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Formerly Utilized Sites Remedial Action Program (FUSRAP)

ADMINISTRATIVE RECORD

for

Niagara Falls Storage Site

U.S. Department of Energy

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ORISE
OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION

ENERGY/ENVIRONMENT SYSTEMS DIVISION

November 4, 1992

W. Alexander Williams, Ph.D.
Designation and Certification Manager
EM-421
Trevion II
U.S. Department of Energy
Washington, DC 20585-0002

SUBJECT: FINAL REPORT - RADIOLOGICAL SURVEY OF BUILDINGS 401A, 402, 416, AND 429 NIAGARA FALLS STORAGE SITE, LEWISTON, NY

Dear Dr. Williams:

Enclosed are three copies of the subject final report. The report describes the results of the radiological survey conducted by ORISE's Environmental Survey and Site Assessment Program during the period March 9-13, 1992. The findings of the Building 434 site verification survey performed during this period will be provided in a separate report for the outdoor land areas.

Please do not hesitate to contact either Michele Landis at (615) 576-2908 or myself at (615) 576-5073 should you have any questions or we may provide additional information.

Sincerely,

Timothy J. Vitkus
Environmental Project Leader
Environmental Survey and
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TJV:kew

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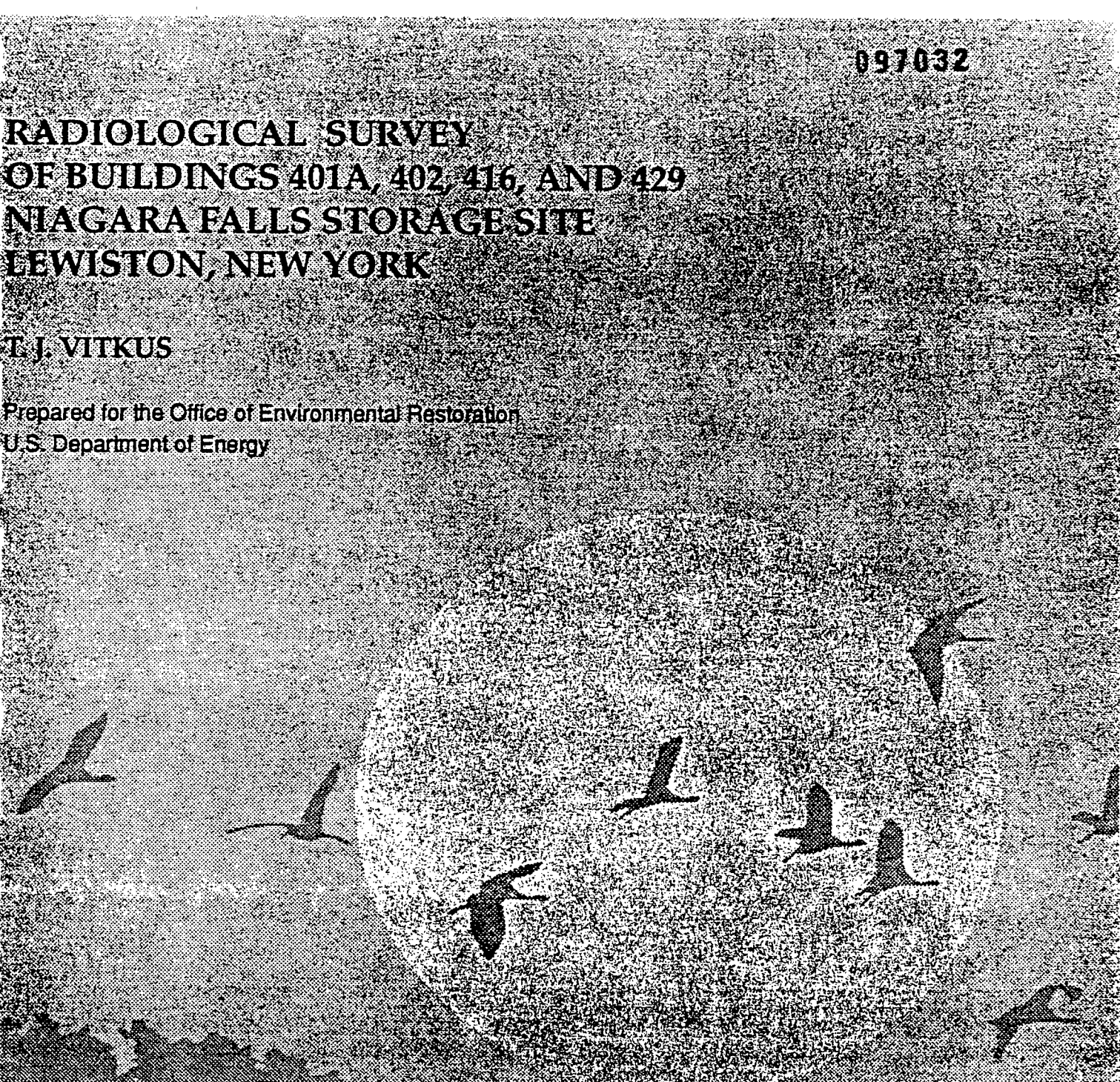
RADIOLOGICAL SURVEY OF BUILDINGS 401A, 402, 416, AND 429 NIAGARA FALLS STORAGE SITE LEWISTON, NEW YORK

T. J. VITKUS

Prepared for the Office of Environmental Restoration
U.S. Department of Energy



ORISE
OAK RIDGE INSTITUTE FOR SCIENCE AND EDUCATION
Environmental Survey and Site Assessment Program
Energy/Environment Systems Division

RADIOLOGICAL SURVEY OF BUILDINGS 401A, 402, 416, AND 429 NIAGARA FALLS STORAGE SITE LEWISTON, NEW YORK

Prepared by

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Office of Environmental Restoration
Department of Energy

FINAL REPORT

OCTOBER 1992

This report is based on work performed under contract number DE-AC-05-76OR00033 with the U.S. Department of Energy

RADIOLOGICAL SURVEY
OF BUILDINGS 401A, 402, 416, AND 429
NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

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RADIOLOGICAL SURVEY
OF BUILDINGS 401A, 402, 416, AND 429
NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

INTRODUCTION

The Niagara Falls Storage Site (NFSS) is a U.S. Department of Energy (DOE) surplus facility, located in Niagara County of western New York. The NFSS property is a portion of the U.S. Army's former Lake Ontario Ordnance Works (LOOW) site. The 3040 hectare (7500 acre) LOOW was established in the early 1940's for the production of TNT during World War II. These operations ceased and approximately 608 hectares (1500 acres) of the property was transferred to the Manhattan Engineer District (MED), predecessor agency to the Atomic Energy Commission (AEC).

The MED/AEC actively used the site from 1944 until 1971. In 1944, the MED began to use buildings and open areas on the site for the storage of pitchblende (uranium ore) processing residues from Linde Air Products Division in Tonawanda, NY and the Middlesex Sampling Plant in Middlesex, NJ. From 1947 until 1954, the AEC continued to use the site for storage of radioactively contaminated equipment, materials, and residues which resulted from the decontamination and ongoing uranium extraction activities at other MED controlled facilities. Additional wastes received for storage and subsequent transshipment included uranium and thorium processing wastes from various New York State facilities, material from Knolls Atomic Power Laboratory, the University of Rochester and the Electro-Metallurgical Company. The final operation at the site occurred when the original site steam plan, Building 401, was modified and used for boron-10 production from 1953 to 1959 and again between 1965 and 1971.

At various times during and subsequent to MED/AEC site operations, cleanup activities were conducted to reduce contamination to historically applicable levels. These remedial actions resulted in all but approximately 77.3 hectares (191 acres) of the original area being declared surplus and sold or transferred by the General Services Administration to private, commercial, or government agencies. The remaining property was retained by the AEC and its successor, the DOE, and placed in caretaker status.

Various organizations have performed radiological surveys since 1971 to characterize the contamination remaining at the site. Residual contamination, primarily uranium and its daughter products-mainly radium, as well as smaller quantities of thorium, strontium-90, and cesium-137, were identified during these surveys on both the site and surrounding vicinity properties. The residual contamination identified exceeded the current guidelines for release to unrestricted use; therefore, the property was included in the DOE's Formerly Utilized Sites Remedial Action Program (FUSRAP). Bechtel National, Inc. (BNI), the FUSRAP Project Management Contractor (PMC), has performed remedial actions to remove both on and off-site contamination and has consolidated the materials in an engineered containment structure on the NFSS.

Most of the original site buildings were demolished during remediation. The only remaining structures include Buildings 401, 401A, 402, 403, 416, 429, and the Hittman building. The current site project plan calls for the demolition of 401A, 402, 416 and 429 and off-site release of the debris.

At the request of the DOE, the Environmental Survey and Site Assessment Program (ESSAP) of Oak Ridge Associated Universities/Oak Ridge Institute for Science and Education (ORAU/ORISE) performed a radiological survey of the interior surfaces and exterior grounds of Buildings 401A, 402, 416, and 429. This report describes the procedures and results of that survey.

SITE DESCRIPTION

The NFSS is located approximately 6 km northeast of the town of Lewiston, NY (Figure 1). The site is bounded on the north by H Street and on the South by R Street. Security fences form the east and west boundaries, which roughly parallel Castle Garden Road and Lutts Road. The remaining buildings on the site, identified as Buildings 401, 401A, 402, 403, 416, 429, and the Hittman Building are clustered in the southeast and south central portions of the site (Figure 2). Buildings 401 and 403 and the Hittman Building were not surveyed as part of this project.

Buildings 401A, 402, 416, and 429 are single-story structures and contain combined floor space of approximately 380 m^2 (Figures 3-6). Building construction is masonry block on concrete slabs with corrugated sheet-metal roofs. Exterior walls are constructed with a transite-type overlayment. The interior surfaces include tile floors, gypsum board or painted masonry block walls, and suspended "false" ceilings, with the exception of Building 401A where the ceiling was the underside of the metal roof.

OBJECTIVE

The objective of the survey was to determine the radiological status of Buildings 401A, 402, 416, and 429, relative to the FUSRAP guidelines and DOE Order 5400.5, Chapter IV. DOE/EM will use the results to determine if the building rubble may be disposed of without radiological restrictions.

PROCEDURES

The survey was conducted during the period of March 9-13, 1992, in accordance with the site specific survey plan, using procedures and instrumentation described in the ESSAP Survey Procedures Manual. Appendices A and B provide an overview of instruments and methods.

REFERENCE GRID

A reference grid, consisting of 1 m^2 grid blocks, was established on the floor and lower walls (up to 2 m) in those rooms larger than 10 m^2 in each of the four buildings. Measurements and smear sampling locations on ungridded surfaces were referenced to the floor or wall grid or to prominent building features.

SURFACE SCANS

Alpha, beta, and gamma surface scans were performed on 100 % of the floors and lower interior walls as well as portions of the ceilings, exterior walls, and exterior grounds for residual direct

radiation. Scans were performed using gas proportional and NaI(Tl) detectors, coupled to ratemeters or ratemeter-scalers with audible indicators. Locations of elevated direct radiation, identified by surface scans, were marked for further investigation.

SURFACE ACTIVITY MEASUREMENTS

Direct measurements to determine total alpha and beta surface activity were performed on 119 randomly selected grid blocks, representing approximately 10% of the total grid blocks in the four buildings. The initial survey plan stated that 25% of the total floor and lower wall grid blocks would be measured. However, based on findings as the survey progressed, the total number of grid blocks selected was reduced. Measurements were performed at the center and four points equidistant between the center and grid block corners using gas proportional detectors coupled to ratemeter-scalers. The five measurements were then averaged to determine average activity within each 1 m^2 grid block.

Single-point direct measurements were performed every 20 m^2 on ungridded surfaces (upper walls and ceilings), in rooms less than 10 m^2, on exterior building surfaces and at areas of elevated direct radiation identified by the surface scans. A total of 125 single-point direct measurements were made on ungridded interior and exterior building surfaces using gas proportional detectors coupled to ratemeter-scalers.

Smear samples to determine removable surface activity were collected from the highest direct measurement location within each grid block and from each single-point measurement location. Refer to Figures 7 through 38 for measurement locations.

SOIL SAMPLING

A surface soil sample (0-15 cm) was collected from an area of elevated direct radiation detected within the drainage ditch located to the south of Building 429 (Figure 39).

SAMPLE ANALYSIS AND DATA INTERPRETATION

Samples and measurement data were returned to ESSAP's Oak Ridge, TN facility for analysis and interpretation. The soil sample was analyzed by gamma spectrometry and the spectrum reviewed for Cs-137, Ra-226, Th-232, U-235, and U-238 concentrations. The spectrum was also reviewed for any other identifiable photopeaks. Results were reported in units of pCi/g. Smear samples were analyzed with a low background proportional counter for gross alpha and gross beta activity. Removable activity data and direct measurement data were then converted to units of dpm/100 cm^2.

FINDINGS AND RESULTS

SURFACE SCANS

Interior surface scans identified a 1 m^2 area of residual alpha activity, on the floor of Building 401A, Room 11 grid block A,0 (Figure 17). Scans of the buildings' exterior grounds identified one location of elevated direct gamma radiation in the drainage ditch southwest of Building 429 (Figure 39). An additional location of elevated direct alpha radiation was noted in the closet of Building 416; however, further investigation did not detect alpha activity above site guidelines. All other surface scans were in the range of ambient site background.

SURFACE ACTIVITY

Total and removable surface activity measurements are summarized in Table 1. The range of average total activity within 1m^2 grid blocks for each building were as follows: Building 401A, <31 to 110 dpm/100 cm^2, alpha, and <430 dpm/100 cm^2, beta; Building 402, <47 dpm/100 cm^2, alpha, and <430 dpm/100 cm^2, beta; Building 416, <37 to 42 dpm/100 cm^2, alpha, and <430 dpm/100 cm^2, beta; and Building 429, <47 dpm/100 cm^2, alpha, and <430 dpm/100 cm^2, beta. Individual surface activity measurement ranges for each building were: Building 401A, <31 to 200 dpm/100 cm^2, alpha, and <430 to

760 dpm/100 cm^2, beta; Building 402, <47 dpm/100 cm^2, alpha, and <430 to 470 dpm/100 cm^2, beta; Building 416, <47 to 180 dpm/100 cm^2, alpha, and <430 dpm/100 cm^2, beta; Building 429, <47 dpm/100 cm^2, alpha, and <430 to 440 dpm/100 cm^2, beta. Measurements on the exterior surfaces of the buildings ranged from <47 to 100 dpm/100 cm^2 and <320 dpm/100 cm^2 for alpha and beta respectively. Removable surface activities for the buildings were <12 dpm/100 cm^2 for alpha and <15 to 25 dpm/100 cm^2 for beta.

RADIONUCLIDE CONCENTRATIONS IN SOIL

Background radionuclide concentration ranges in soil for the Lewiston, New York area, determined from an earlier survey, were as follows: Ra-226, 0.1 to 1.2 pCi/g; U-235, <0.1 to 0.5 pCi/g; U-238, <2.2 to 6.3 pCi/g; Th-232, 0.3 to 1.2 pCi/g; and Cs-137, <0.1 to 1.1 pCi/g. The radionuclide concentrations in the soil sample collected from the localized area of elevated direct radiation within the drainage ditch were as follows: Ra-226, 6.2 pCi/g; U-235, 0.7 pCi/g; U-238, 3.9 pCi/g; Th-232, 0.9 pCi/g; and Cs-137, 0.8 pCi/g.

COMPARISON OF RESULTS WITH GUIDELINES

DOE surface contamination and generic soil concentration guidelines for the release of a FUSRAP facility to unrestricted use are found in References 2 through 4. Argonne National Laboratory developed site specific soil concentration guidelines that were subsequently issued by DOE in an August 30, 1988 memorandum.[5] Appendix C provides a summary of the DOE guidelines.

A number of radionuclides have been previously identified in characterization samples. Two of the radionuclides identified, Ra-226 and Sr-90, are included in the most restrictive guideline categories. As the potential contaminants on surfaces were unknown, the most restrictive guidelines were selected for alpha and beta surface activity data comparison.

The Ra-226 surface contamination guidelines are as follows:

Total Activity

100 dpm/100 cm^2, averaged over 1 m^2
300 dpm/100 cm^2 maximum in 100 cm^2

Removable Activity

20 dpm/100 cm^2

The Sr-90 surface contamination guidelines are:

Total Activity

1000 dpm/100 cm^2, averaged over 1 m^2
3000 dpm/100 cm^2, maximum in 100 cm^2

Removable Activity

200 dpm/100 cm^2

Generic guidelines for residual concentrations in soil of Ra-226 and Th-232 are:

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

The site specific soil concentration guidelines are 33 pCi/g for Cs-137 and 90 pCi/g for total uranium.

With the exception of grid block A,0 in Building 401A, Room 11, where the average alpha activity within the 1 m^2 gridblock was 110 dpm/100 cm^2, all total and removable contamination levels were below these guidelines. BNI remediated this grid block during May 1992 and provided to ESSAP the post-remedial action total and removable surface activity level data for review. The data indicates that surface activity was reduced to levels below the guidelines for release to unrestricted use. Post-remedial action alpha surface activity levels for the grid block ranged from <31 to 75 dpm/100 cm^2 and averaged 49 dpm/100 cm^2.

The soil sample collected from the drainage ditch outside of Building 429 contained 5.5 pCi/g above background of Ra-226. Surface scans did not indicate that the elevated direct radiation was distributed, but rather confined to an area measuring less than 1 m^2. The DOE soil concentration guidelines provide for averaging radionuclide concentration levels over 100 m^2 areas to determine guideline compliance. A systematic soil sample, which contained 2.3 pCi/g of Ra-226, had been collected from the contiguous area during the previous radiological site survey.[1] The average soil concentration would therefore satisfy the guidelines. Concentrations of other radionuclides were below the generic or site specific guideline levels.

SUMMARY

The Environmental Survey and Site Assessment Program of ORAU/ORISE performed a radiological survey of Buildings 401A, 402, 416, and 429 during the period of March 9 through 13, 1992. The survey included surface scans, direct measurements and sample collection.

The survey identified a 1 m^2 section of floor in Building 401A, where the DOE residual surface contamination levels were exceeded. Bechtel National, Inc. performed remediation and a post-remedial action survey of the area. All final residual surface and soil contamination levels satisfy the guidelines for release to unrestriced use.

