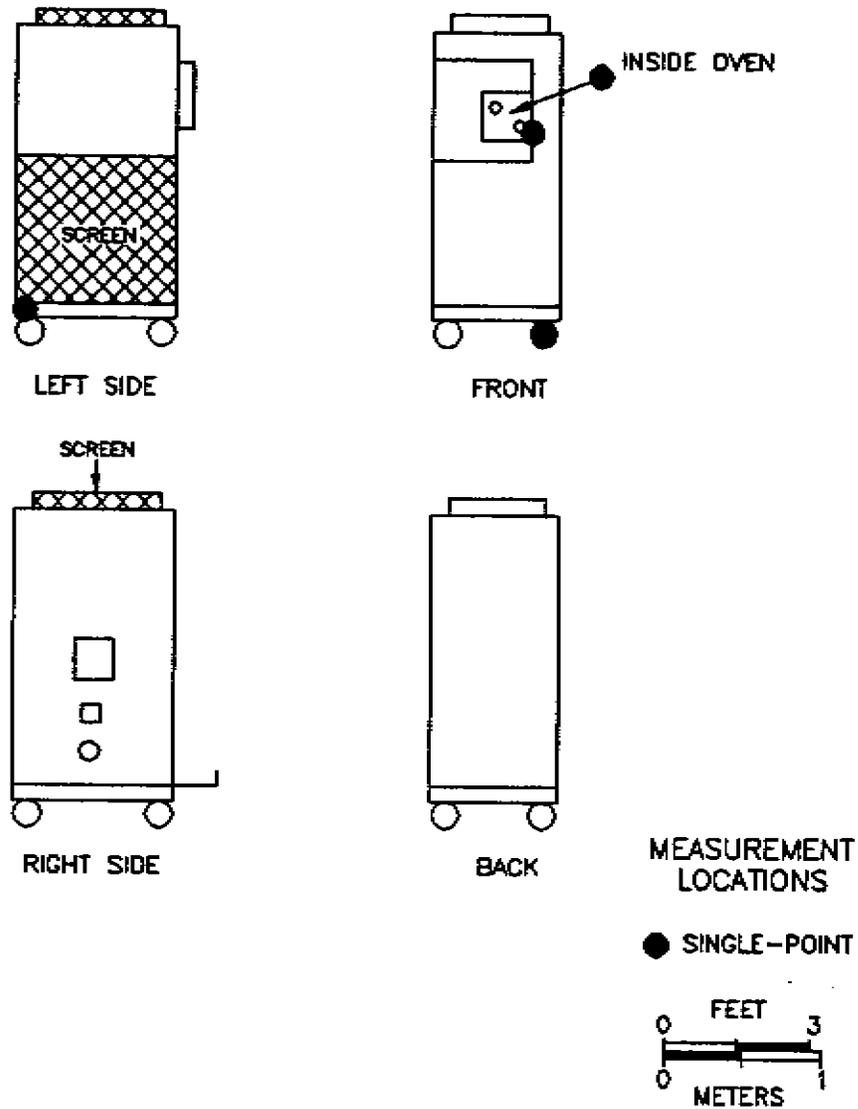


FIGURE 49: Building 30, Fabrication Room, Portable Keith Oven #52478, Indicating Measurement Locations