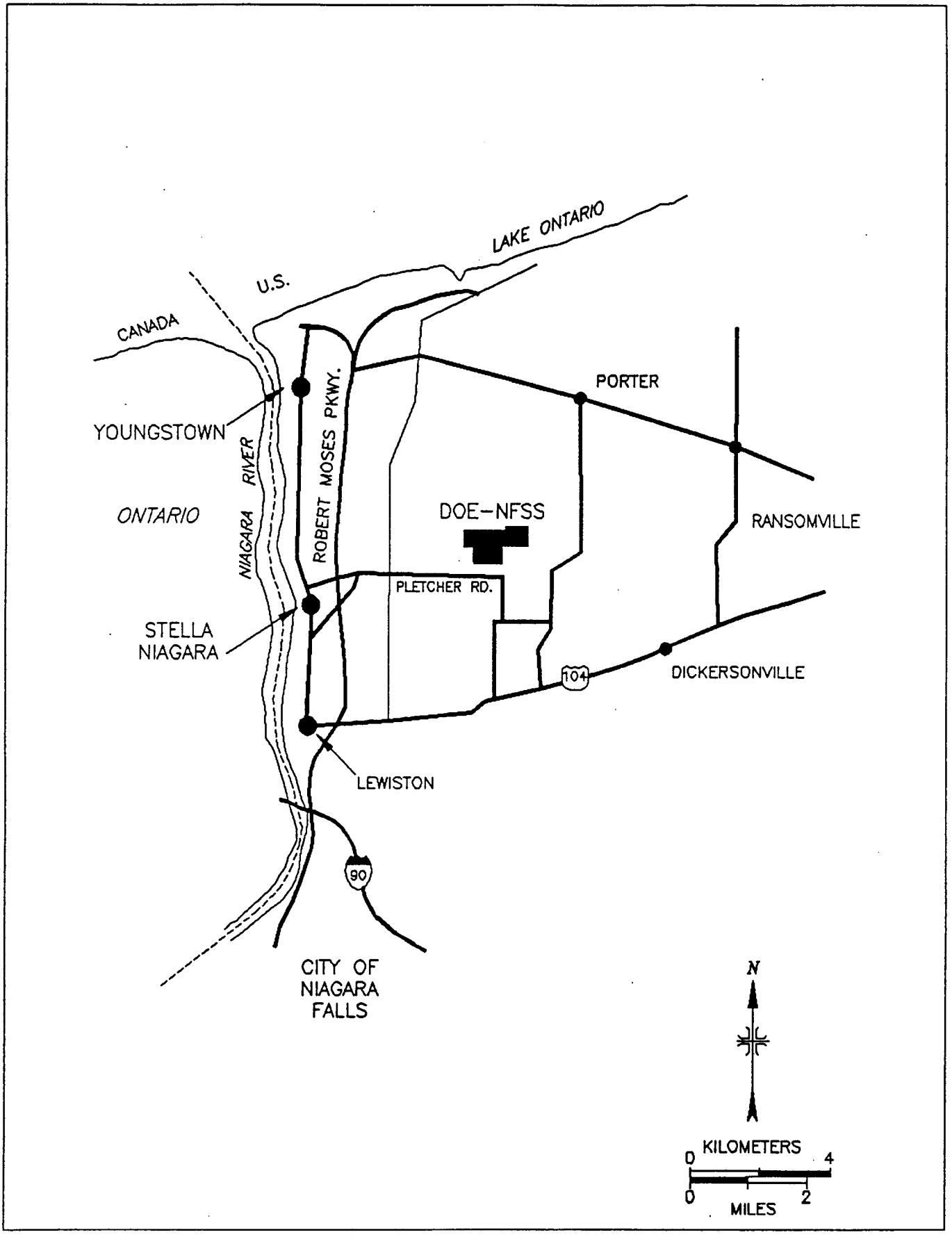

FIGURE 1: Northern Niagara County, New York – Area Map of the Niagara Falls Storage Site

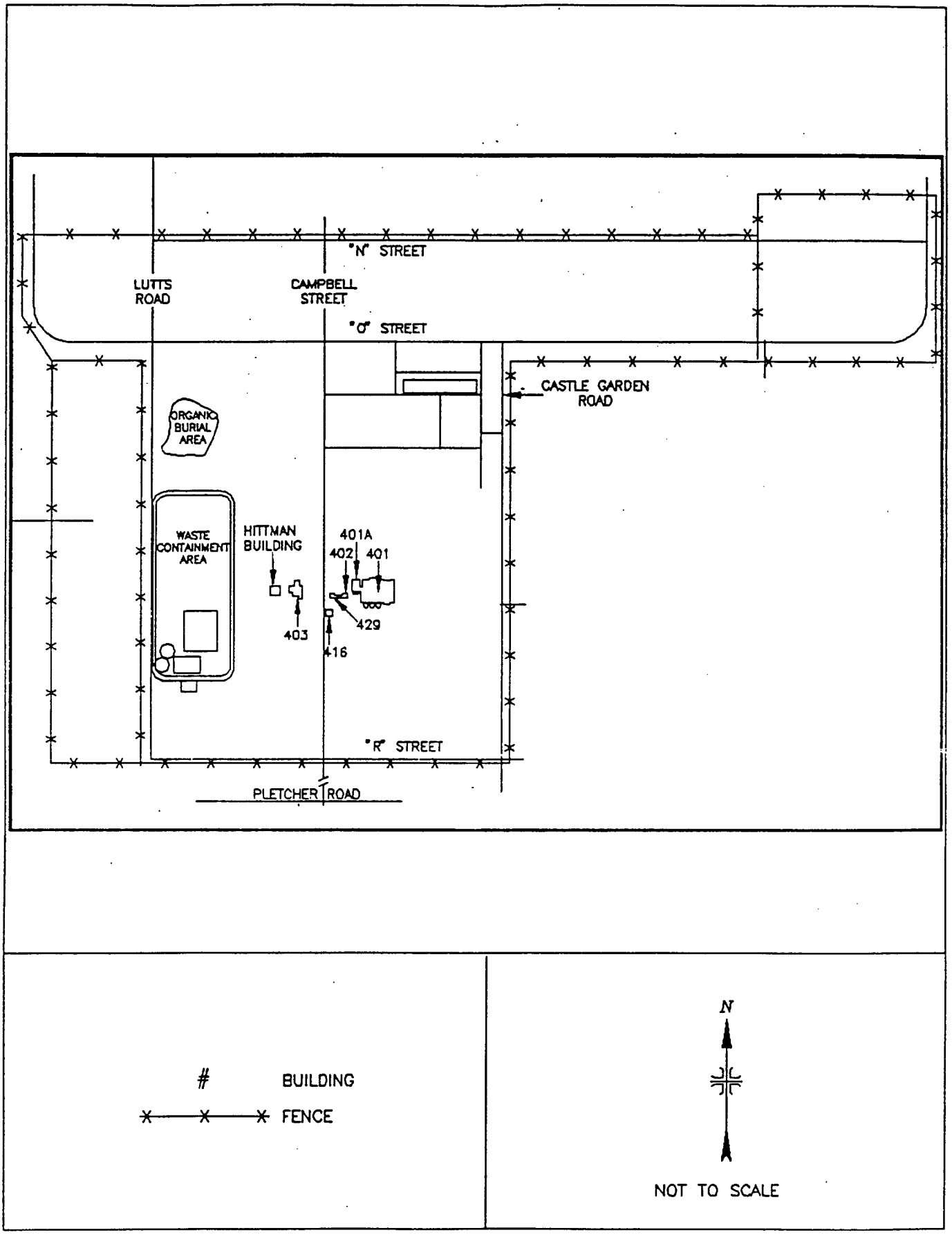

FIGURE 2: Plan View of the Niagara Falls Storage Site

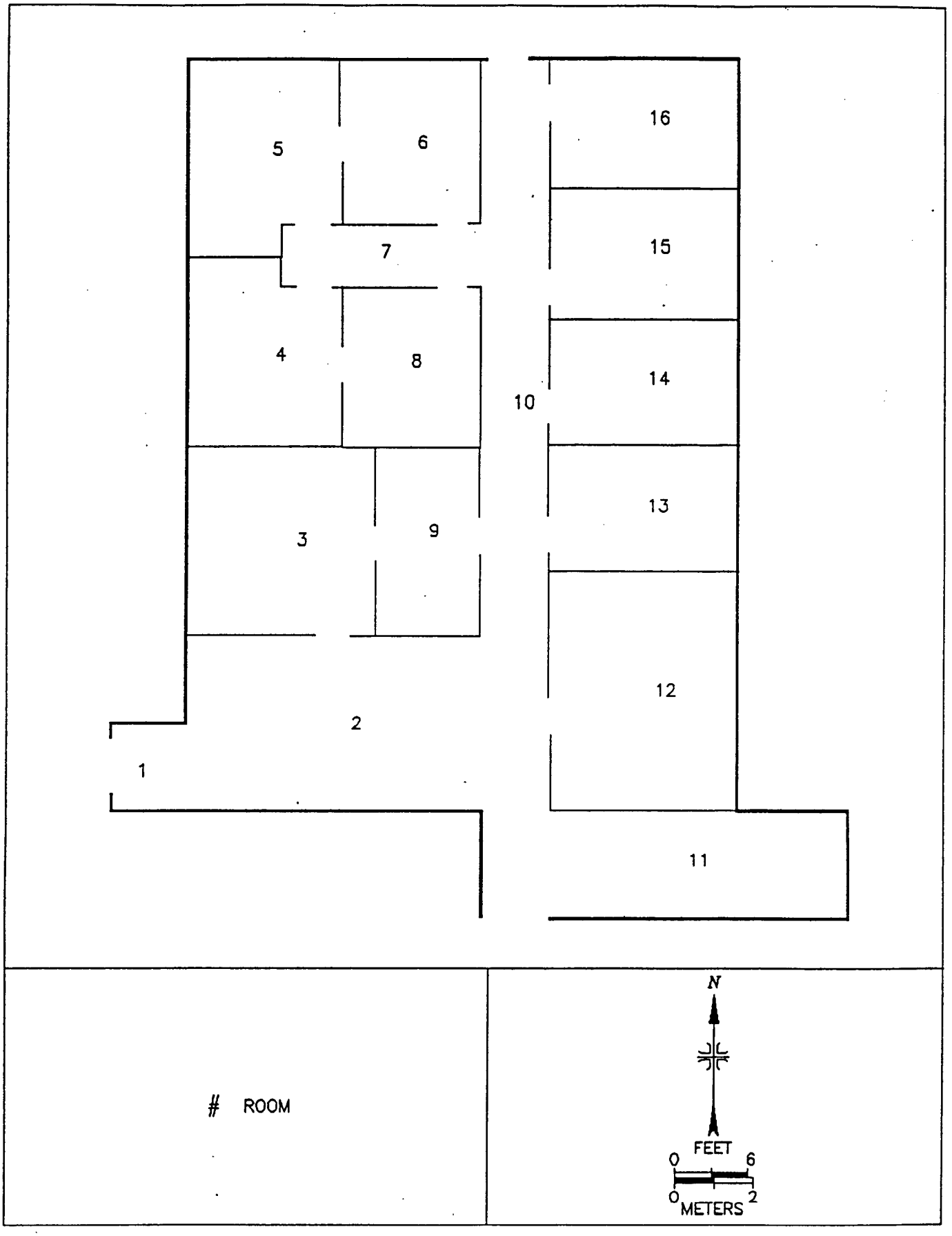

FIGURE 3: Building 401A – Floor Plan

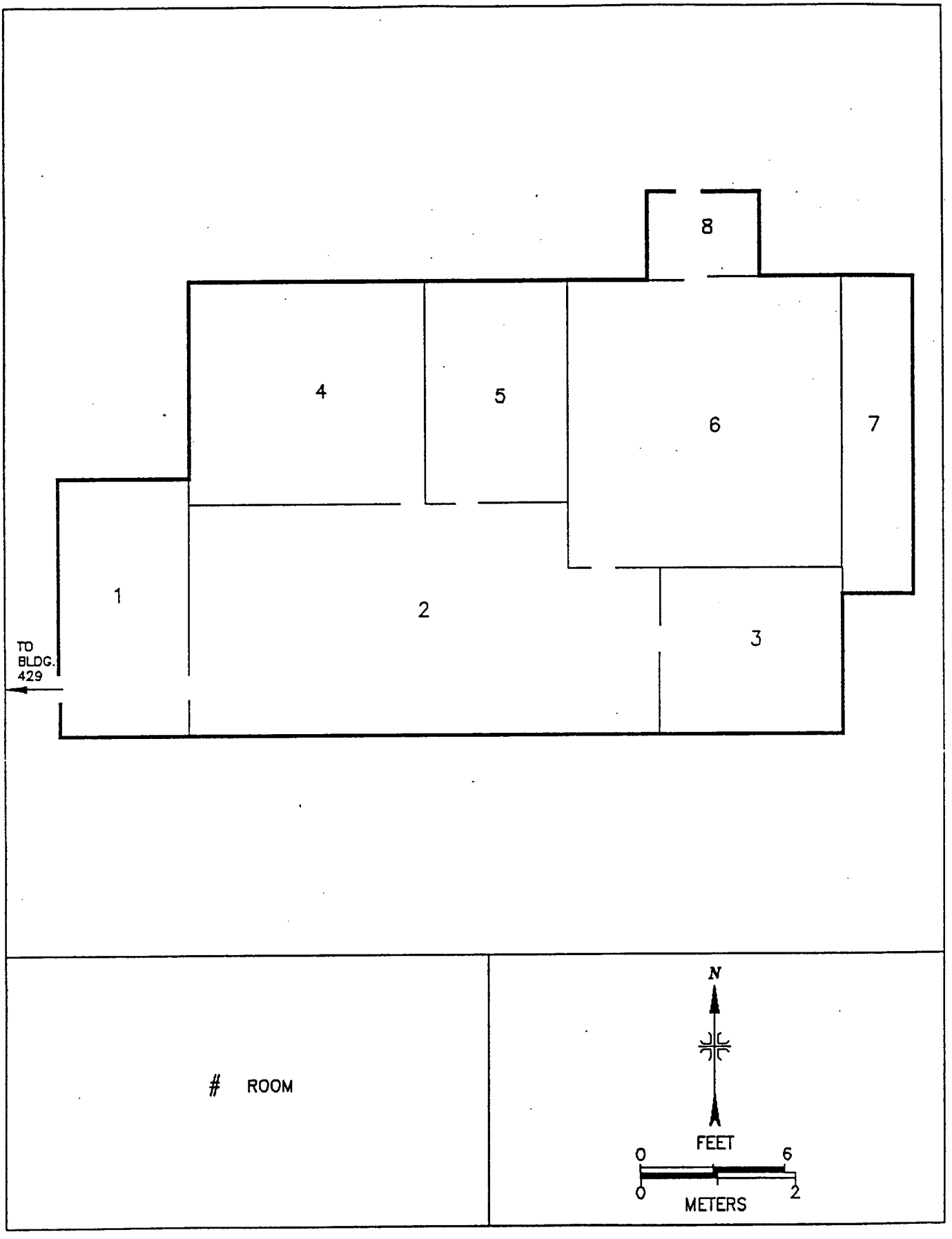

FIGURE 4: Building 402 — Floor Plan

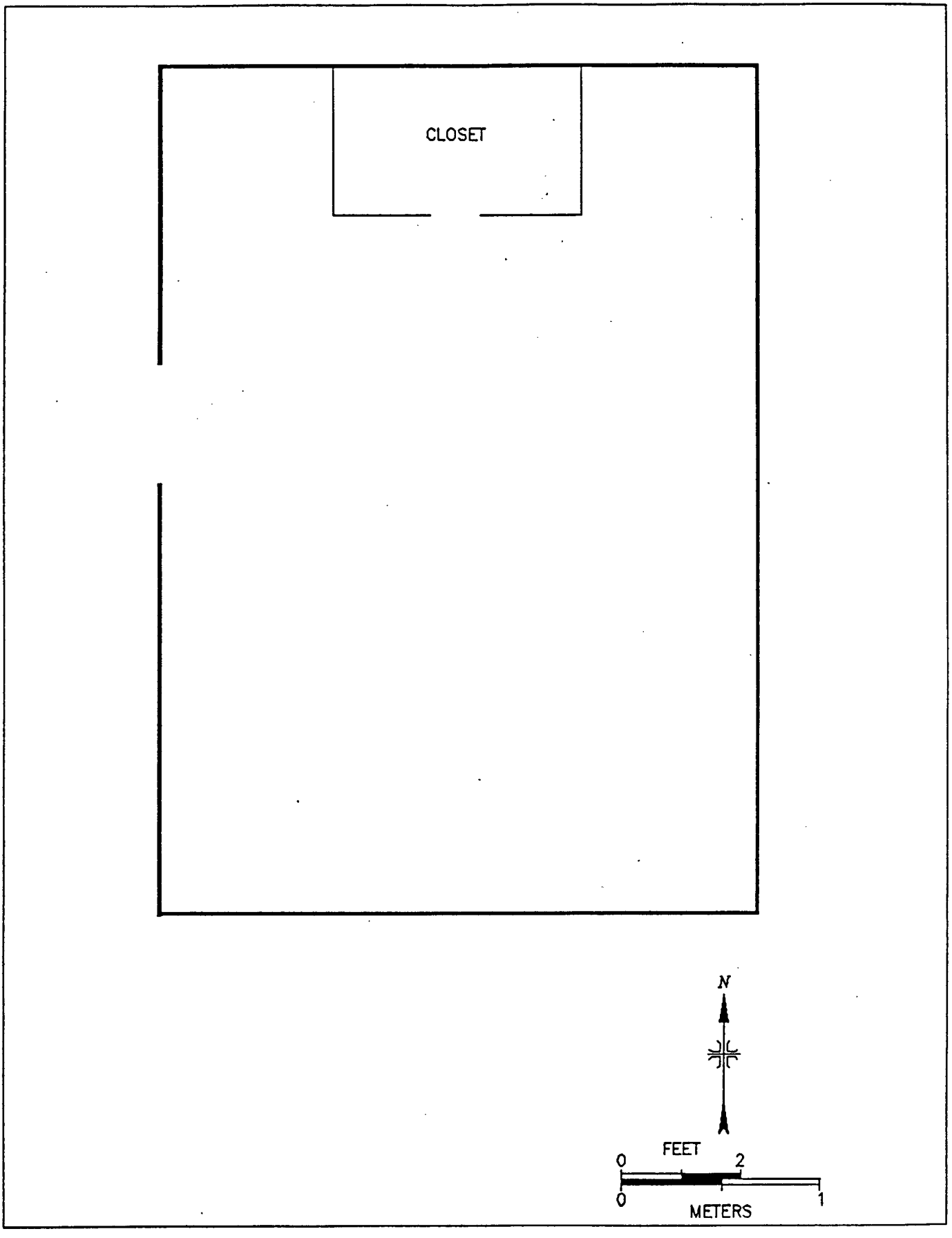

FIGURE 5: Building 416 – Floor Plan

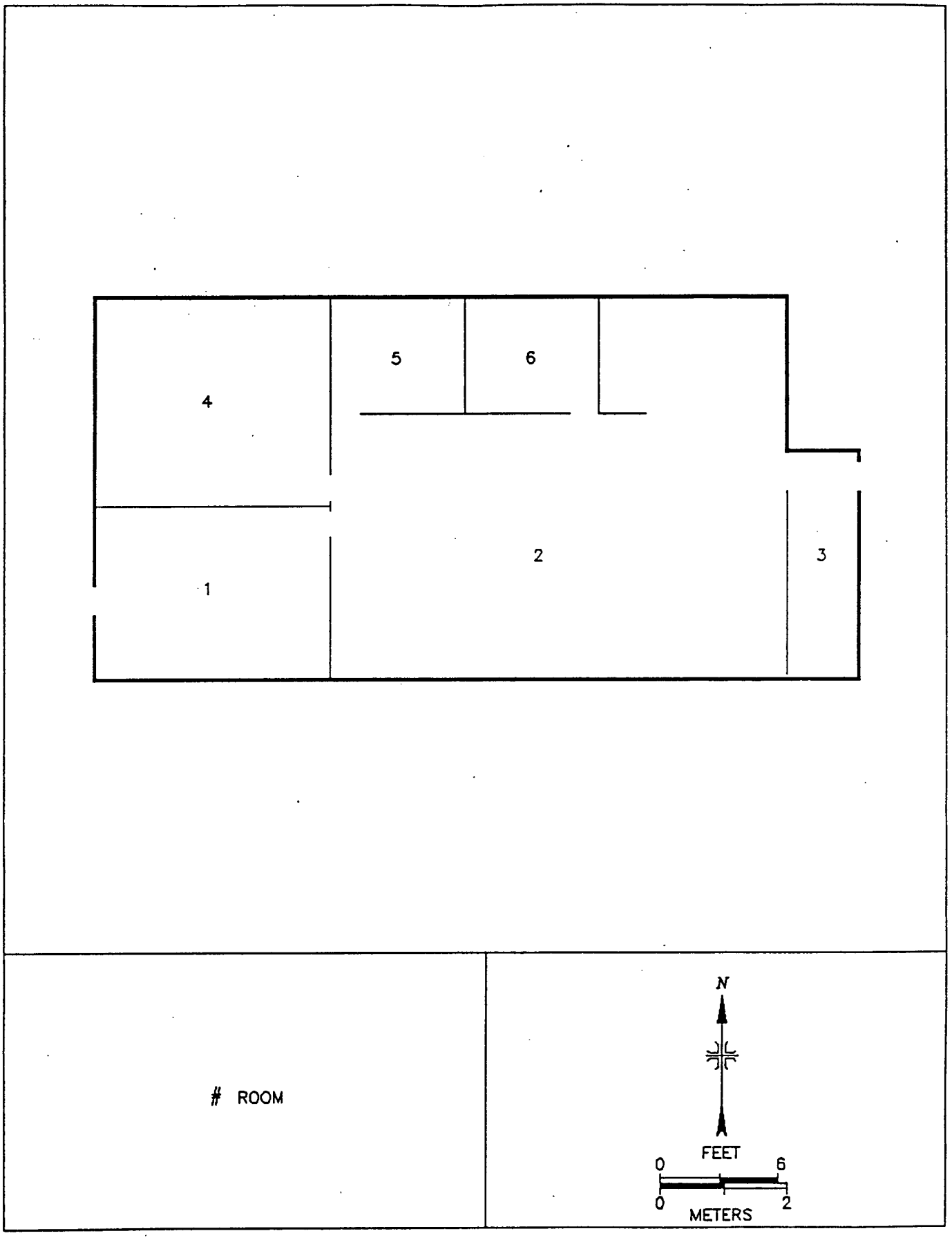

FIGURE 6: Building 429 – Floor Plan

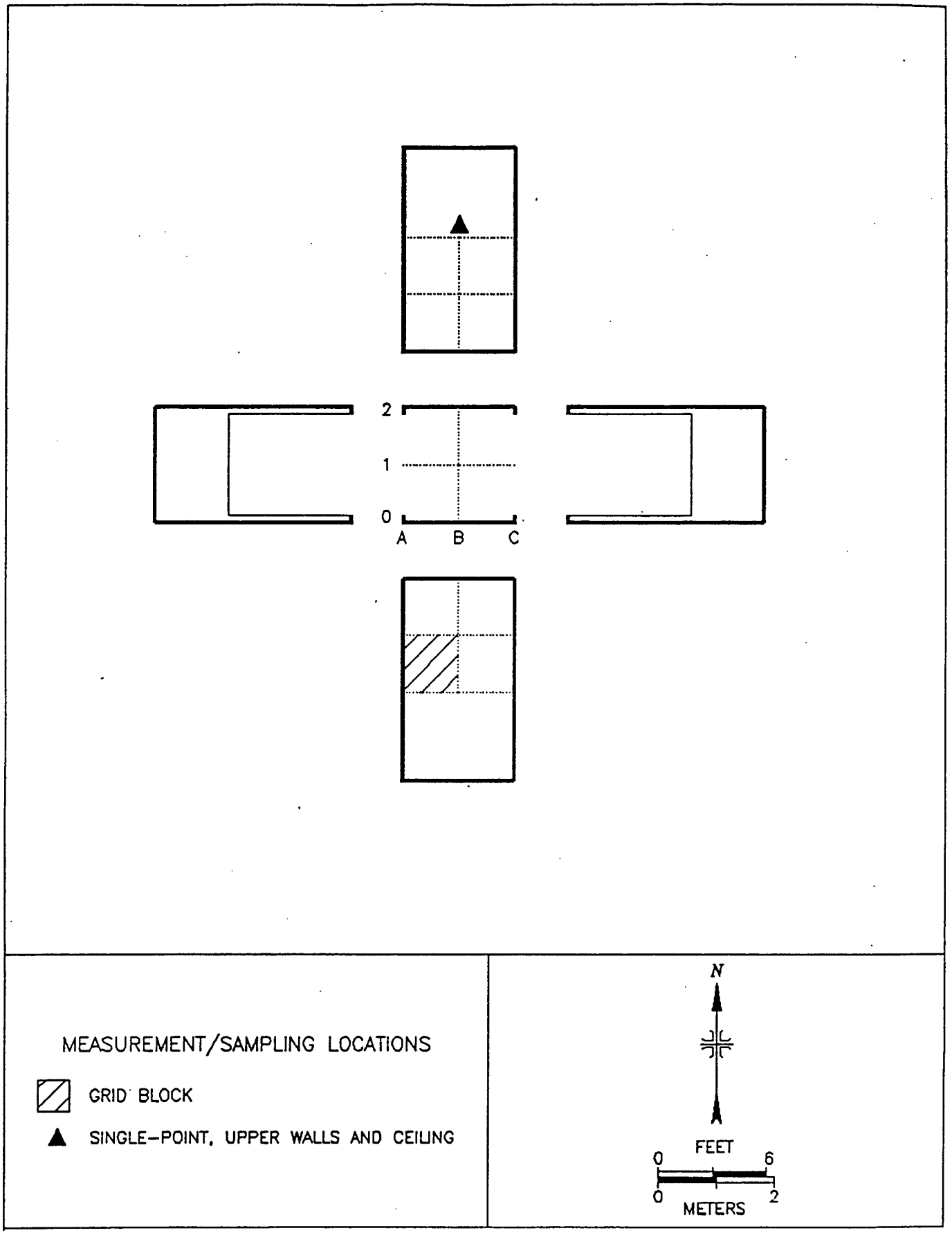

FIGURE 7: Building 401A, Room 1 – Measurement and Sampling Locations

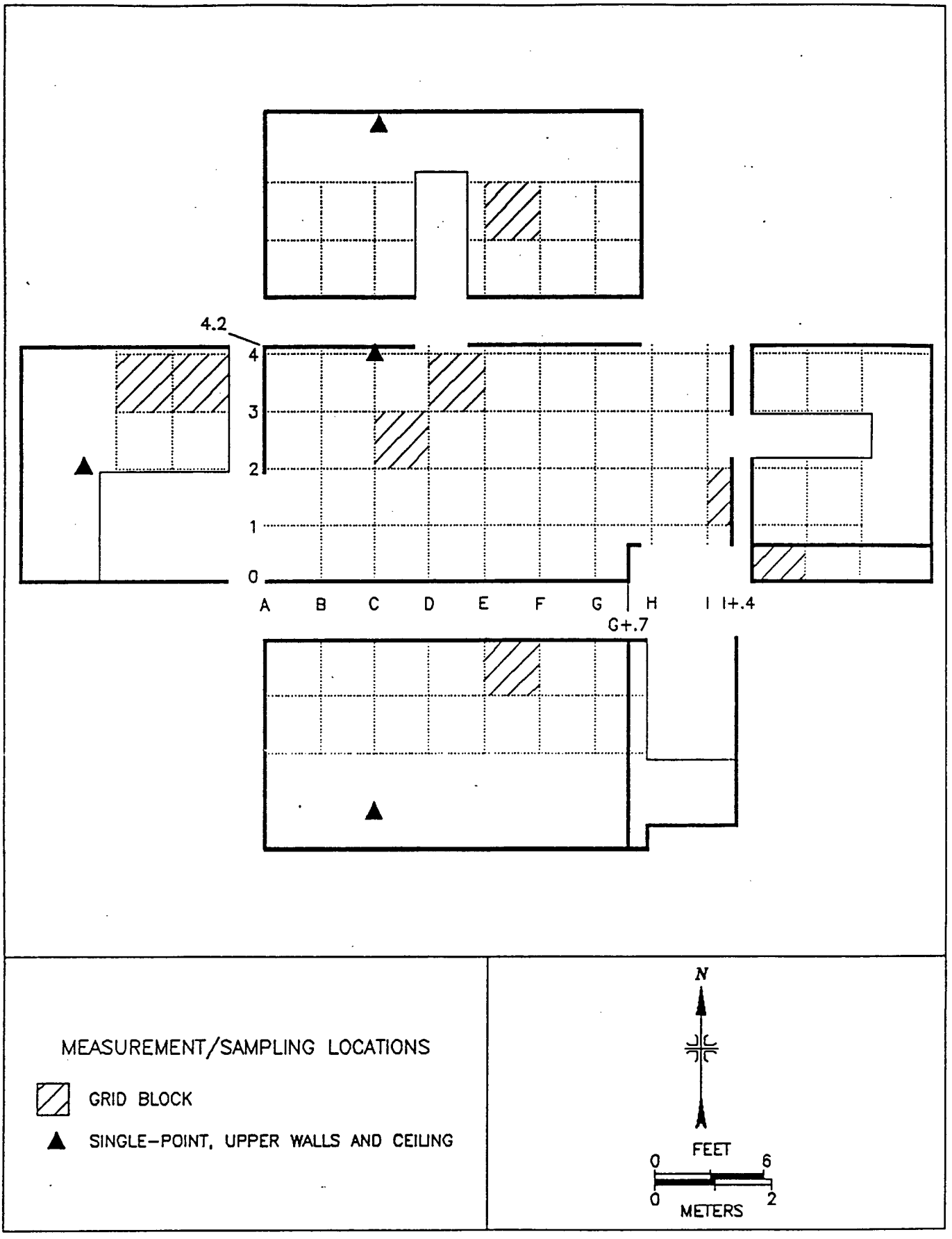

FIGURE 8: Building 401A, Room 2 – Measurement and Sampling Locations