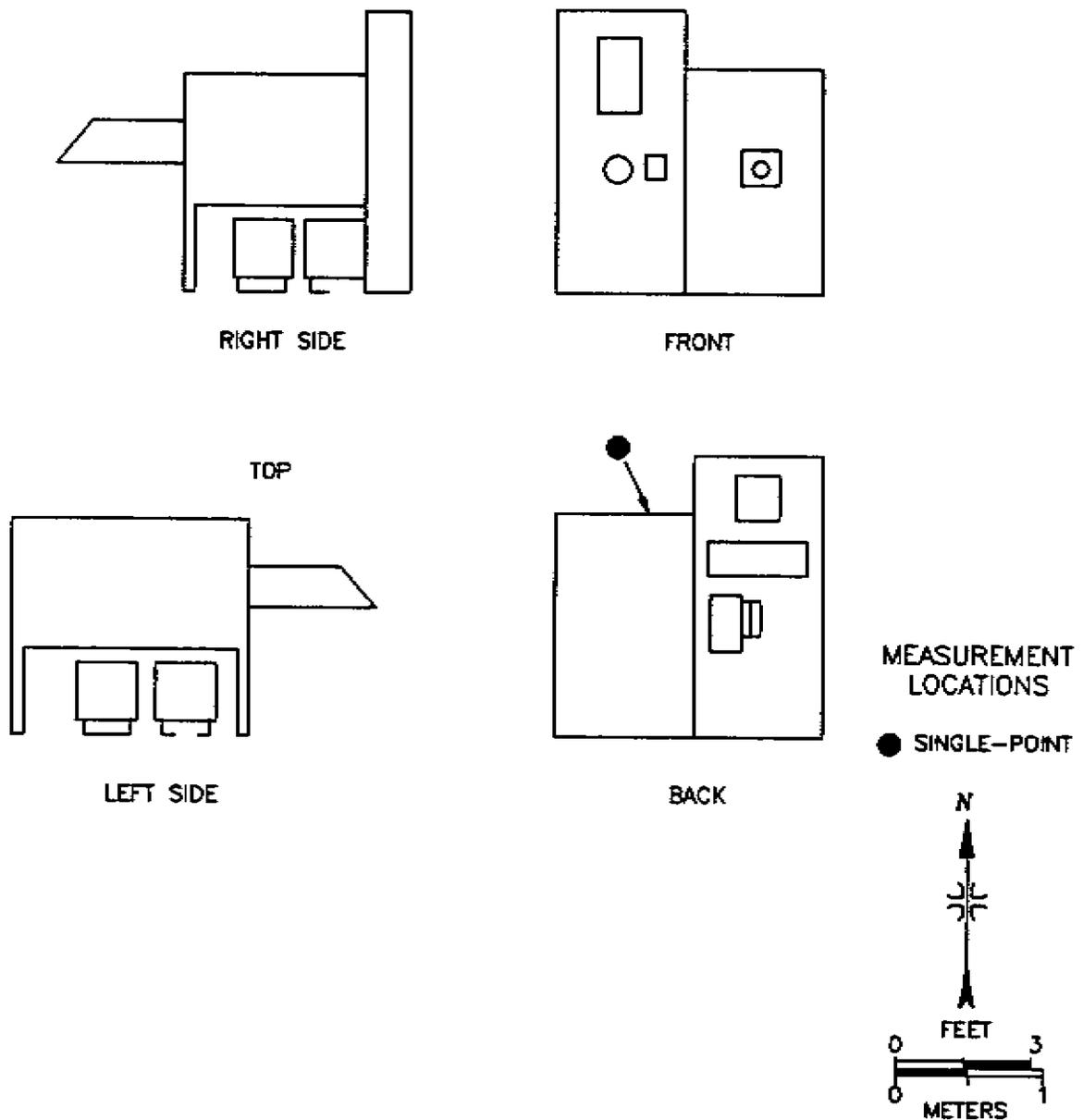


FIGURE 50: Building 30, Fabrication Room, Hydrogen Oven Equipment #50430, Indicating Measurement Locations

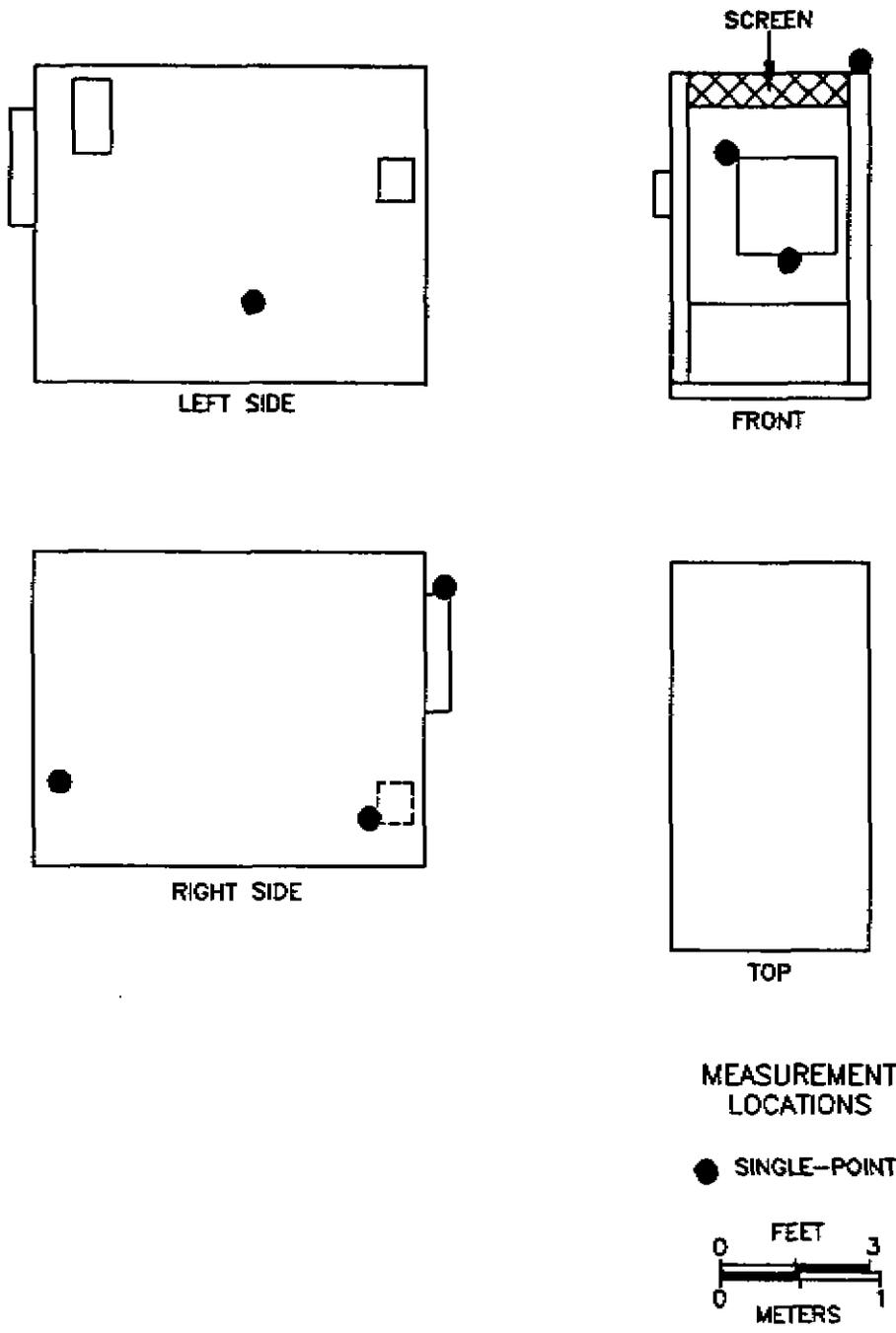


FIGURE 51: Building 30, Fabrication Room,  
Hevi-Duty Oven #35693,  
Indicating Measurement Locations