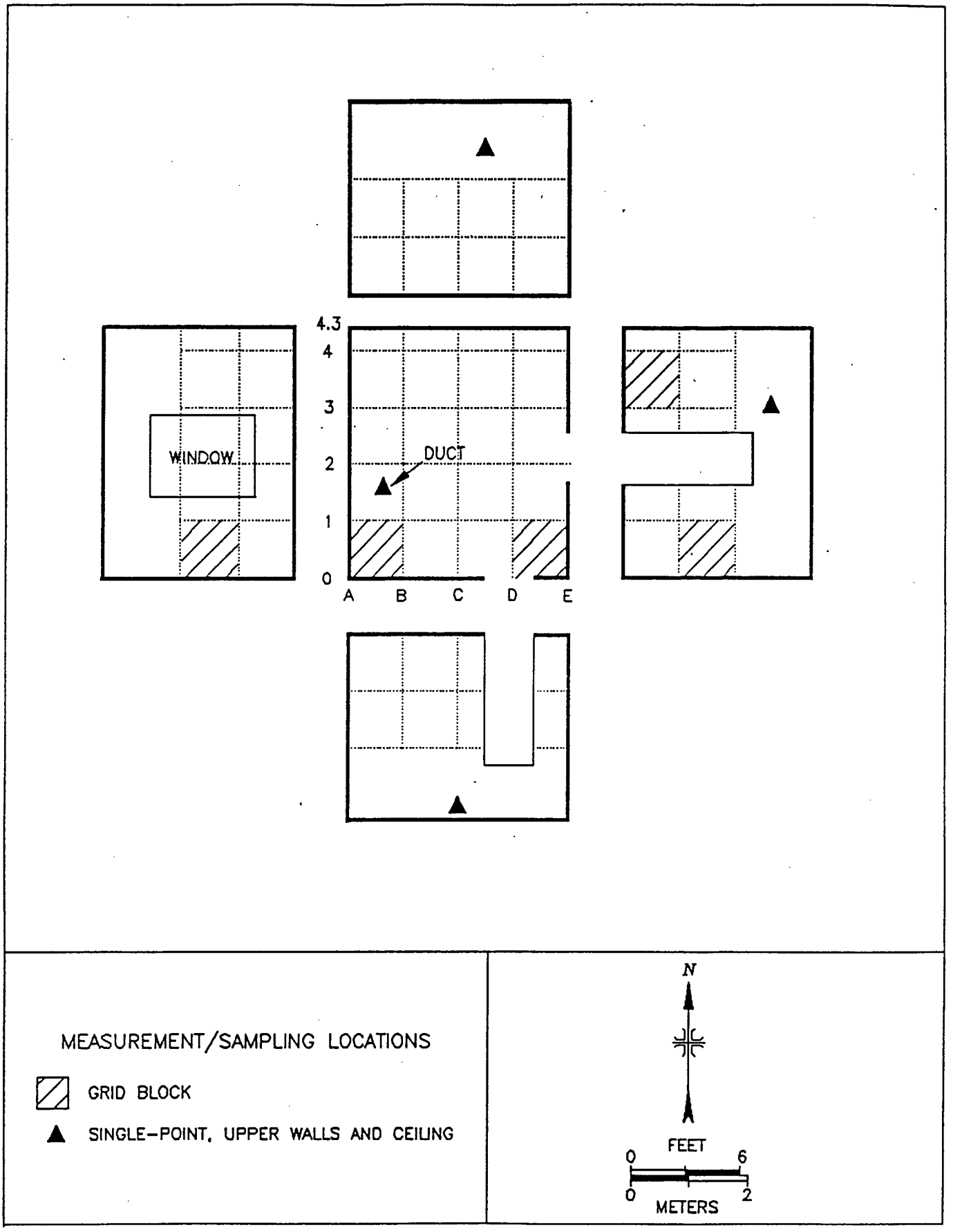

FIGURE 9: Building 401A, Room 3 – Measurement and Sampling Locations

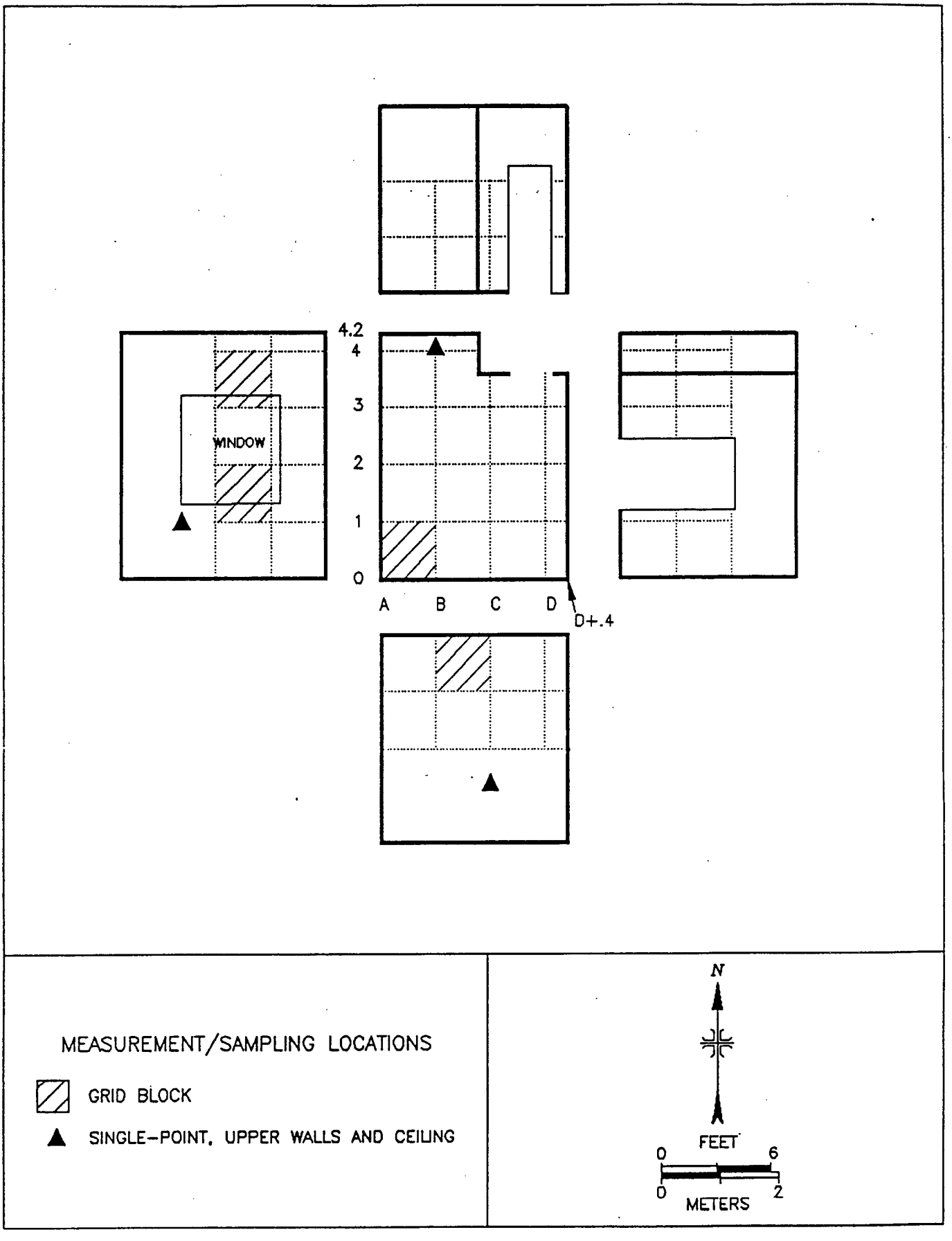

FIGURE 10: Building 401A, Room 4 – Measurement and Sampling Locations

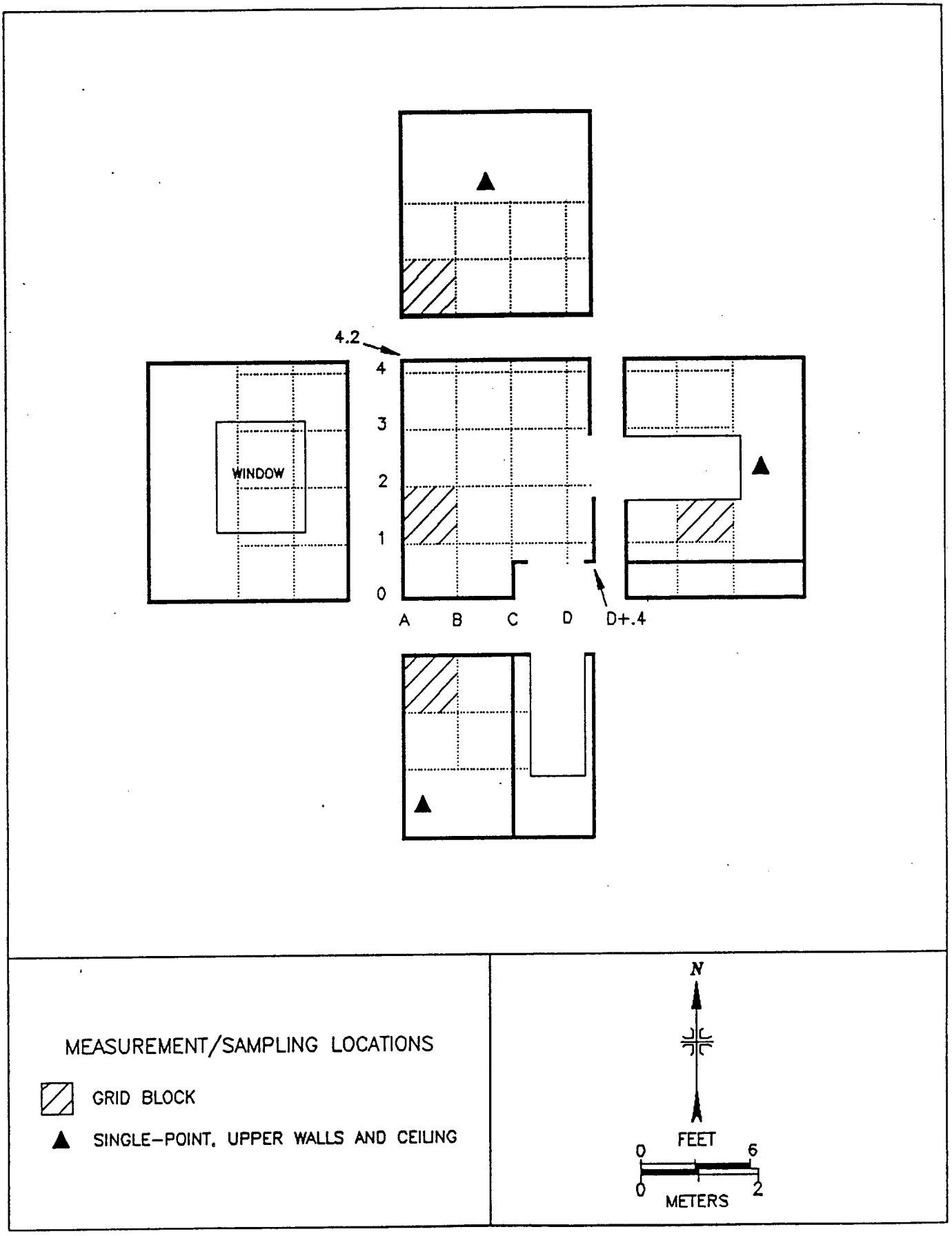

FIGURE 11: Building 401A, Room 5 – Measurement and Sampling Locations

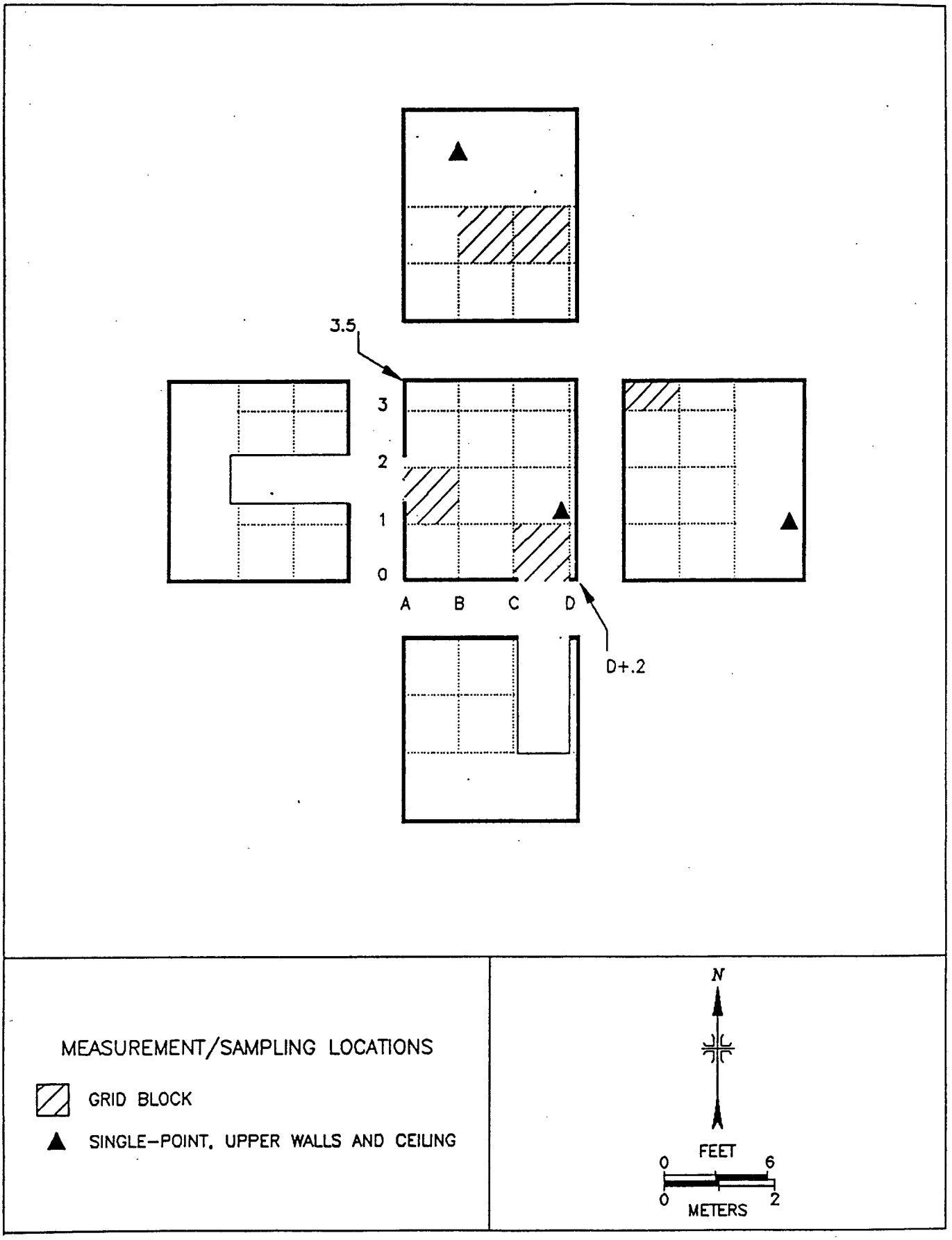

FIGURE 12: Building 401A, Room 6 – Measurement and Sampling Locations

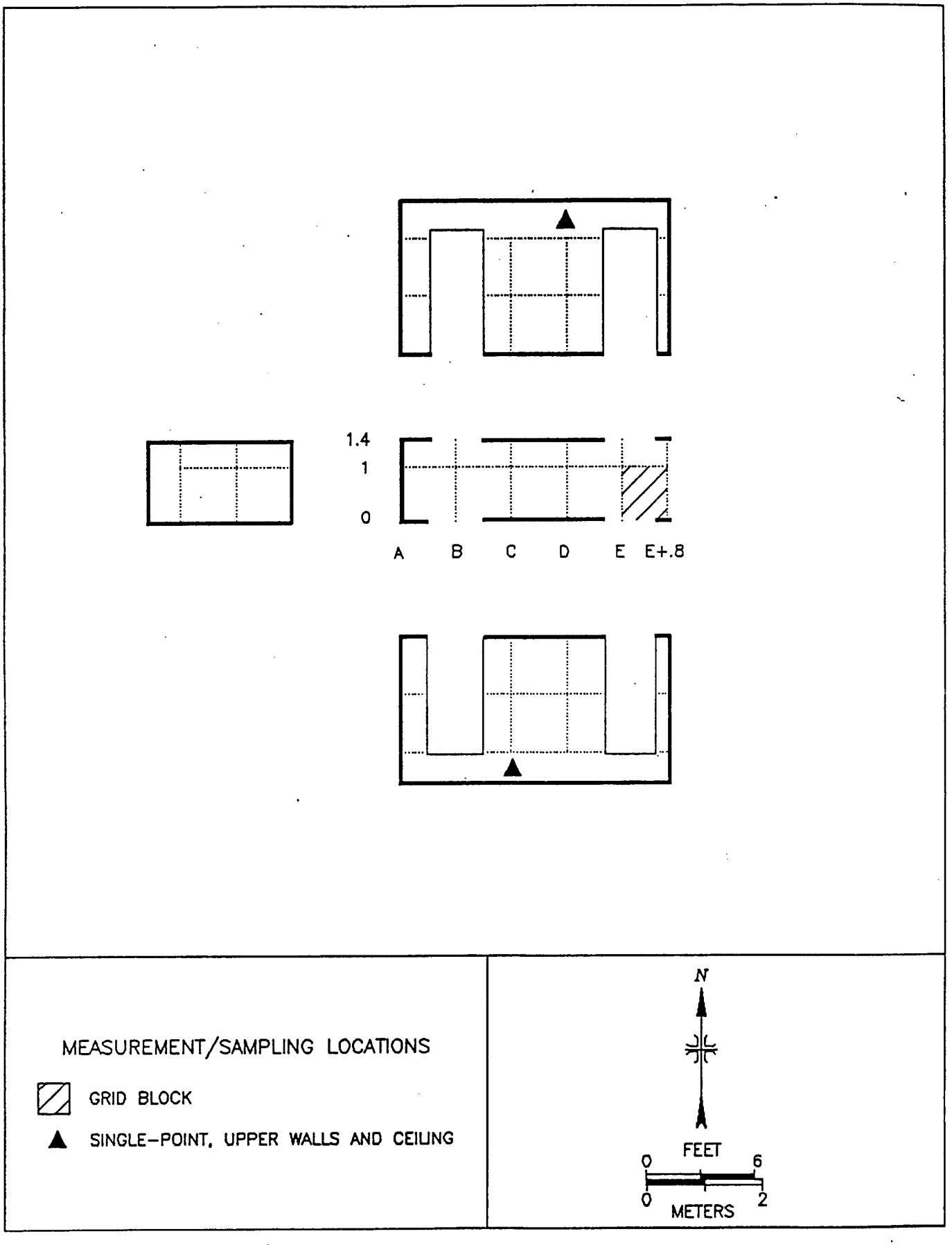

FIGURE 13: Building 401A, Room 7, (Hallway) – Measurement and Sampling Locations

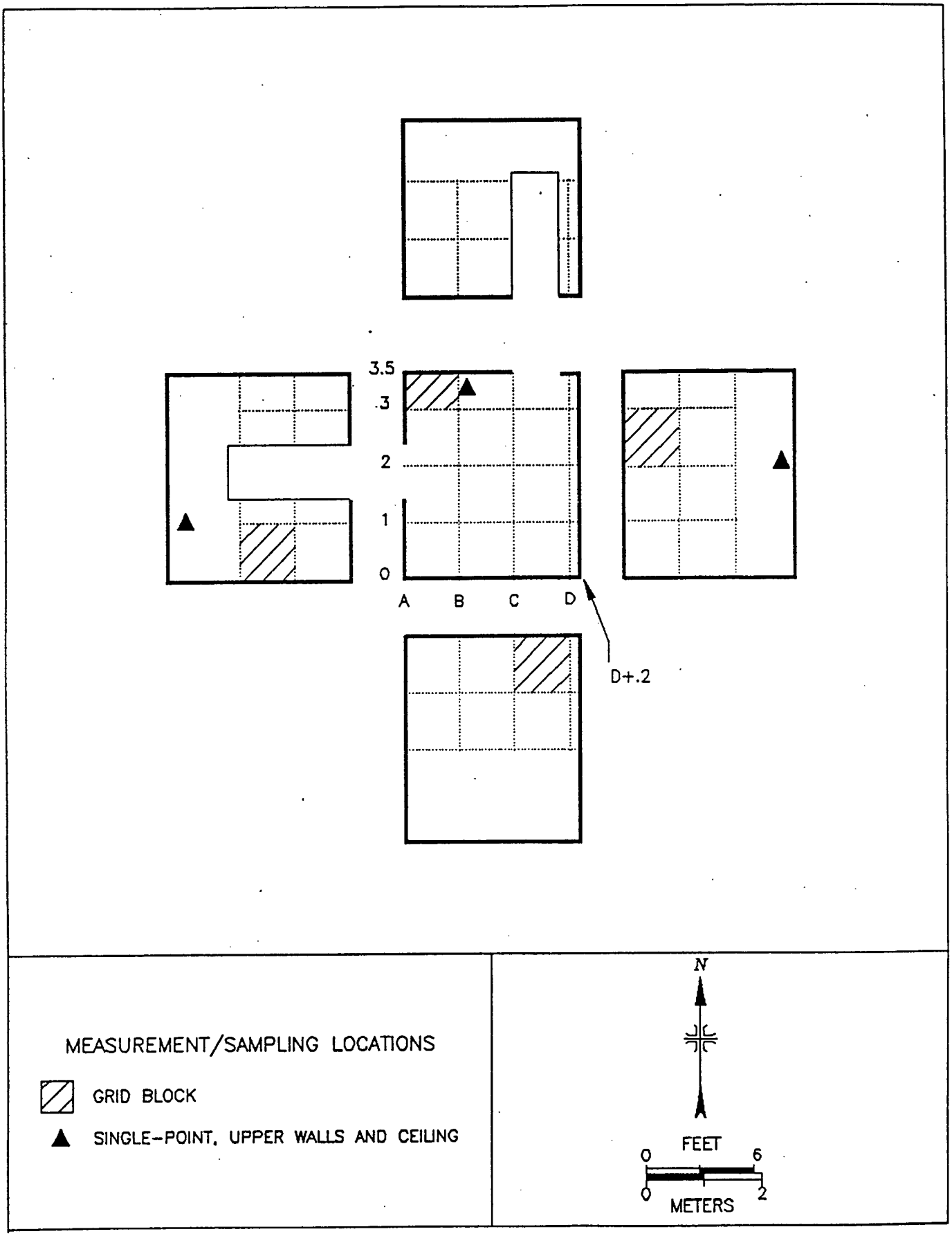

FIGURE 14: Building 401A, Room 8 – Measurement and Sampling Locations