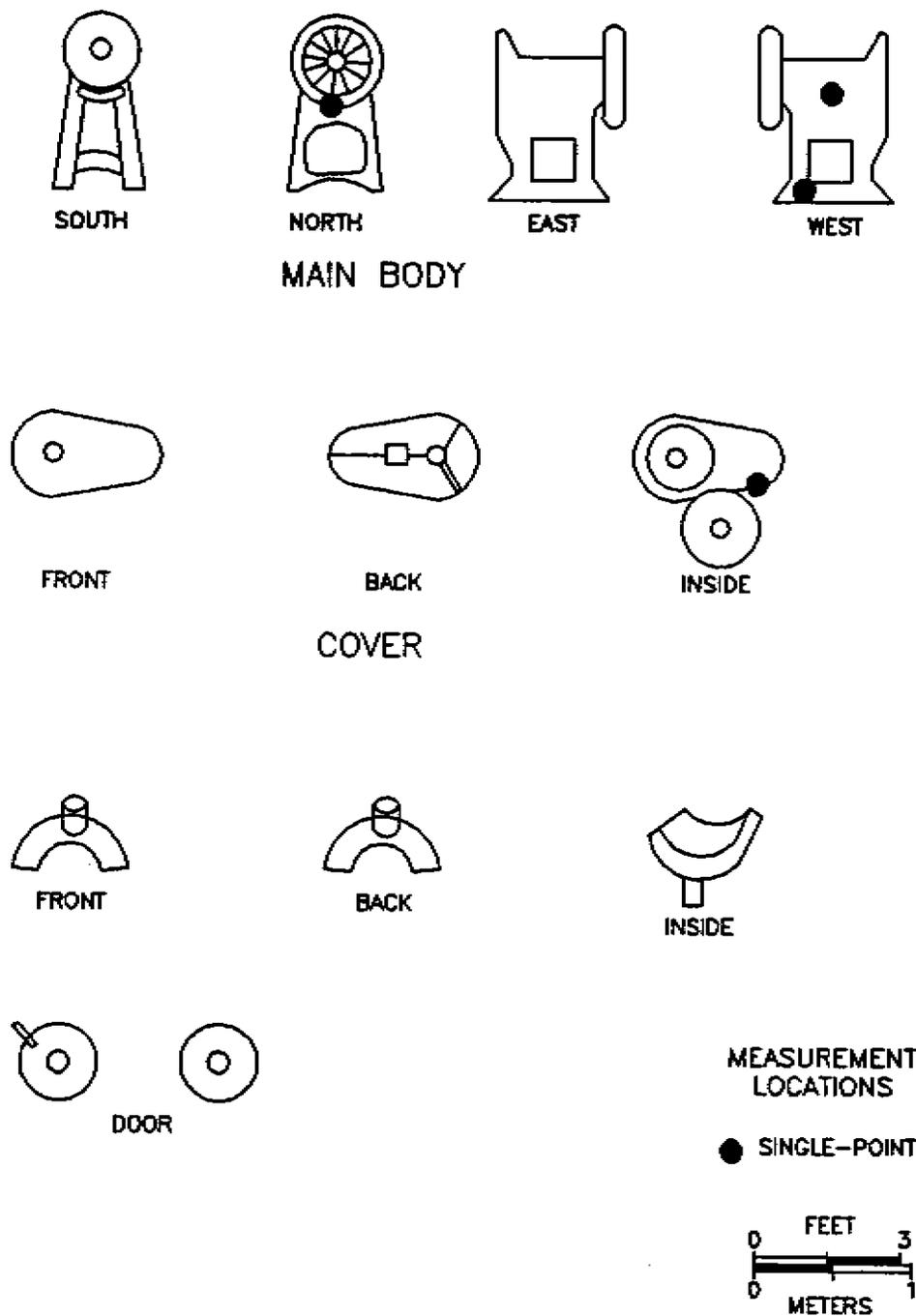


FIGURE 52: Building 30, Fabrication Room, Extruder #38348, Indicating Measurement Locations