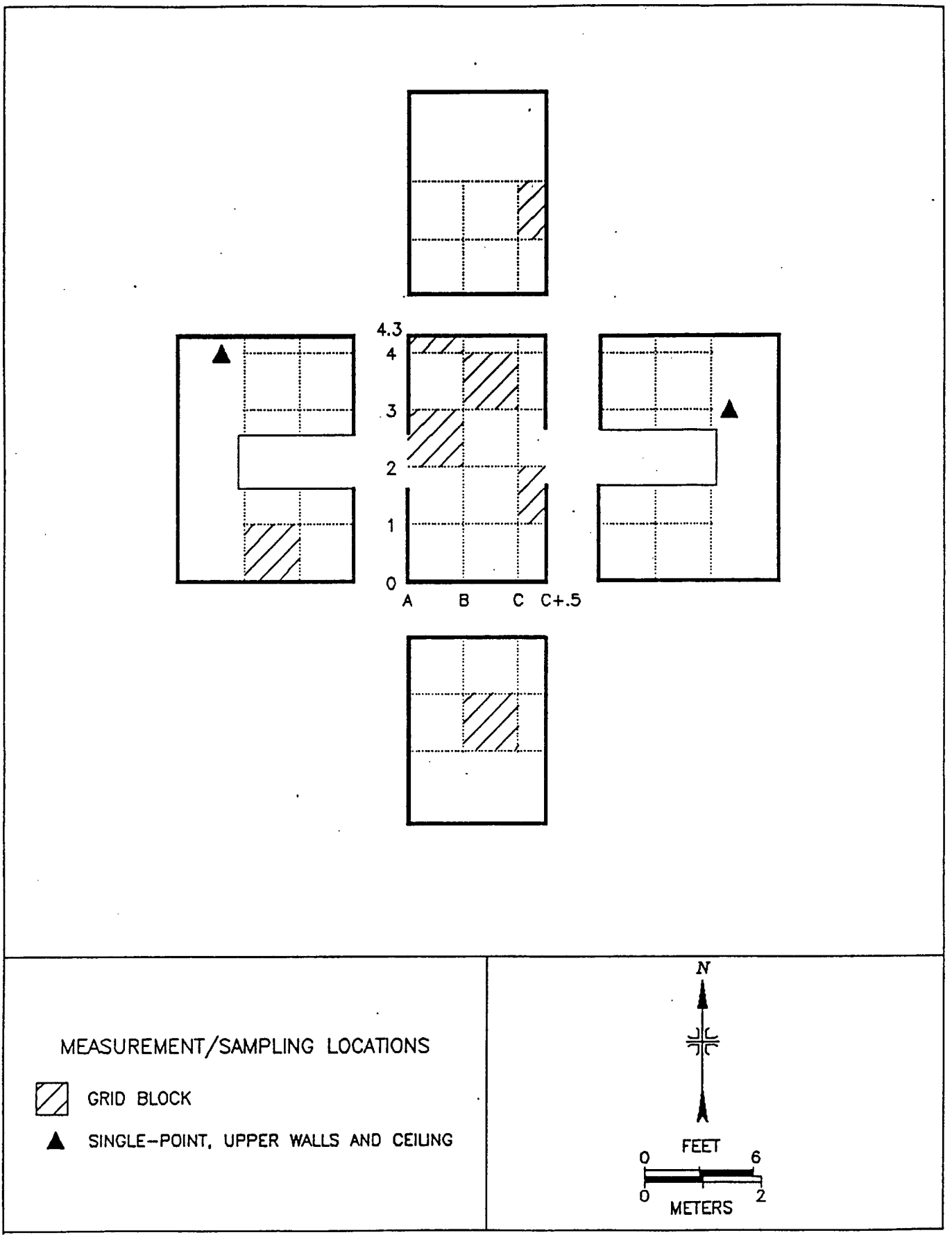

FIGURE 15: Building 401A, Room 9 – Measurement and Sampling Locations

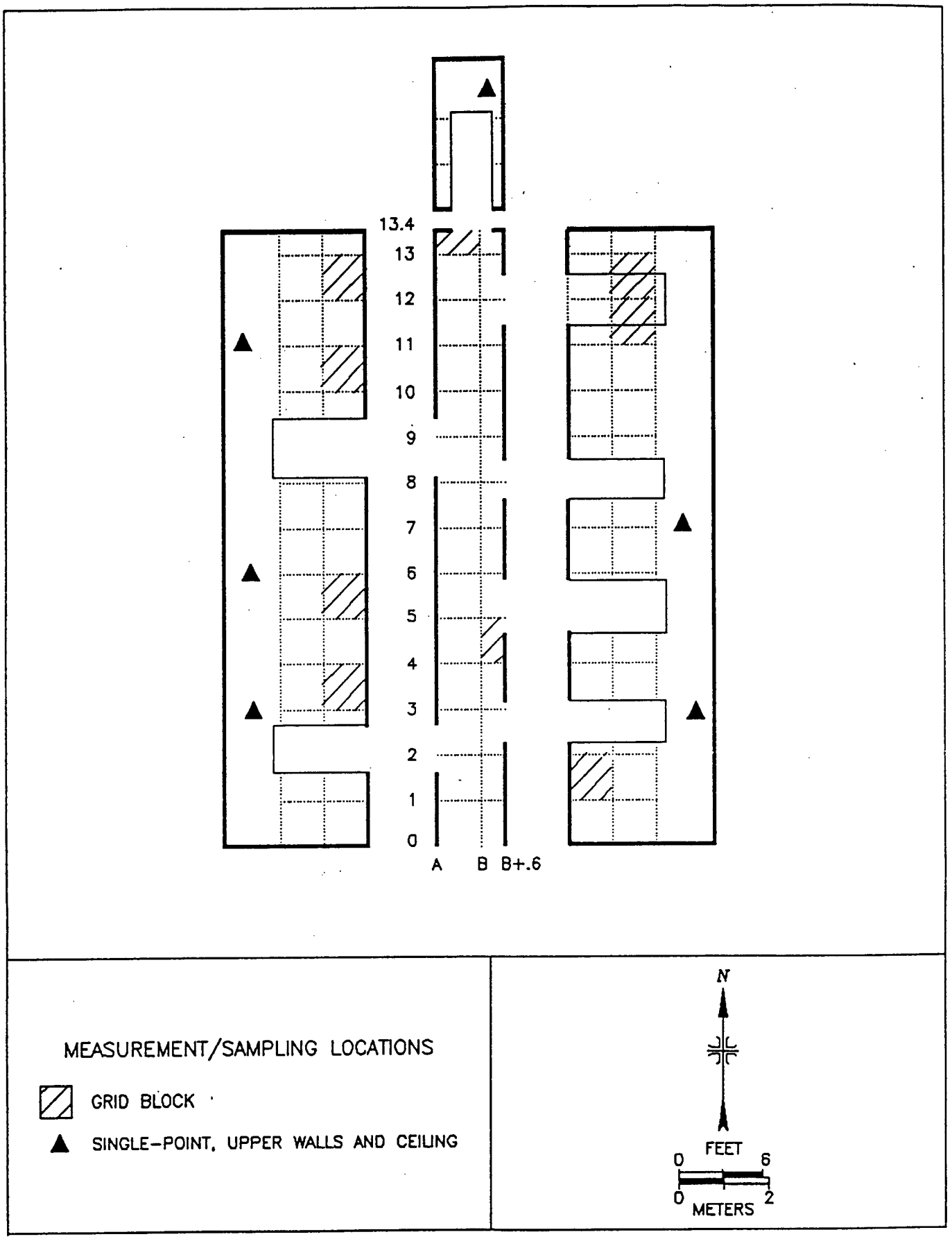

FIGURE 16: Building 401A, Room 10 – Measurement and Sampling Locations

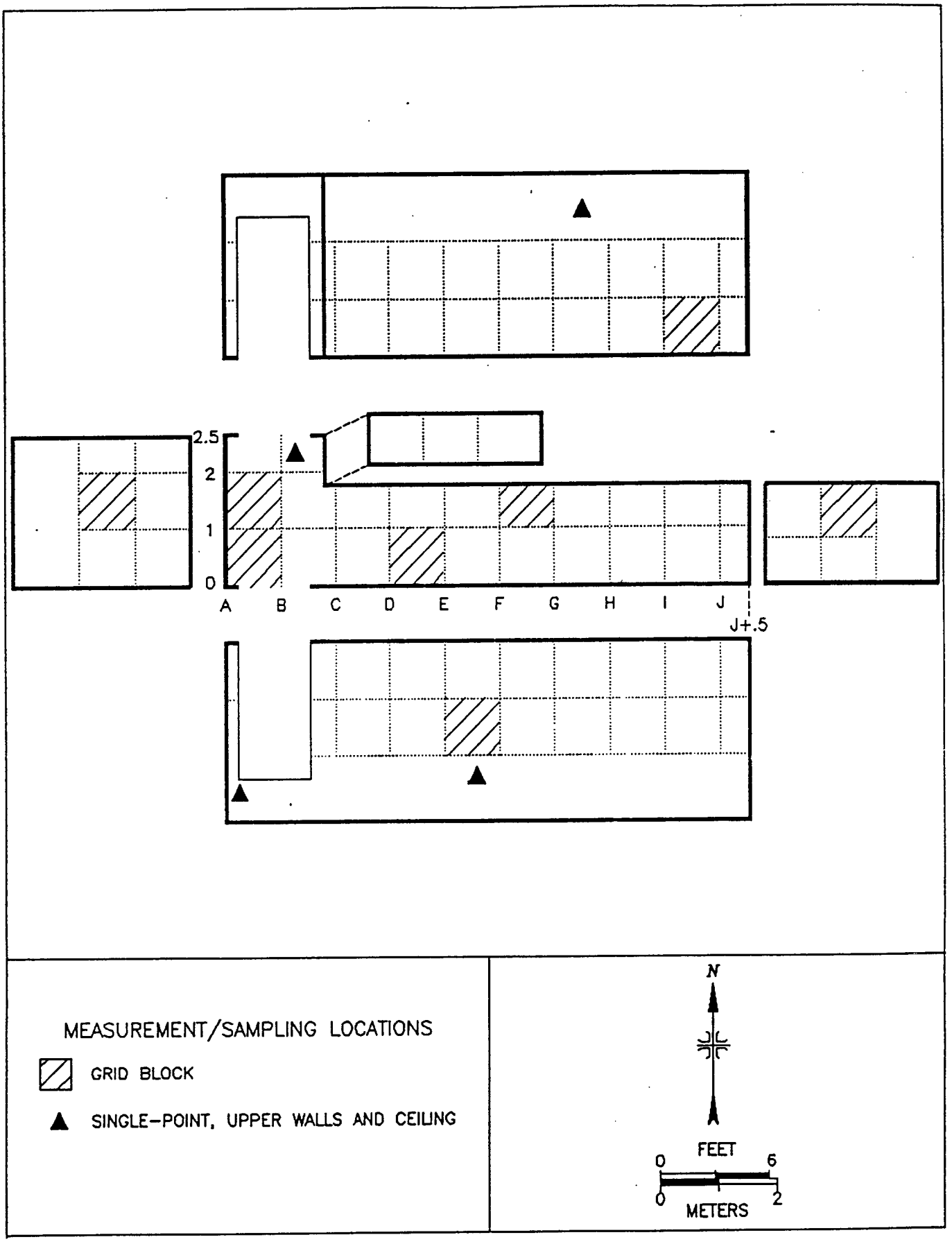

FIGURE 17: Building 401A, Room 11 – Measurement and Sampling Locations

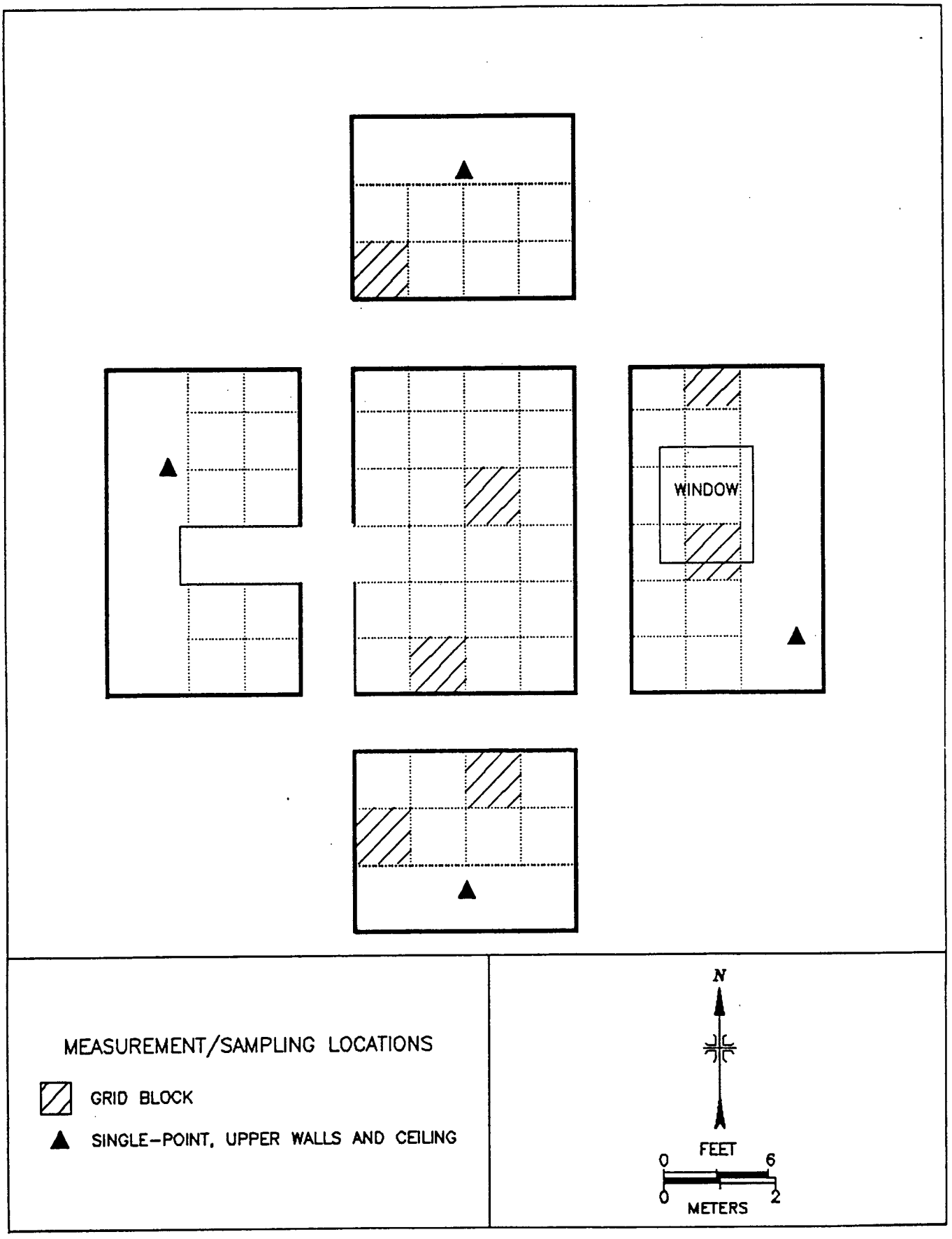

FIGURE 18: Building 401A, Room 12 – Measurement and Sampling Locations

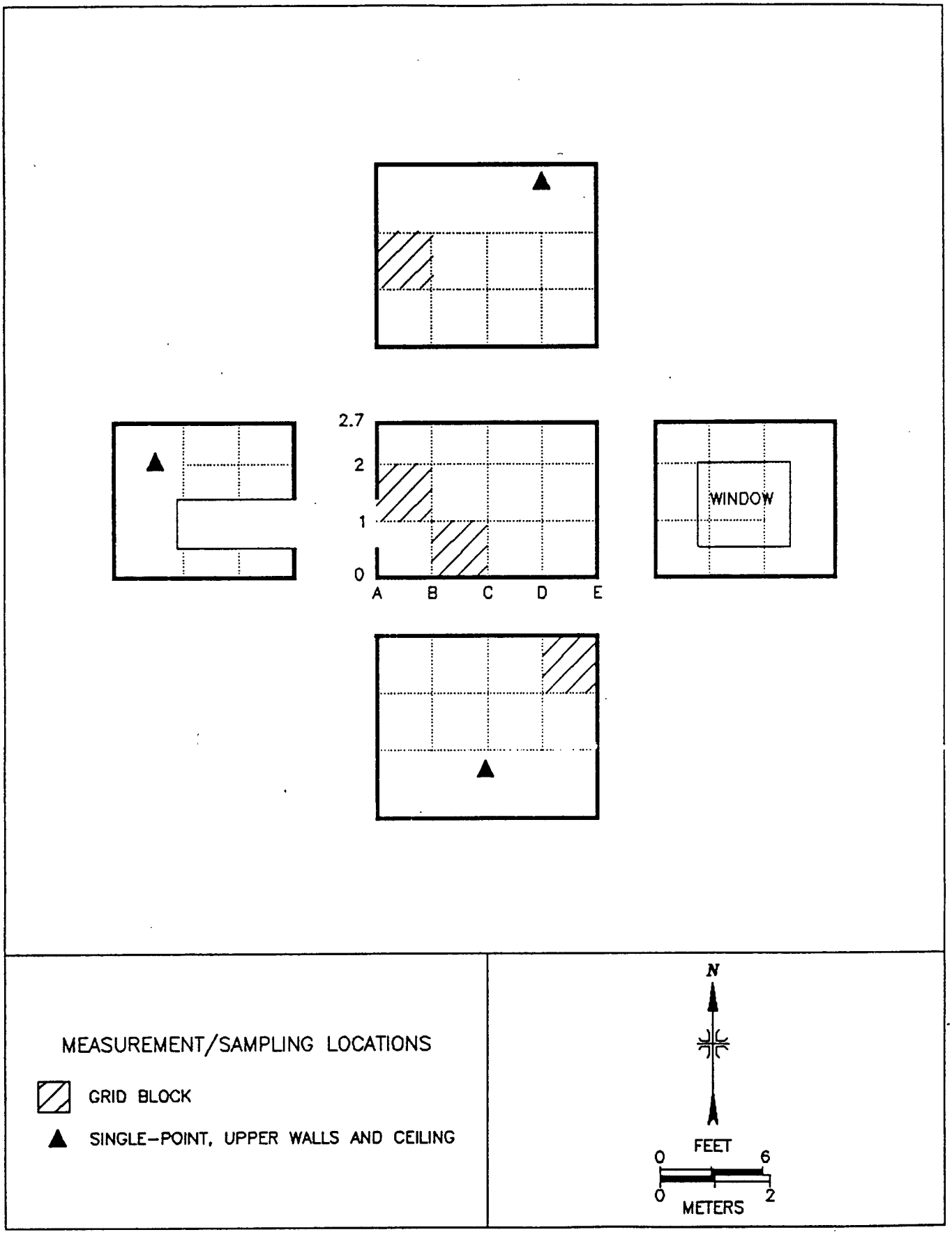

FIGURE 19: Building 401A, Room 13 – Measurement and Sampling Locations

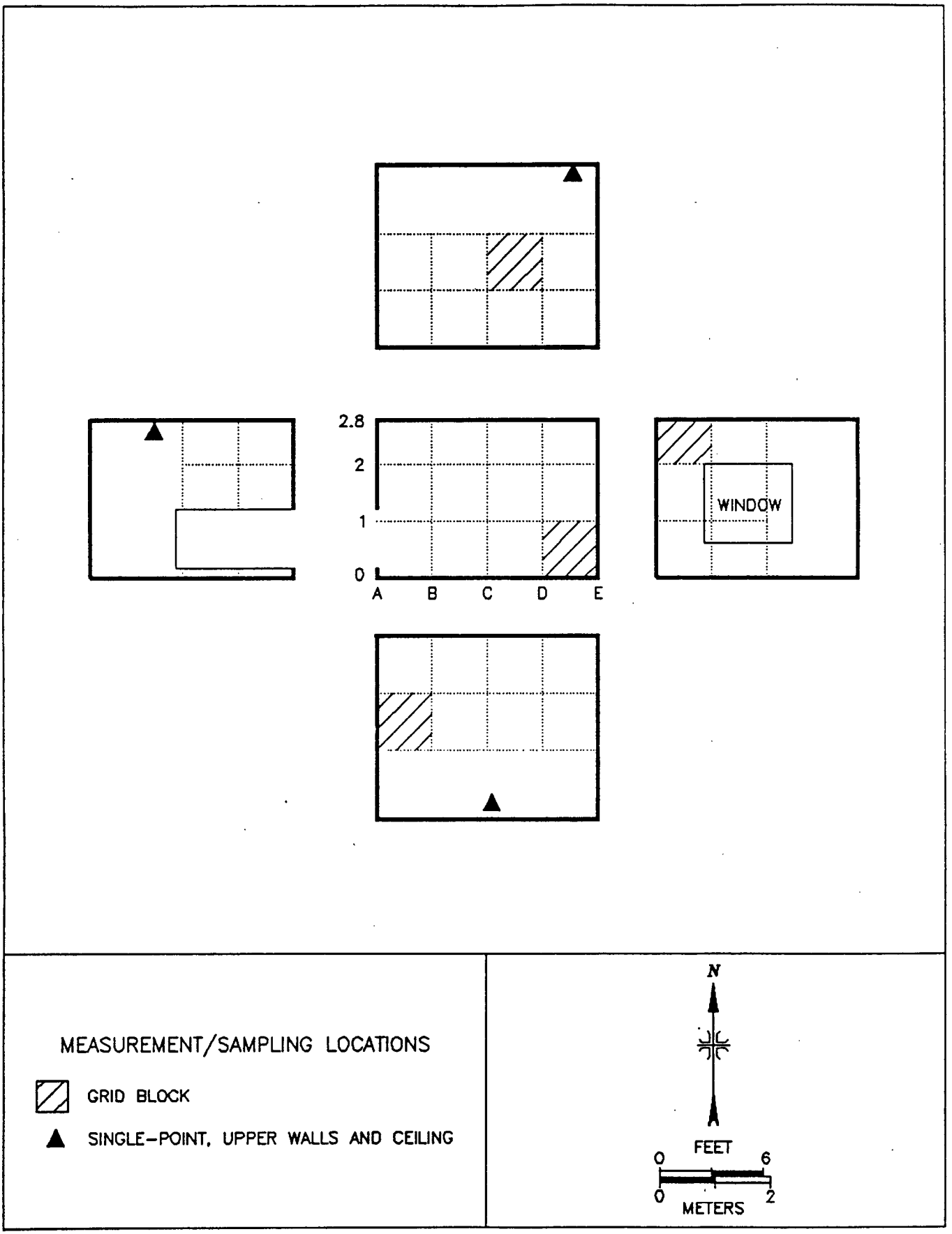

FIGURE 20: Building 401A, Room 14 – Measurement and Sampling Locations

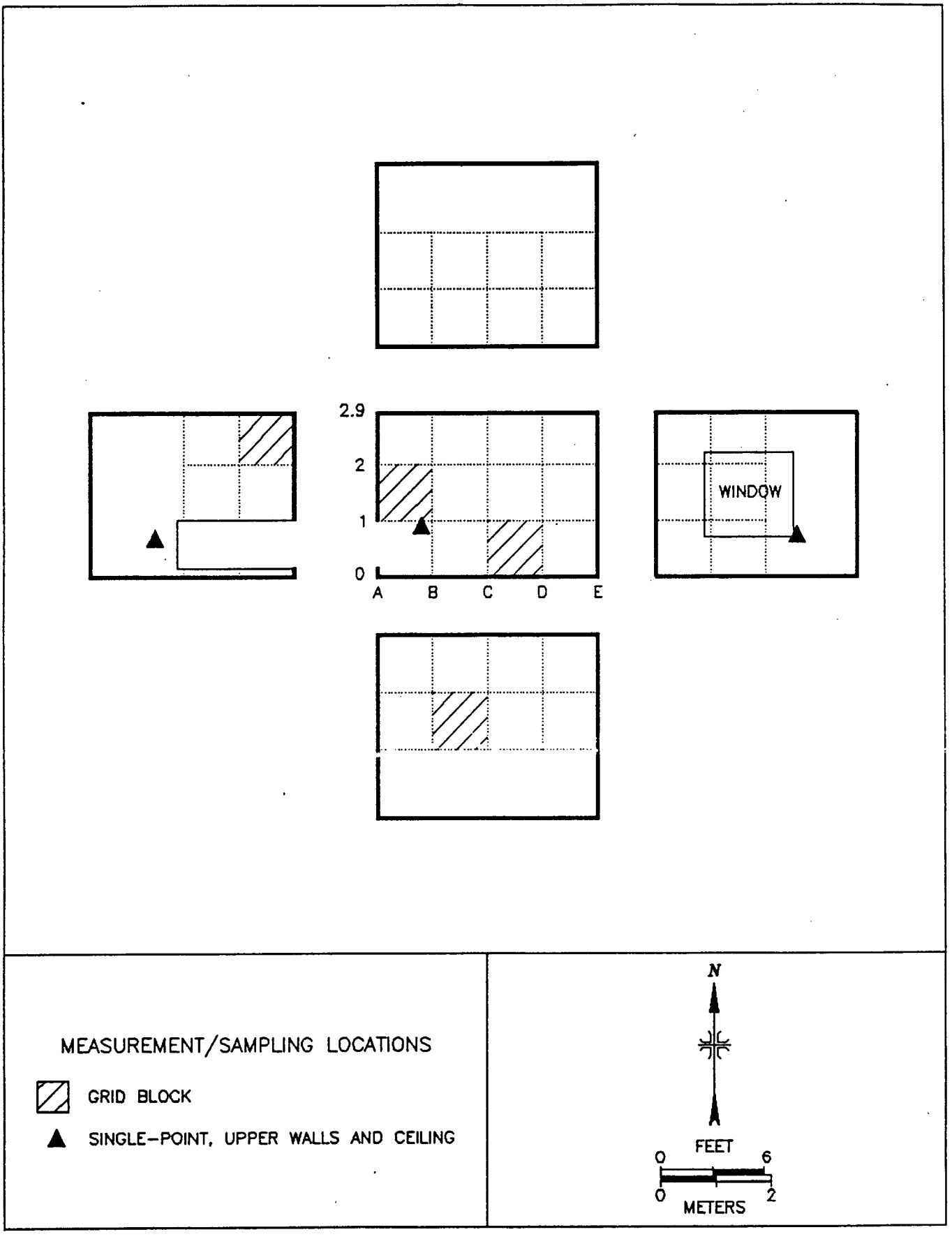

FIGURE 21: Building 401A, Room 15 – Measurement and Sampling Locations

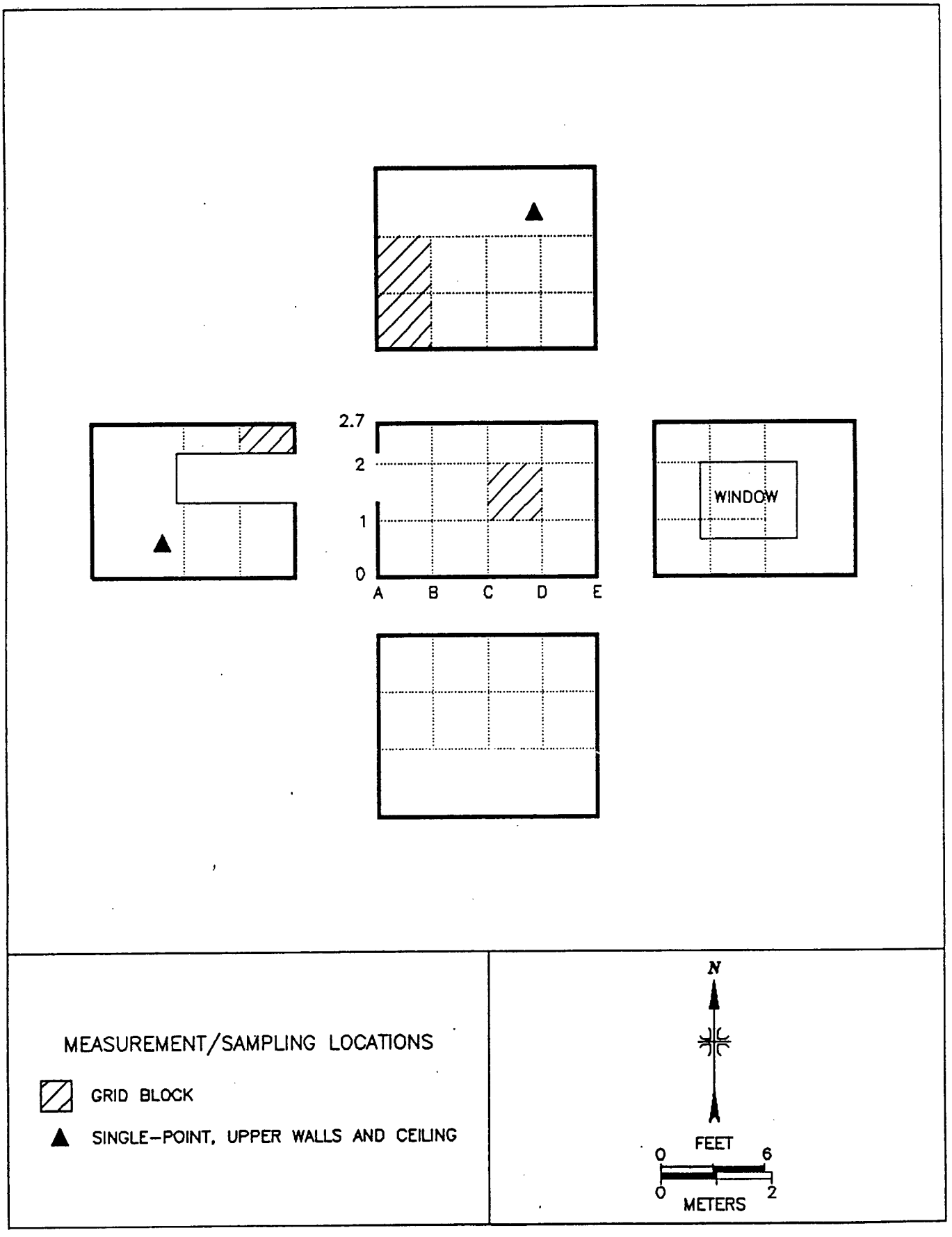

FIGURE 22: Building 401A, Room 16 – Measurement and Sampling Locations

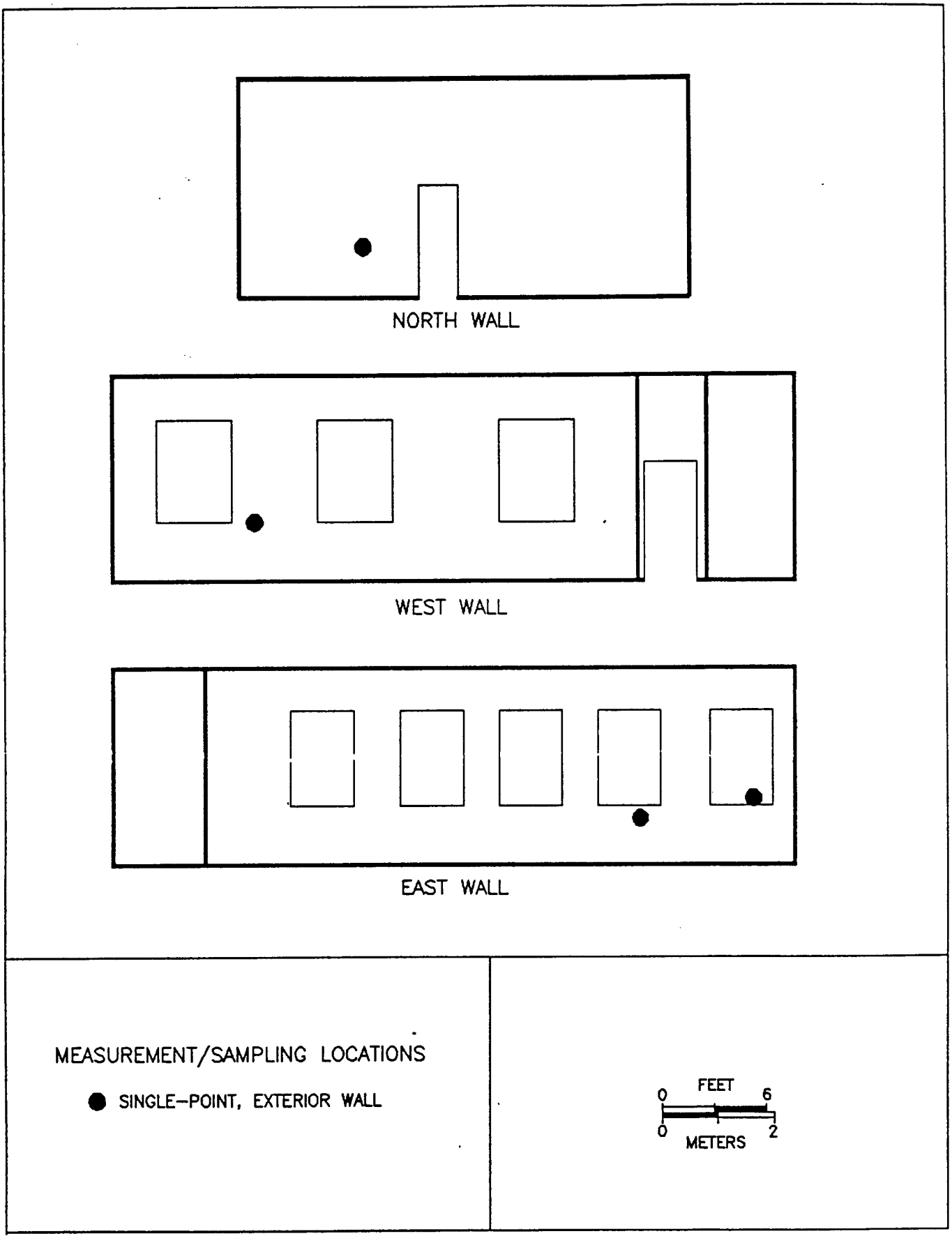

FIGURE 23: Building 401A, Exterior Walls – Measurement and Sampling Locations

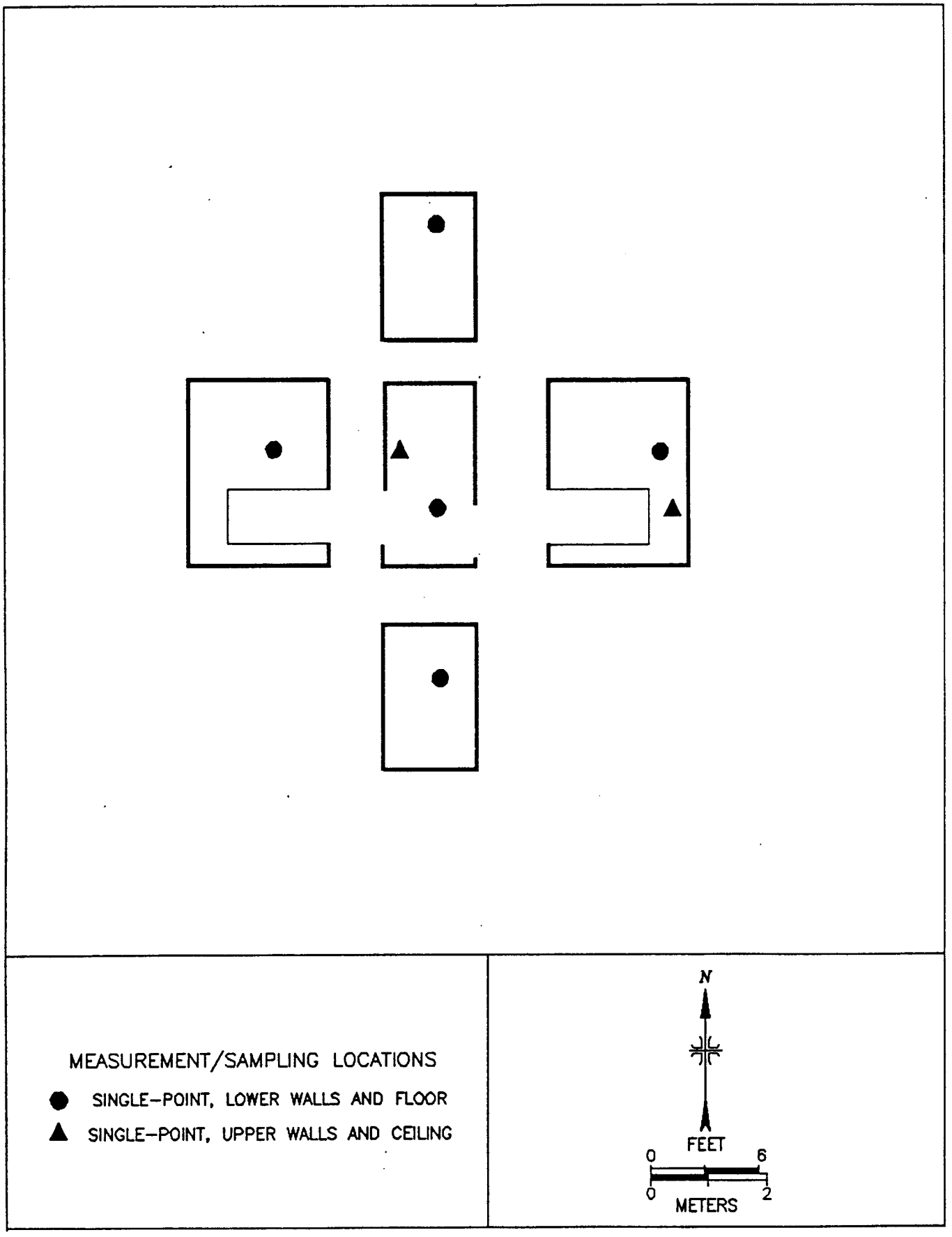

FIGURE 24: Building 402, Room 1 – Measurement and Sampling Locations

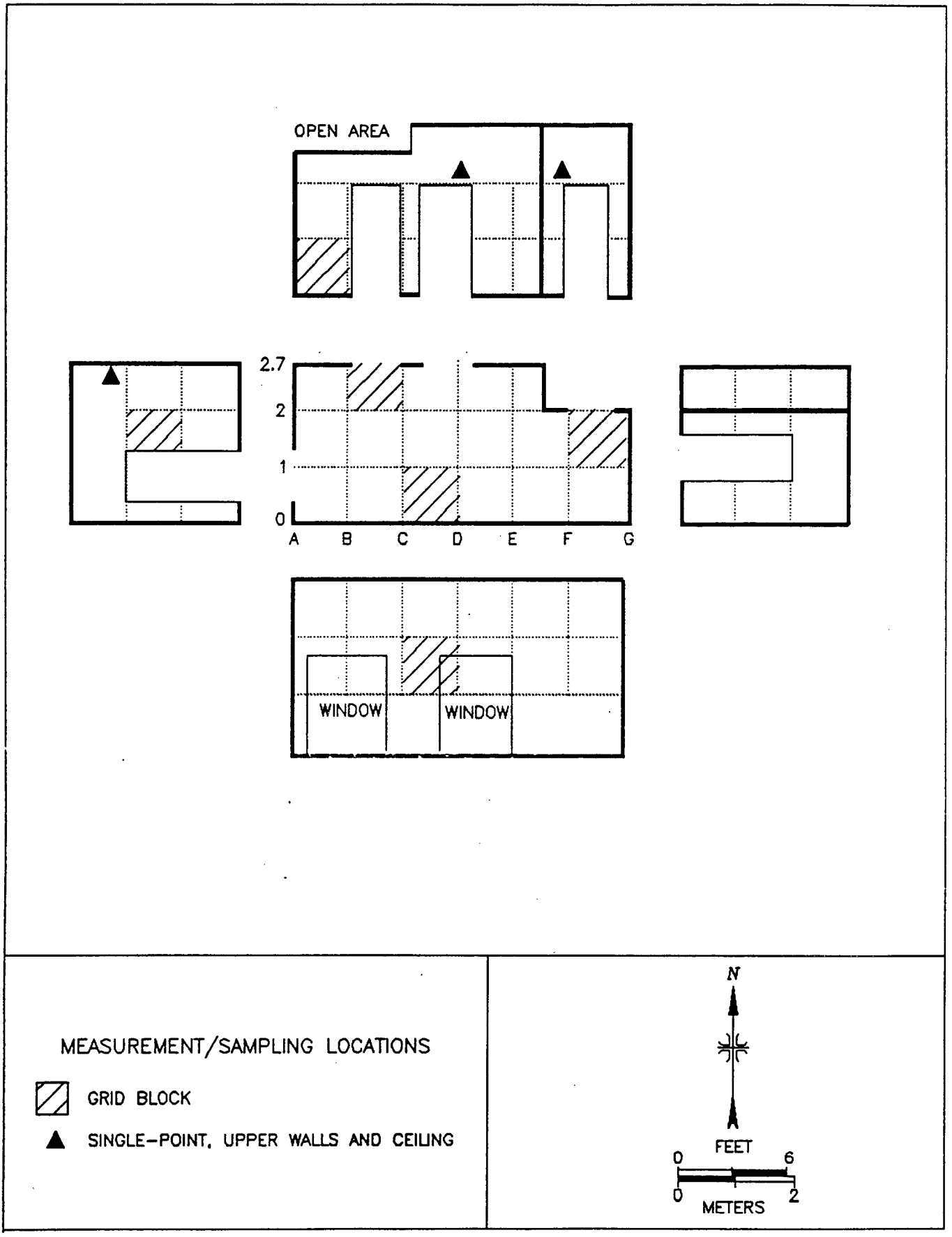

FIGURE 25: Building 402, Room 2 – Measurement and Sampling Locations