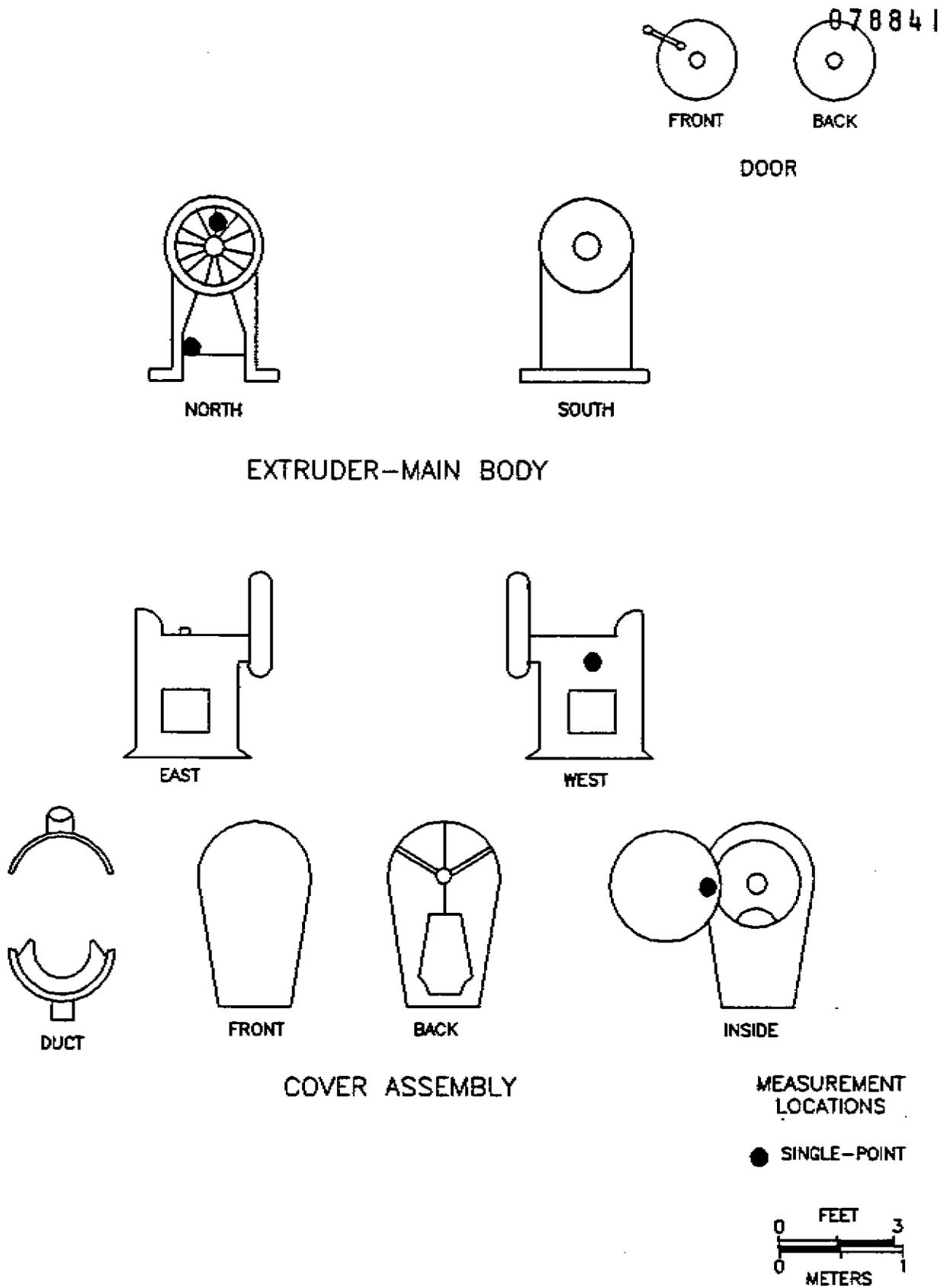


FIGURE 53: Building 30, Fabrication Room, Extruder #38347, Indicating Measurement Locations

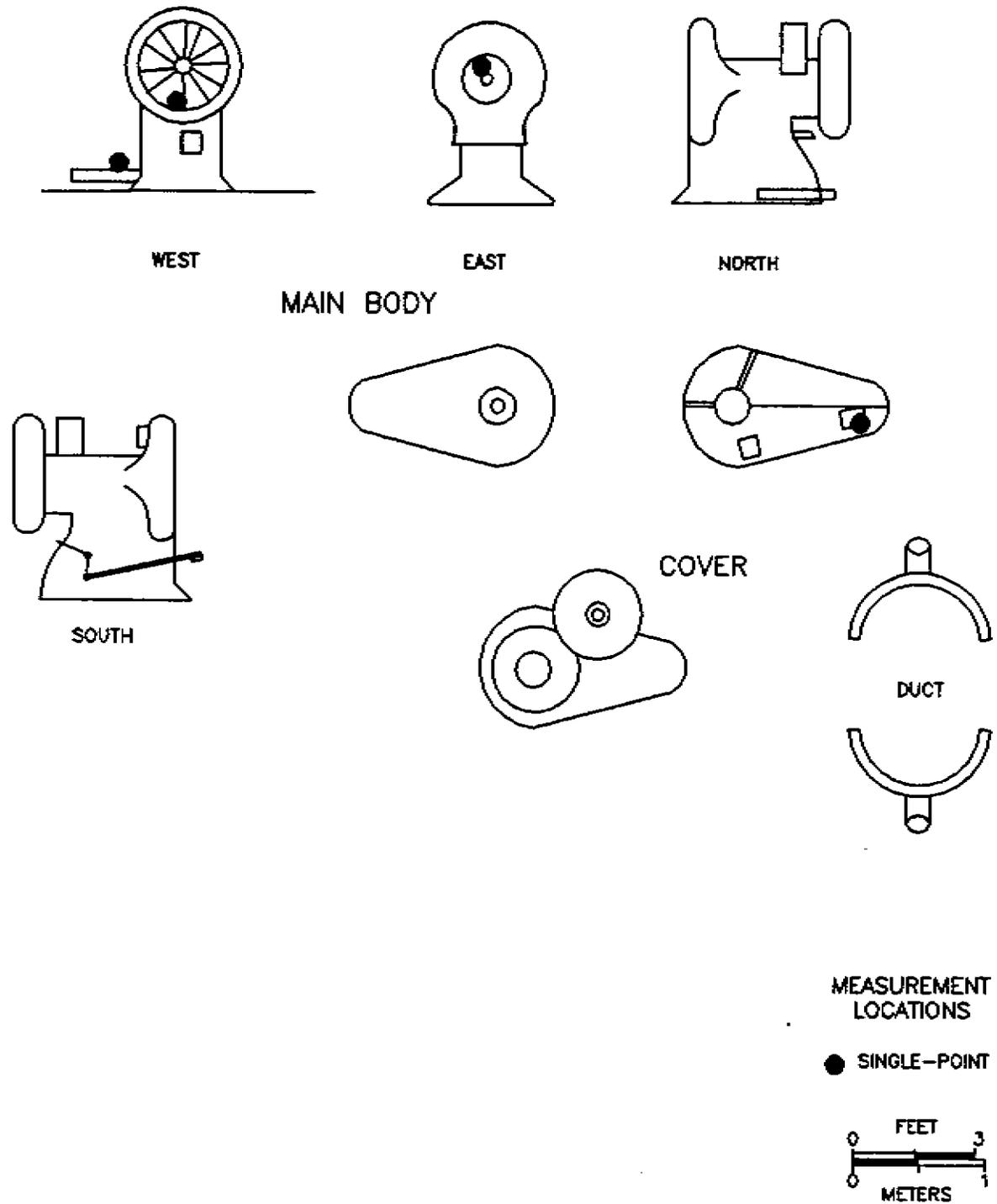


FIGURE 54: Building 30, Fabrication Room, Extruder #40659, Indicating Measurement Locations