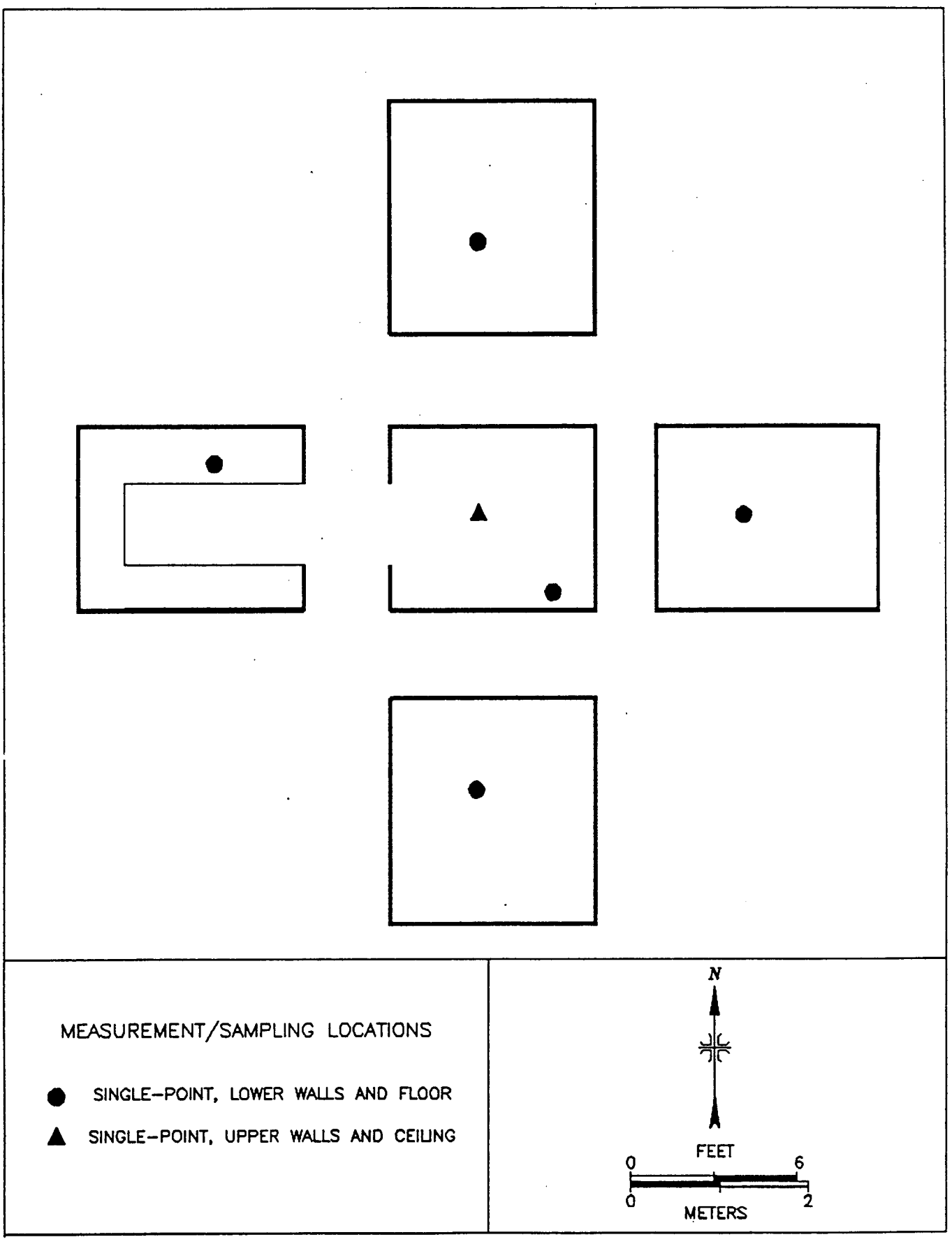

FIGURE 26: Building 402, Room 3 – Measurement and Sampling Locations

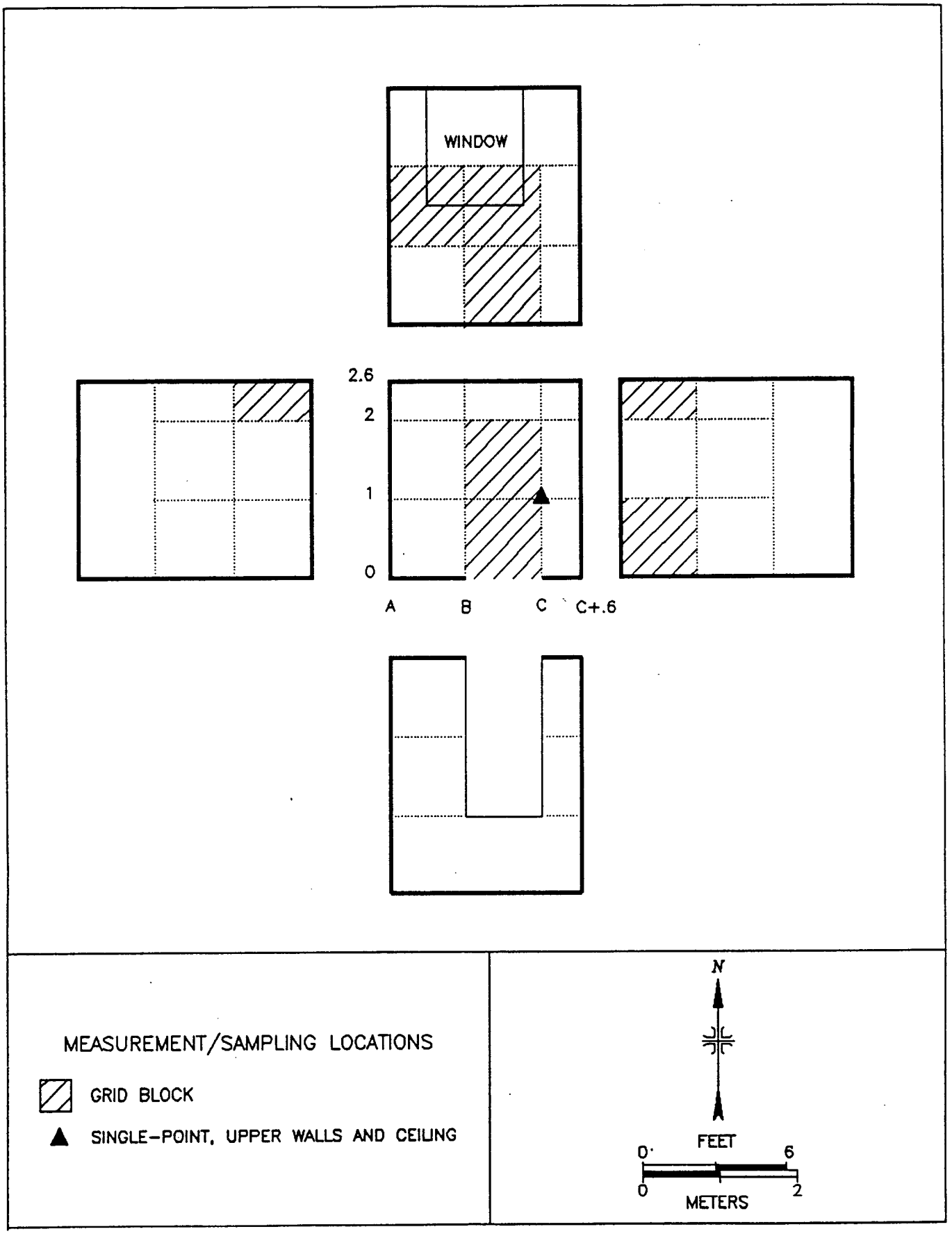

FIGURE 27: Building 402, Room 4 – Measurement and Sampling Locations

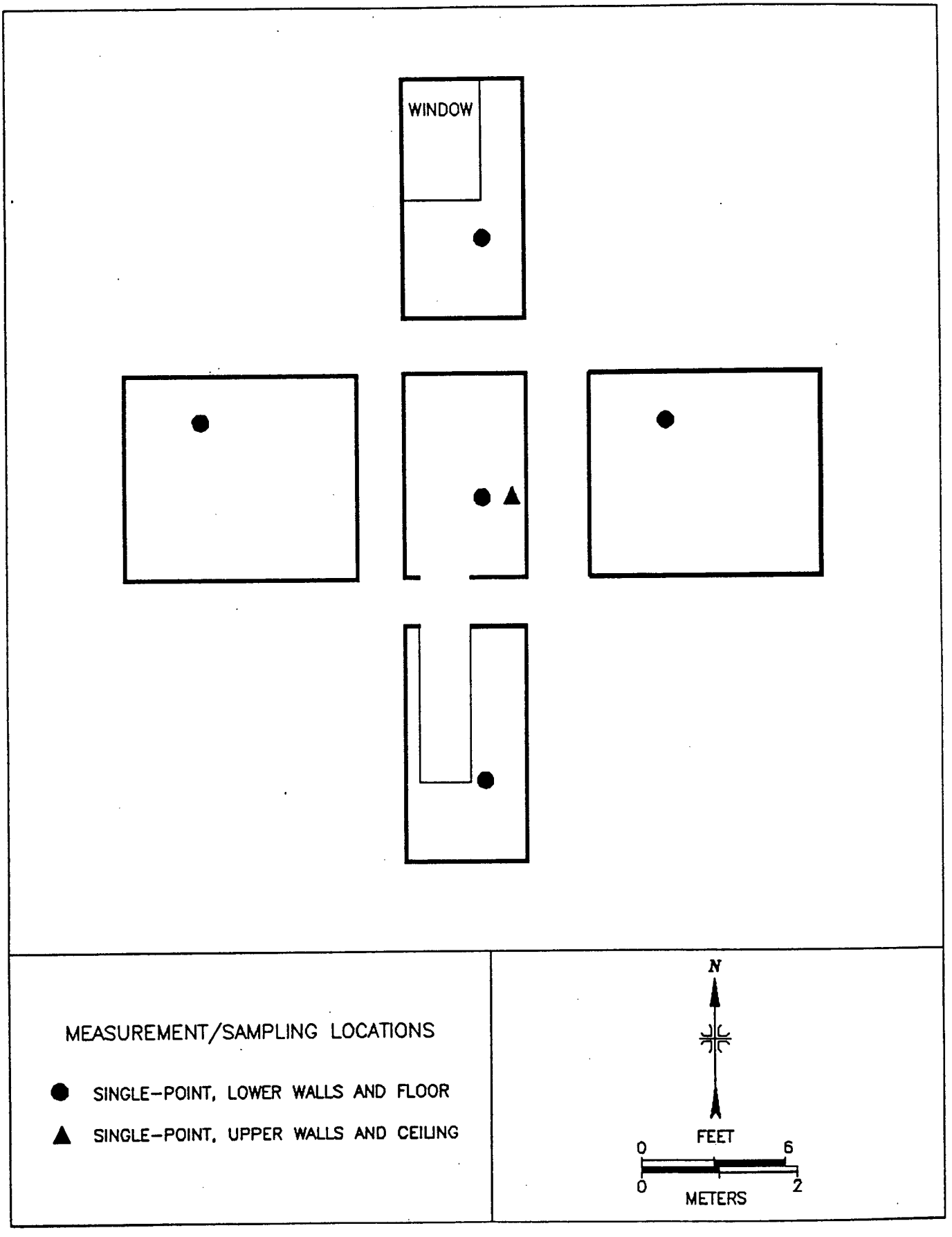

FIGURE 28: Building 402, Room 5 – Measurement and Sampling Locations

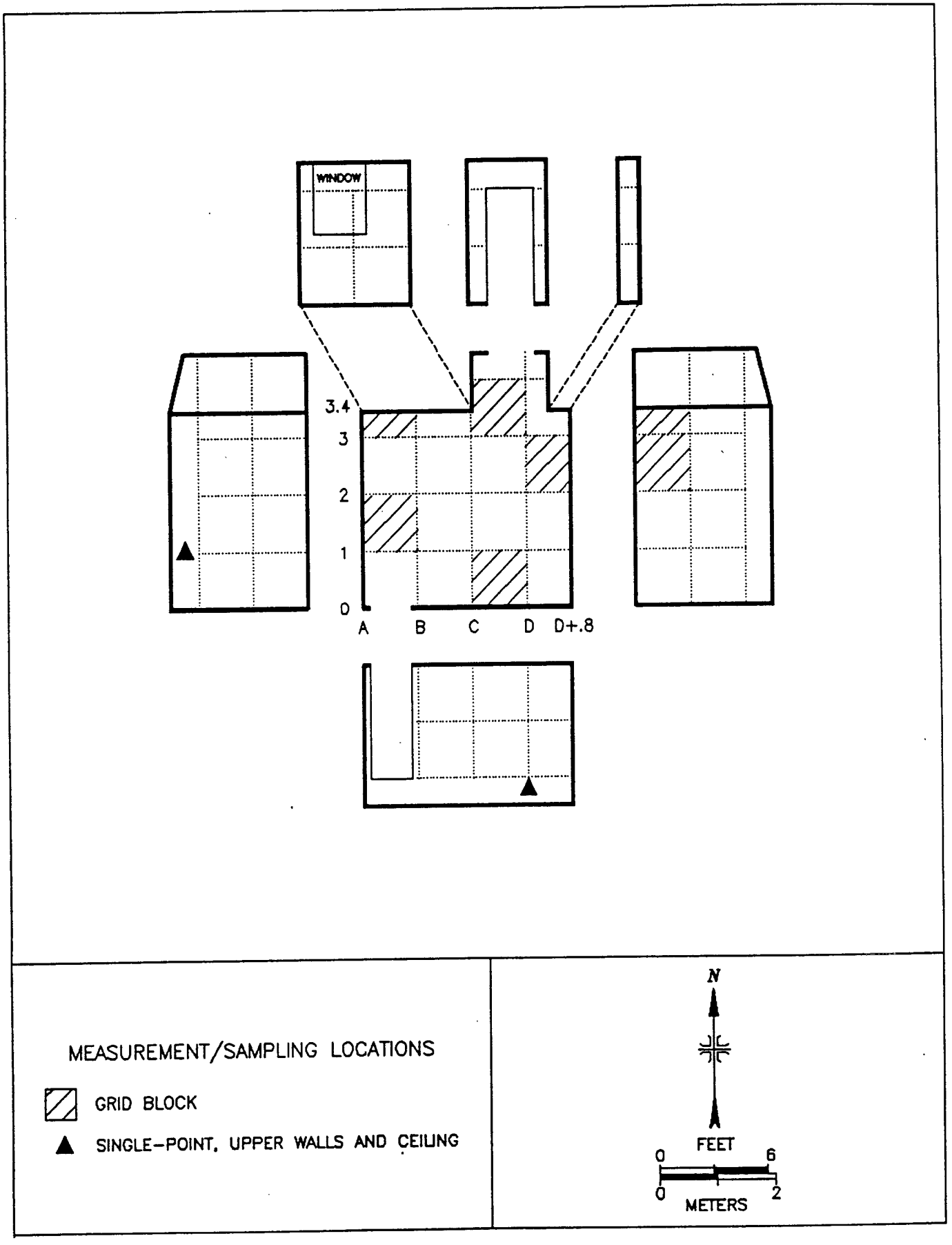

FIGURE 29: Building 402, Room 6 & 8 – Measurement and Sampling Locations

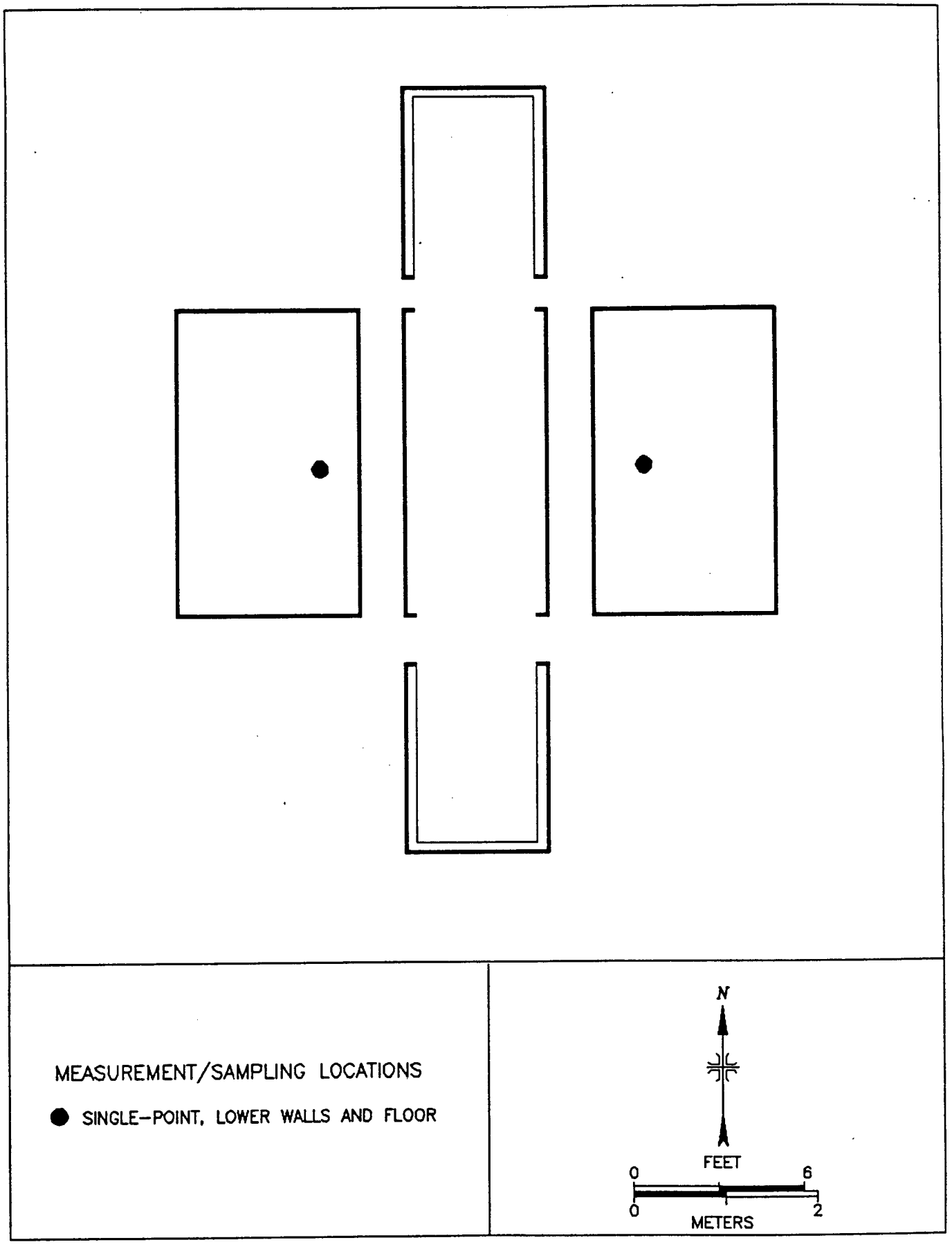

FIGURE 30: Building 402, Room 7 – Measurement and Sampling Locations

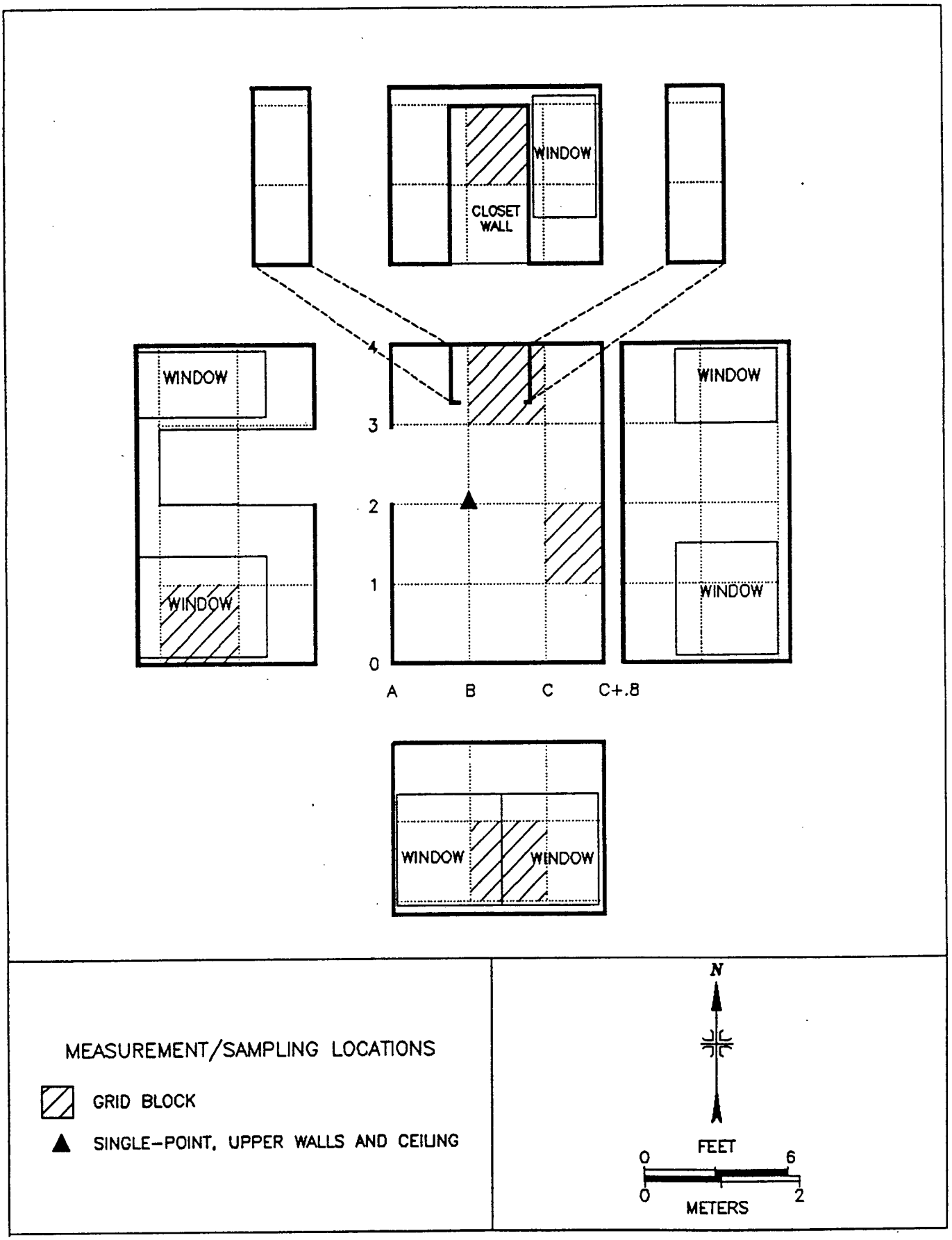

FIGURE 32: Building 416, Guard House – Measurement and Sampling Locations