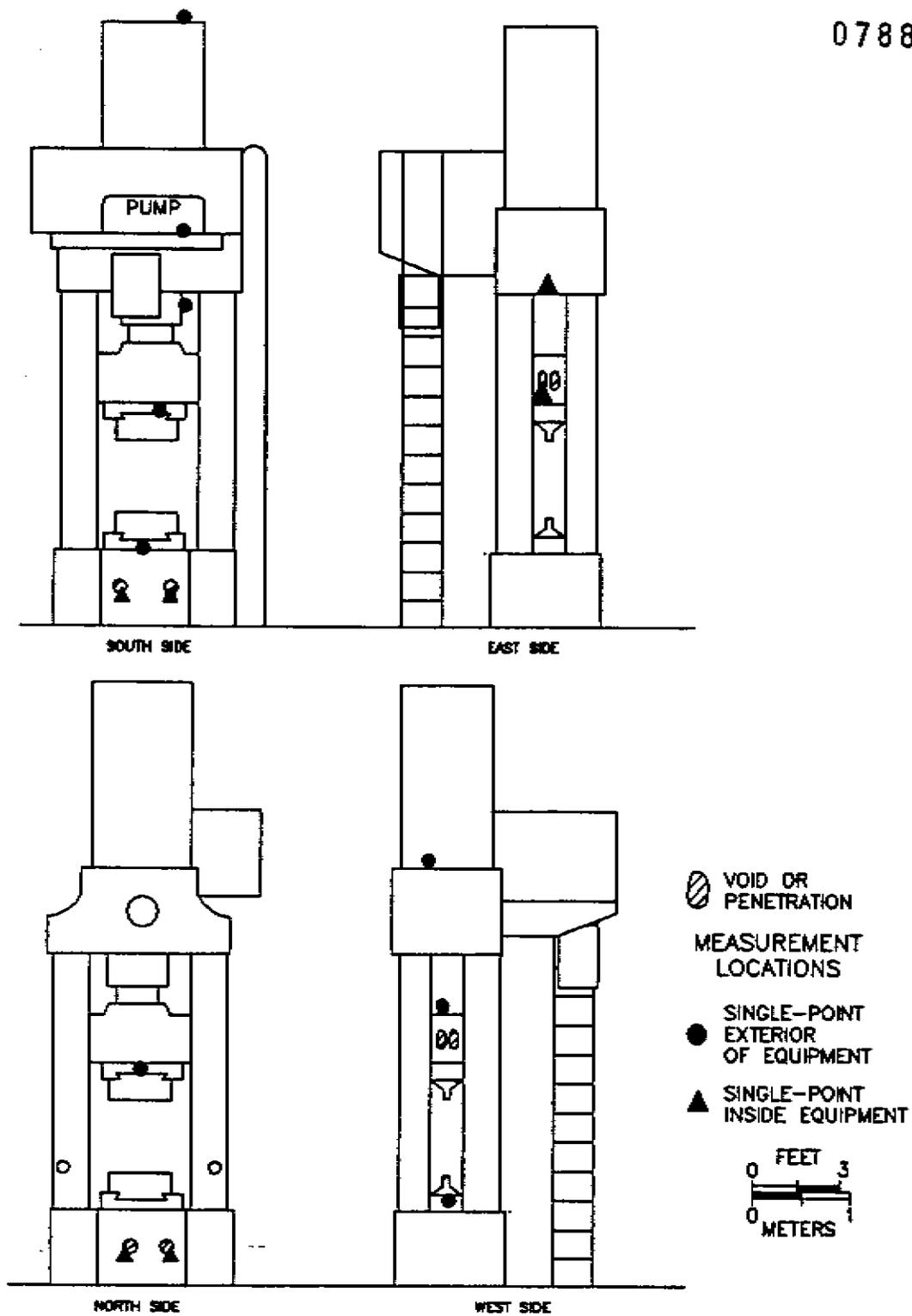
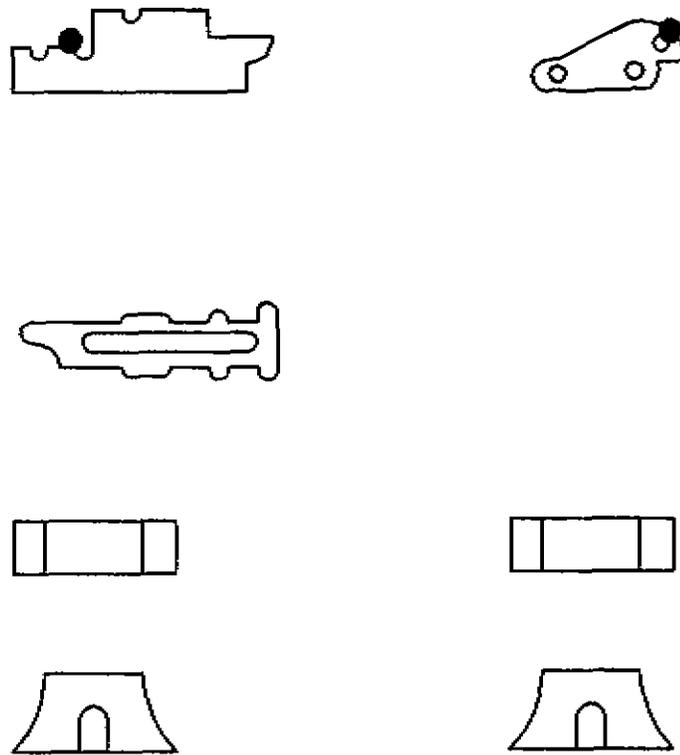


FIGURE 55: Building 30, Fabrication Room, HPM Hydraulic Press #34469, Indicating Measurement Locations



MEASUREMENT  
LOCATIONS

● SINGLE-POINT



FIGURE 56: Building 30, Fabrication Room, Parts of Shear #33988, Indicating Measurement Locations

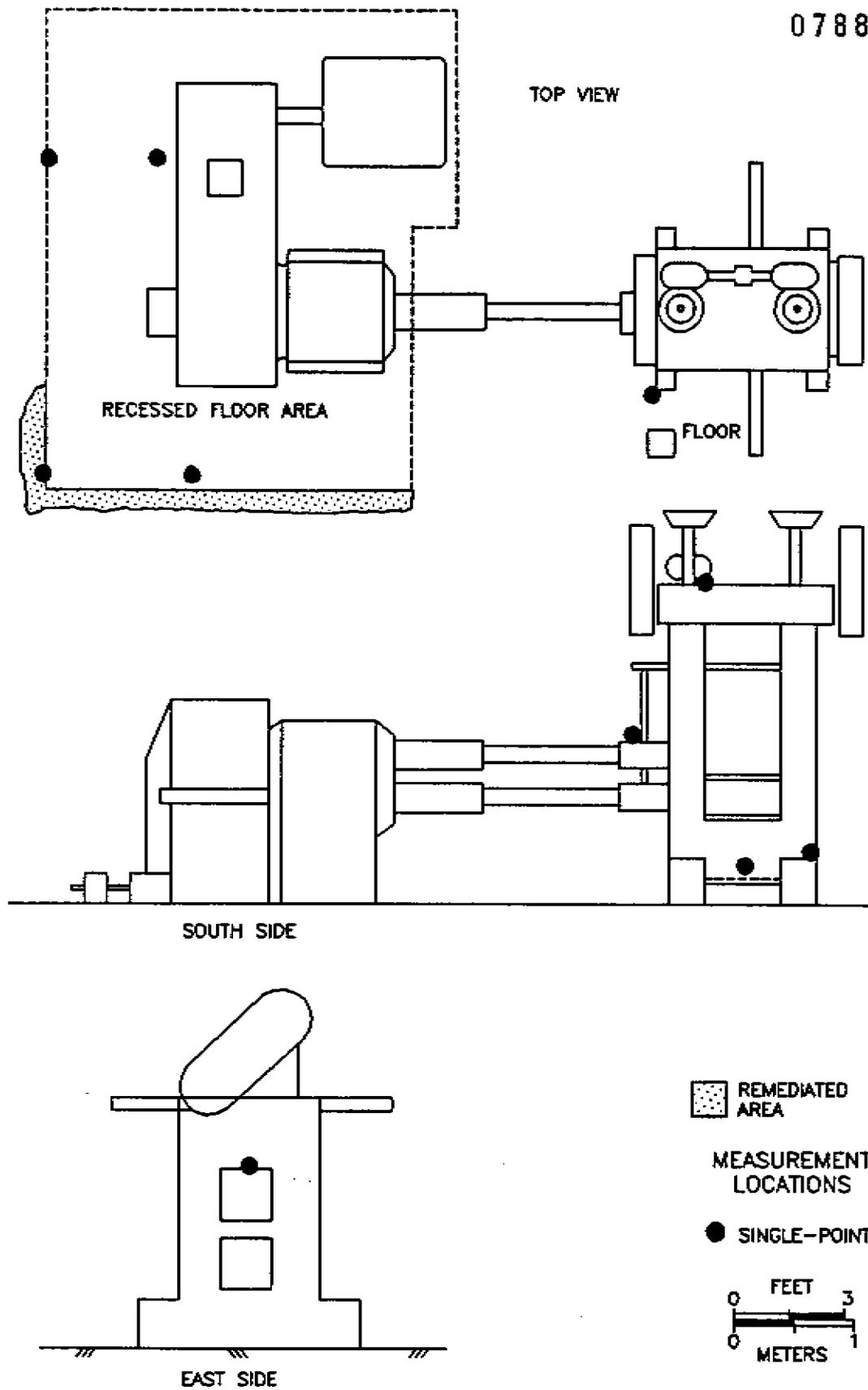


FIGURE 57: Building 30, Fabrication Room, Loma Roller #53550, Indicating Measurement Locations

**TABLE 1**  
**SUMMARY OF SURFACE ACTIVITY MEASUREMENTS**  
**ALBANY RESEARCH CENTER**  
**ALBANY, OREGON**

BLDG.	ROOM	LOCATION*	# OF GRID BLKS OR LOCATIONS MEASURED	HIGHEST GRID BLOCK AVERAGE DPM/100 cm <sup>2</sup>		TOTAL ACTIVITY DPM/100 cm <sup>2</sup>		REMOVABLE ACTIVITY DPM/100 cm <sup>2</sup>	
				$\alpha$	$\beta$	$\alpha$ range	$\beta$ - $\gamma$ range	$\alpha$ range	$\beta$ - $\gamma$ range
3	102	Hydraulic Press #35443	8 <sup>a</sup>	N/A	N/A	<62-220	<410 - 960	<6	<13
	103	Area Scanned only	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4	103	Trench	2 <sup>b</sup>	N/A	N/A	<83	<440 - 500	<6	<13
		Drains	4 <sup>c</sup>	N/A	N/A	N/A	<440 - 1900	<6	<13
	105	Trench	2 <sup>b</sup>	N/A	N/A	<83	<440	<6	<13
		East Pit	4 <sup>c</sup>	N/A	N/A	<83 - 340	<440 - 1500	<6	<13
		West Pit	4 <sup>c</sup>	N/A	N/A	110 - 240	940 - 1500	<6	<13
		Pit	4 <sup>c</sup>	N/A	N/A	<69 - 90	<440 - 850	<6	<13
		Mezzanine	6 <sup>d</sup> /1 <sup>e</sup>	<62	<410	<62	<410	<6-7	<13
	Exterior	Blower Platform South Wall	5 <sup>b</sup>	N/A	N/A	<62	<410 - 680	<6	<13
5	Plumbing Shop	Floor	9 <sup>f</sup> /3 <sup>g</sup>	<69	510	<69	<440 - 970	<6	<13
		Lower Walls	3 <sup>h</sup> /2 <sup>i</sup>	<69	<440	<69	<440	<6	<13
		Upper Walls	3 <sup>h</sup>	N/A	N/A	<69	<440	<6	<13
		Ceiling	3 <sup>h</sup>	N/A	N/A	<69	<440	<6	<13

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS  
ALBANY RESEARCH CENTER  
ALBANY, OREGON

BLDG.	ROOM	LOCATION*	# OF GRID BLKS OR LOCATIONS MEASURED	HIGHEST GRID BLOCK AVERAGE DPM/100 cm <sup>2</sup>		TOTAL ACTIVITY DPM/100 cm <sup>2</sup>		REMOVABLE ACTIVITY DPM/100 cm <sup>2</sup>	
				$\alpha$	$\beta$	$\alpha$ range	$\beta$ - $\gamma$ range	$\alpha$ range	$\beta$ - $\gamma$ range
		Equipment	2 <sup>†</sup>	N/A	N/A	<69	<440	<6	<13
		Roof	11 <sup>1/2</sup> <sup>†</sup>	88	<440	<69 - 150	<440	<6	<13
	Machine Shop	Exterior South Windows	10 <sup>†</sup>	N/A	N/A	<62 - 220	<410 - 700	<6	<13
		South Wall Roof Eave	7 <sup>†</sup>	N/A	N/A	<83	<440	<6	<13
		South Walls Conduit	4 <sup>†</sup>			100 - 140	<380 - 2400 <sup>†</sup>	<6	<13
17	1st Floor Mens Rm	Valve Pit	7 <sup>†</sup>	49	710	270 - 680	<410 - 2600	<6	<13
	2nd Floor Storage	Floor	1 <sup>1/2</sup> <sup>†</sup>	<83	<440	<83	<440	<6	<13
		Lower Walls	3 <sup>†</sup>	<83	<440	<83	<440	<6	<13
		Upper Walls	2 <sup>†</sup>	N/A	N/A	<83	<440	<6	<13
		North and South Trusses	11 <sup>†</sup>	N/A	N/A	<83	<440	<6	<13
		Cabinet	3 <sup>†</sup>	N/A	N/A	<62 - 160	<410 - 520	<6	15 - 19
23	Lab 1	Trench 1	4 <sup>†</sup>	N/A	N/A	<69	<440 - 1600	<6	<13
		Trench 2	4 <sup>†</sup>	N/A	N/A	<69	<440 - 1400	<6	<13

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS  
ALBANY RESEARCH CENTER  
ALBANY, OREGON

BLDG.	ROOM	LOCATION*	# OF GRID BLKS OR LOCATIONS MEASURED	HIGHEST GRID BLOCK AVERAGE DPM/100 cm <sup>2</sup>		TOTAL ACTIVITY DPM/100 cm <sup>2</sup>		REMOVABLE ACTIVITY DPM/100 cm <sup>2</sup>	
				$\alpha$	$\beta$	$\alpha$ range	$\beta$ - $\gamma$ range	$\alpha$ range	$\beta$ - $\gamma$ range
		Trench 3	6*	N/A	N/A	<69	<440 - 560	<6	<13
		Trench 4	4*	N/A	N/A	<69	<410	<6	<13
		Trench 5	5*	N/A	N/A	<69	<410	<6	<13
		Trench 17	6 <sup>1</sup> / <sub>2</sub> *	98	800	<69 - 130	<440 - 1800	<6	<13
		Trench 18	10*	N/A	N/A	<62 - 200	<410 - 2300	<6	<13
		Trench 19	4*	N/A	N/A	<62	560 - 900	<6	<13
		Valve Pit	2*	N/A	N/A	<69	<440	<6	<13
		Lower North Wall	3*	N/A	N/A	<83	<440 - 920	<6	<13
		North Wall/ Floor Interface	6 <sup>1</sup> / <sub>1</sub> *	<83	560	<83	<440 - 1000	<6	<13
		Upper North Wall	14 <sup>1</sup> / <sub>1</sub> *	<83	1300	<83 - 90	<440 - 2400	<6	<13
		Blower North Wall	2*	N/A	N/A	<83	<440	<6	<13
23	Lab 1	Floor North of Thorium Room	5 <sup>1</sup> / <sub>1</sub> *	<83	470	<83	<440 - 520	<6	<13

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS  
ALBANY RESEARCH CENTER  
ALBANY, OREGON

BLDG.	ROOM	LOCATION*	# OF GRID BLKS OR LOCATIONS MEASURED	HIGHEST GRID BLOCK AVERAGE DPM/100 cm <sup>2</sup>		TOTAL ACTIVITY DPM/100 cm <sup>2</sup>		REMOVABLE ACTIVITY DPM/100 cm <sup>2</sup>	
				$\alpha$	$\beta$	$\alpha$ range	$\beta$ - $\gamma$ range	$\alpha$ range	$\beta$ - $\gamma$ range
	Thorium	Blower Outside Best Wall	3 <sup>a</sup>	N/A	N/A	<83	<440	<6	<13
		Floor	13 <sup>b</sup> /1 <sup>c</sup>	<62	750	<83	<410 - 970	<6	<13
		Lower Walls	10 <sup>b</sup> /3 <sup>c</sup>	<83	990	<83	<410 - 1200	<6	<13
		Upper Walls/Ceiling	11 <sup>b</sup> /2 <sup>c</sup>	64	960	<62 - 93	<410 - 1100	<6	<13
	Crusher Room	Conical Mill #38362	7 <sup>a</sup>	N/A	N/A	200	<300 - 6200	<6 - 15	<13 - 15
26	103	Floor	5 <sup>b</sup> /1 <sup>c</sup>	<62	<410	<62 - 68	<410	<6	<13
		Lower Walls	1 <sup>b</sup> /2 <sup>c</sup>	<62	<410	<62	<410	<6	<13
		Upper Walls/Ceiling	6 <sup>a</sup>	N/A	N/A	<62	<410 - 860	<6	<13
		North Pit	5 <sup>a</sup>	N/A	N/A	<62 - 68	<410 - 600	<6	<13
		South Pit	5 <sup>a</sup>	N/A	N/A	<62	<410	<6	<13
28	Basement	Toledo Scale #31155	10 <sup>a</sup>	N/A	N/A	<62	<410 - 1000	<6	<13
		Braun Pulverizer #39514	2 <sup>a</sup>	N/A	N/A	<69 - 120	<440 - 620	<6	<13

TABLE 1 (Continued)

**SUMMARY OF SURFACE ACTIVITY MEASUREMENTS  
ALBANY RESEARCH CENTER  
ALBANY, OREGON**

BLDG.	ROOM	LOCATION*	# OF GRID BLKS OR LOCATIONS MEASURED	HIGHEST GRID BLOCK AVERAGE DPM/100 cm <sup>2</sup>		TOTAL ACTIVITY DPM/100 cm <sup>2</sup>		REMOVABLE ACTIVITY DPM/100 cm <sup>2</sup>	
				$\alpha$	$\beta$	$\alpha$ range	$\beta$ - $\gamma$ range	$\alpha$ range	$\beta$ - $\gamma$ range
30	Fab Shop	East Floor	17 <sup>1/2</sup>	<83	840	<83 - 85	<440 - 4100	<6	<13
		East Wall	1 <sup>1</sup>	<83	<440	<83	<440	<6	<13
		Hydrogen Oven #50430	1 <sup>1</sup>	N/A	N/A	<83	<440	<6	<13
		Keith Oven #52478	4 <sup>1</sup>	N/A	N/A	<69	<440	<6	<13
		HEVI-DUTY Oven #35693	7 <sup>1</sup>	N/A	N/A	<69 - 75	<440	<6	<13
		Portable Rolling Mill #52544	3 <sup>1</sup>	N/A	N/A	<69	<300 - 750	<6	<13
		Hoskins Furnace #39242	4 <sup>1</sup>	N/A	N/A	<69 - 75	<440 - 490	<6	<13
		Portable Electric Oven #34840	6 <sup>1</sup>	N/A	N/A	<69	<440	<6	<13
		Loma Roller #53550	10 <sup>1</sup>	N/A	N/A	<62 - 110	<410 - 910	<6	<13
		Shear (Disassembled) #33988	2 <sup>1</sup>	N/A	N/A	<62 - 93	1800 - 17,000	<6	<13
		HPM Hydraulic Press #34469	15 <sup>1</sup>	N/A	N/A	<62 - 1800	<410 - 24,000	<6 - 9	<13 - 14
		Steel Anvils HPM Press	2 <sup>1</sup>	N/A	N/A	<62	<410	<6	<13

TABLE I (Continued)

**SUMMARY OF SURFACE ACTIVITY MEASUREMENTS  
ALBANY RESEARCH CENTER  
ALBANY, OREGON**

BLDG.	ROOM	LOCATION*	# OF GRID BLKS OR LOCATIONS MEASURED	HIGHEST GRID BLOCK AVERAGE DPM/100 cm <sup>2</sup>		TOTAL ACTIVITY DPM/100 cm <sup>2</sup>		REMOVABLE ACTIVITY DPM/100 cm <sup>2</sup>	
				$\alpha$	$\beta$	$\alpha$ range	$\beta$ - $\gamma$ range	$\alpha$ range	$\beta$ - $\gamma$ range
		Extruder #40659	4 <sup>†</sup>	N/A	N/A	<62 - 68	<410	<6	<13
		Extruder #38347	4 <sup>†</sup>	N/A	N/A	<62	<410	<6	<13
		Extruder #38348	4 <sup>†</sup>	N/A	N/A	<62	<410	<6	<13

\*Refer to Figures 3-57.

<sup>†</sup>Number of single-point measurements.

<sup>‡</sup>Number of 5-point measurements.

<sup>§</sup>5-Point measurements not performed. Additional single-point measurements performed within a 1 m<sup>2</sup> area resulted in an average activity of < 1000 dpm/100 cm<sup>2</sup>.

**TABLE 2**  
**RADIONUCLIDE CONCENTRATIONS IN SOIL**  
**ALBANY RESEARCH CENTER**  
**ALBANY, OREGON**

Location <sup>a</sup>	Th-232 Concentration (pCi/g)
Building 4, Room 105 East Pit	1.6 ± 0.5 <sup>b</sup>
Building 4, Room 106 Pit	1.1 ± 0.5
Building 5, Plumbing Shop	0.7 ± 0.5
Building 17, Men's Room, Valve Pit	1.2 ± 0.5
Building 26, Room 103, North Pit	<1.5

<sup>a</sup>Refer to Figures 8, 9, 13, 19, and 41.

<sup>b</sup>Uncertainties represent the 95% confidence level, based only on counting statistics; additional laboratory uncertainties of ± 6 to 10% have not been propagated into these data.

## REFERENCES

1. P.R. Cotten, Verification of Remediation, Albany Research Center, Albany, Oregon, October 1989.
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3. T.J. Vitkus, Verification Survey of Phase II Remedial Actions, Albany Research Center, Albany, Oregon, Interim Report II, March 1991.