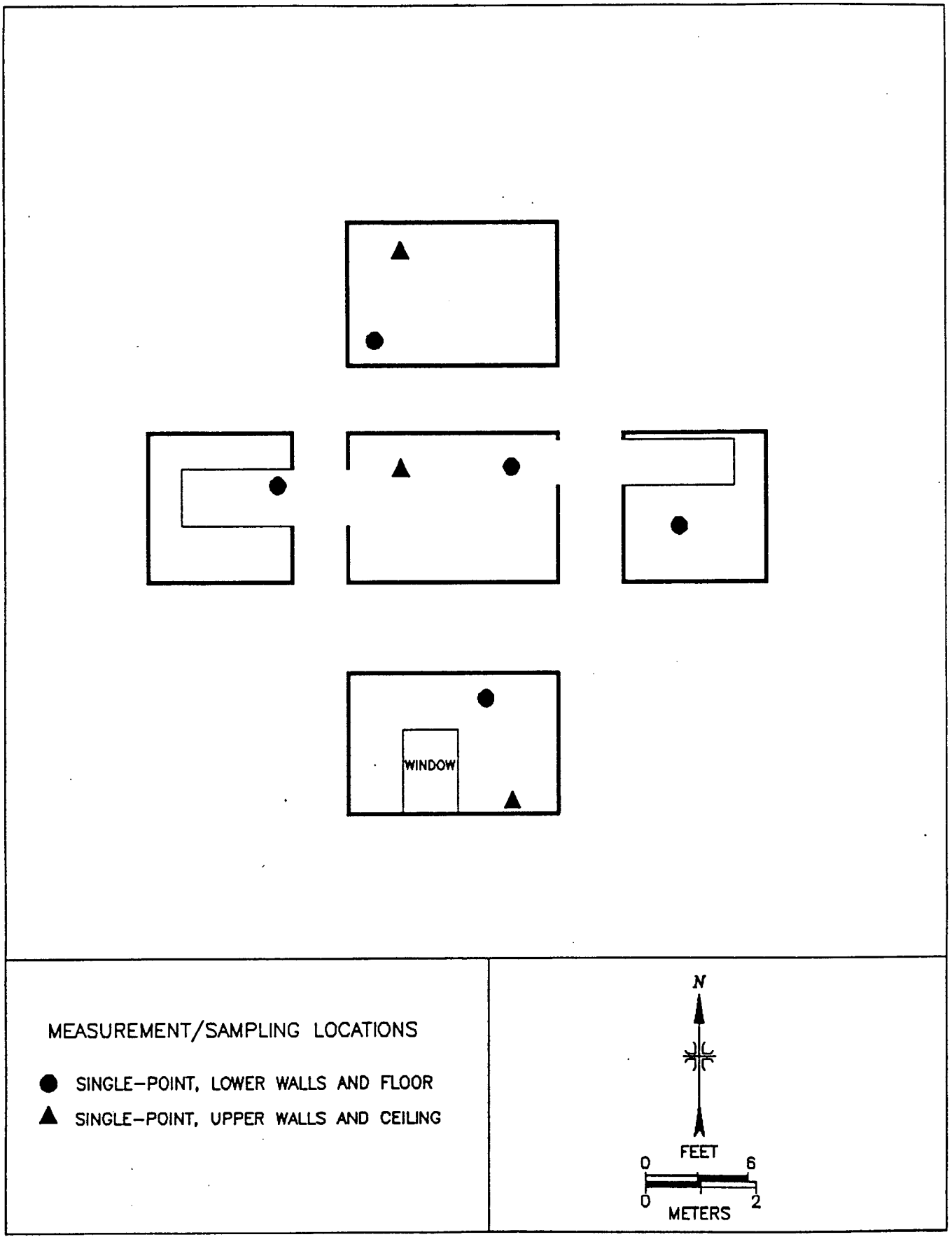

FIGURE 33: Building 429, Room 1 Office – Measurement and Sampling Locations

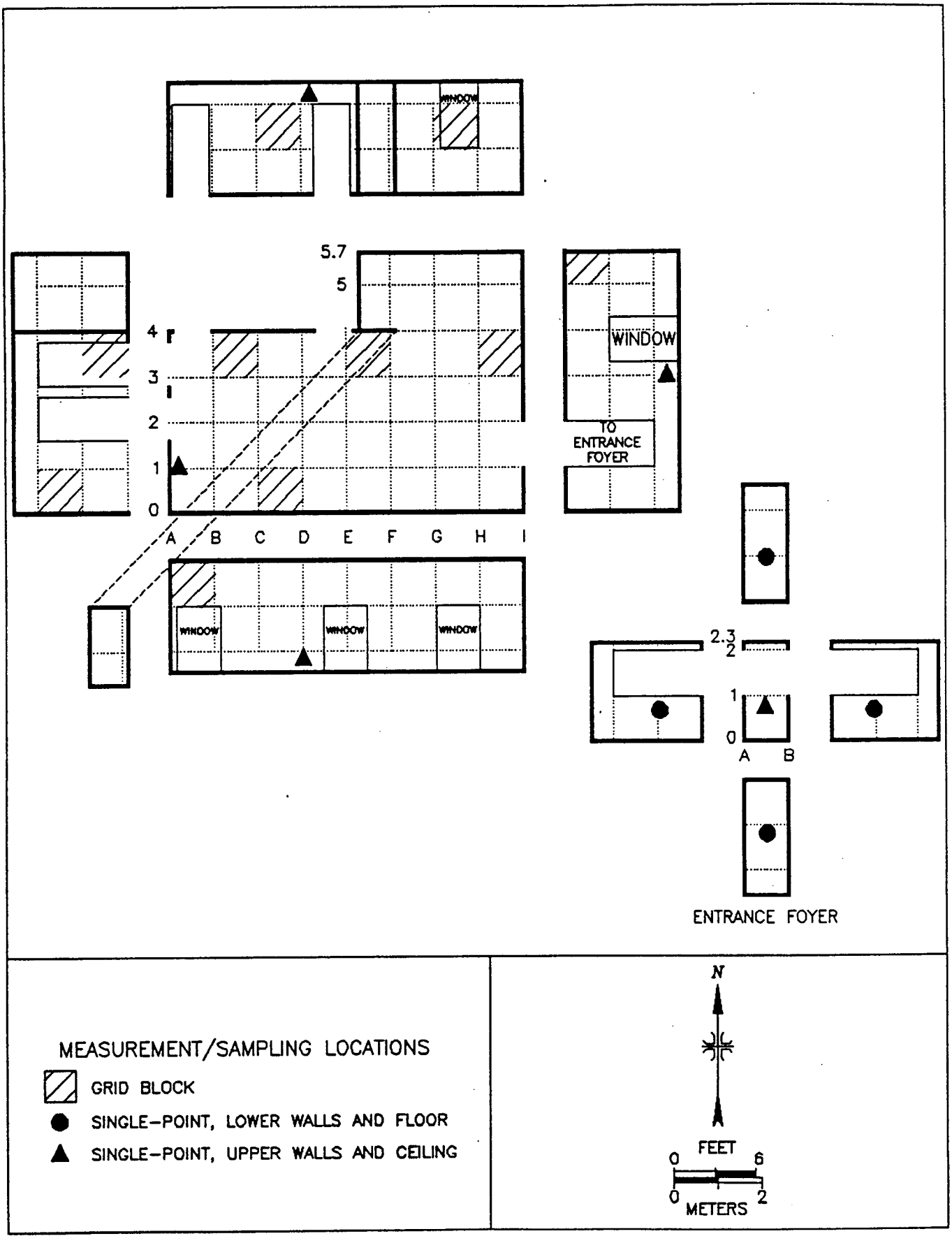

FIGURE 34: Building 429, Room 3 (Entrance Foyer Connected to Room 2) – Measurement and Sampling Locations

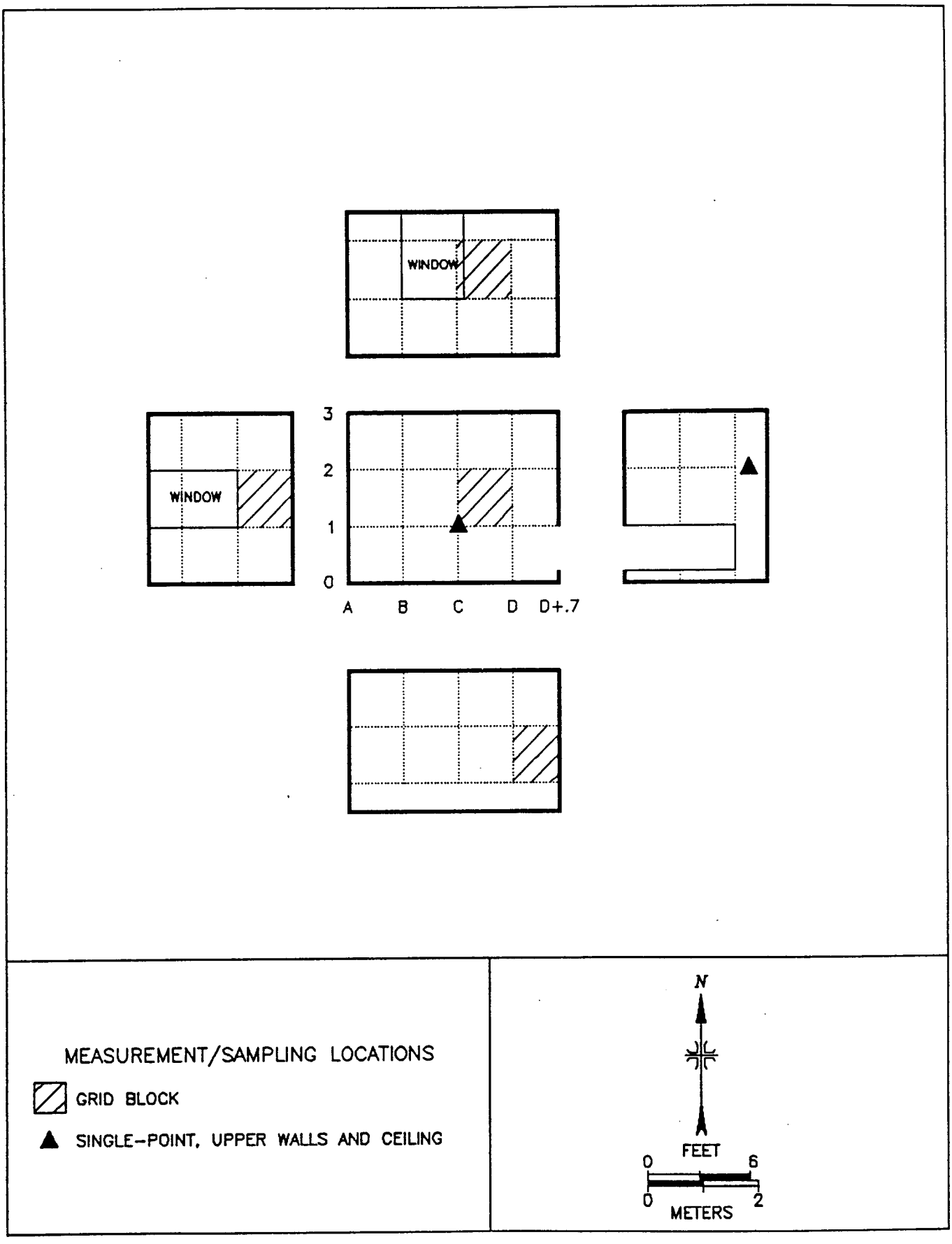

FIGURE 35: Building 429, Room 4 Office – Measurement and Sampling Locations

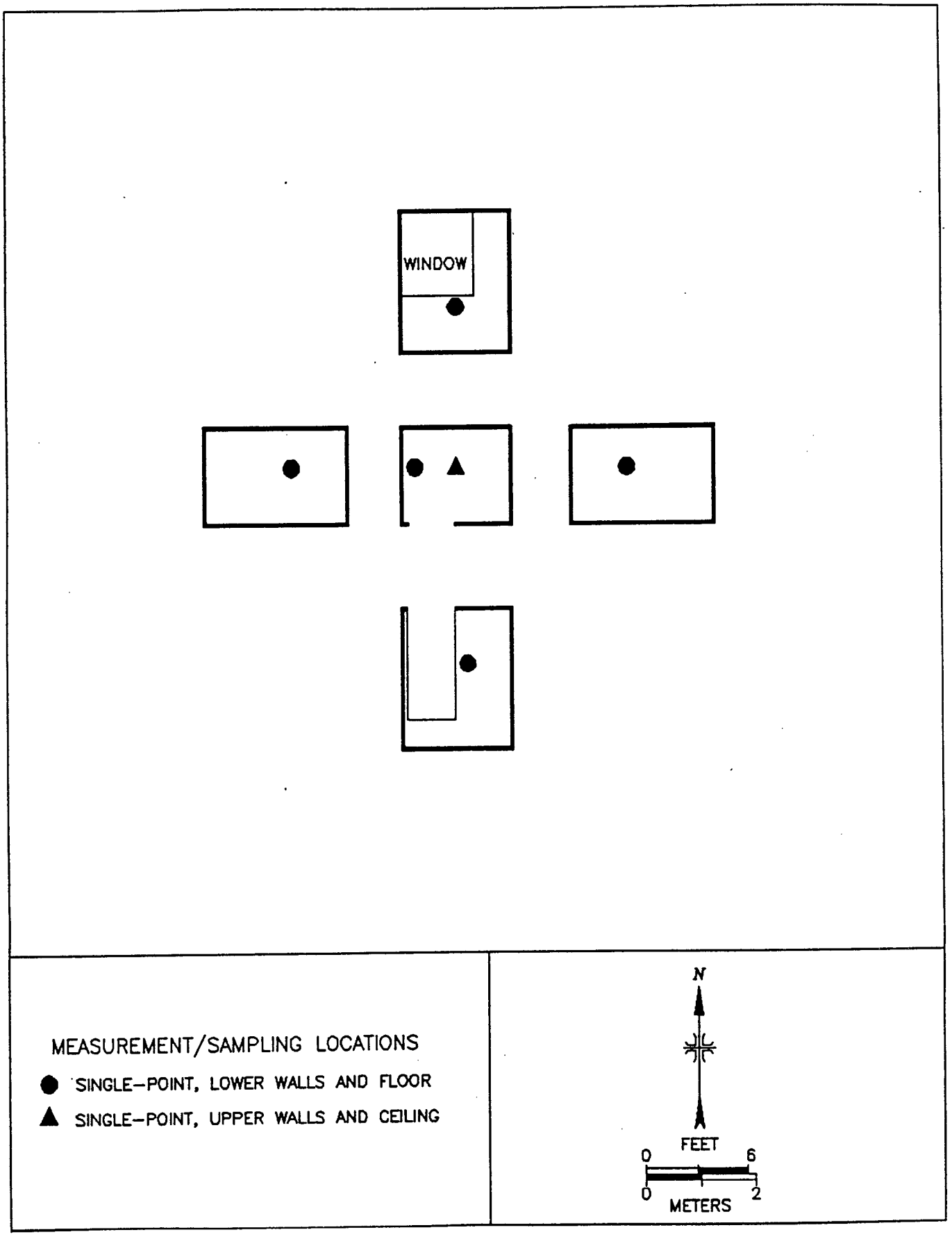

FIGURE 36: Building 429, Room 5, Restroom – Measurement and Sampling Locations

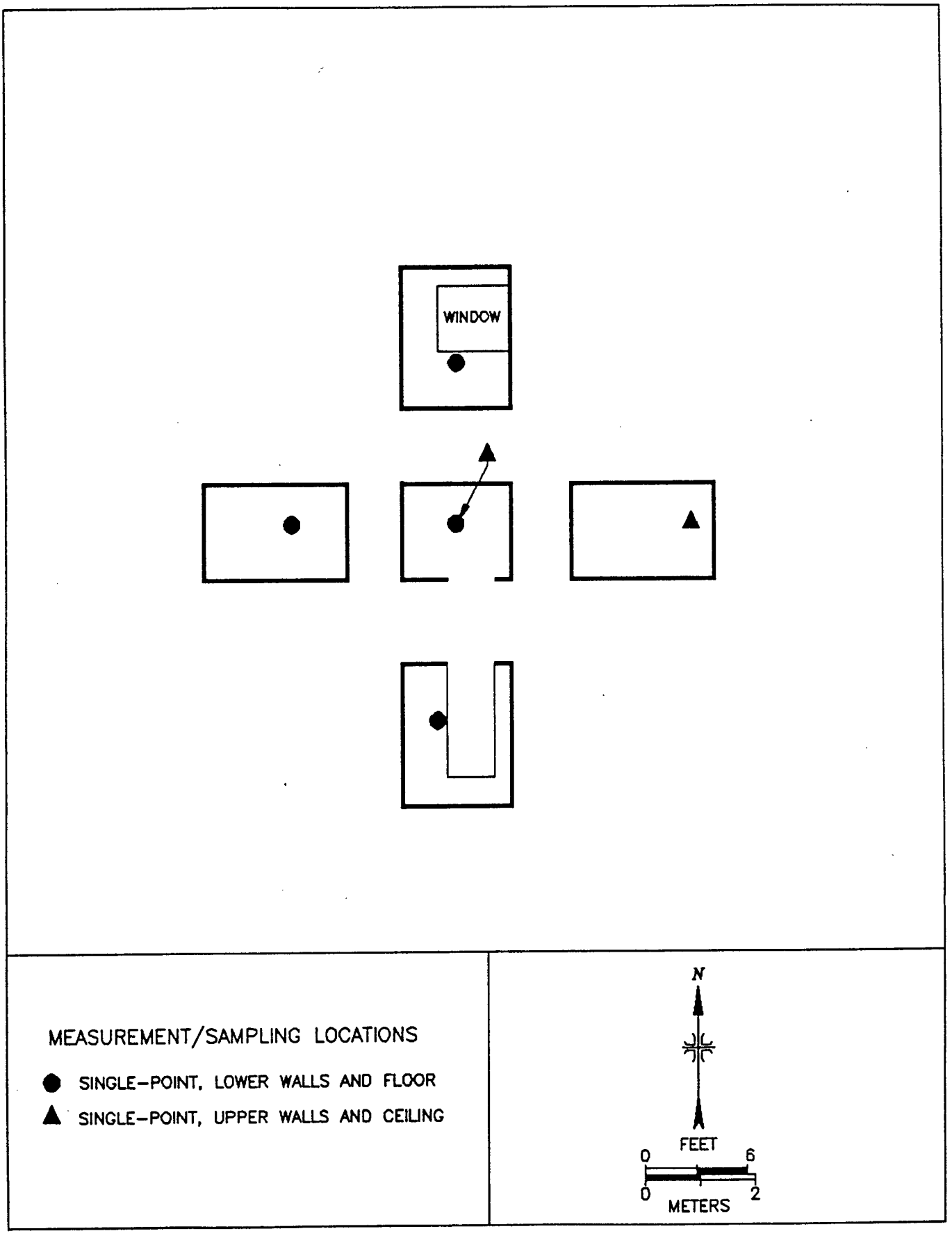

FIGURE 37: Building 429, Room 6 – Measurement and Sampling Locations

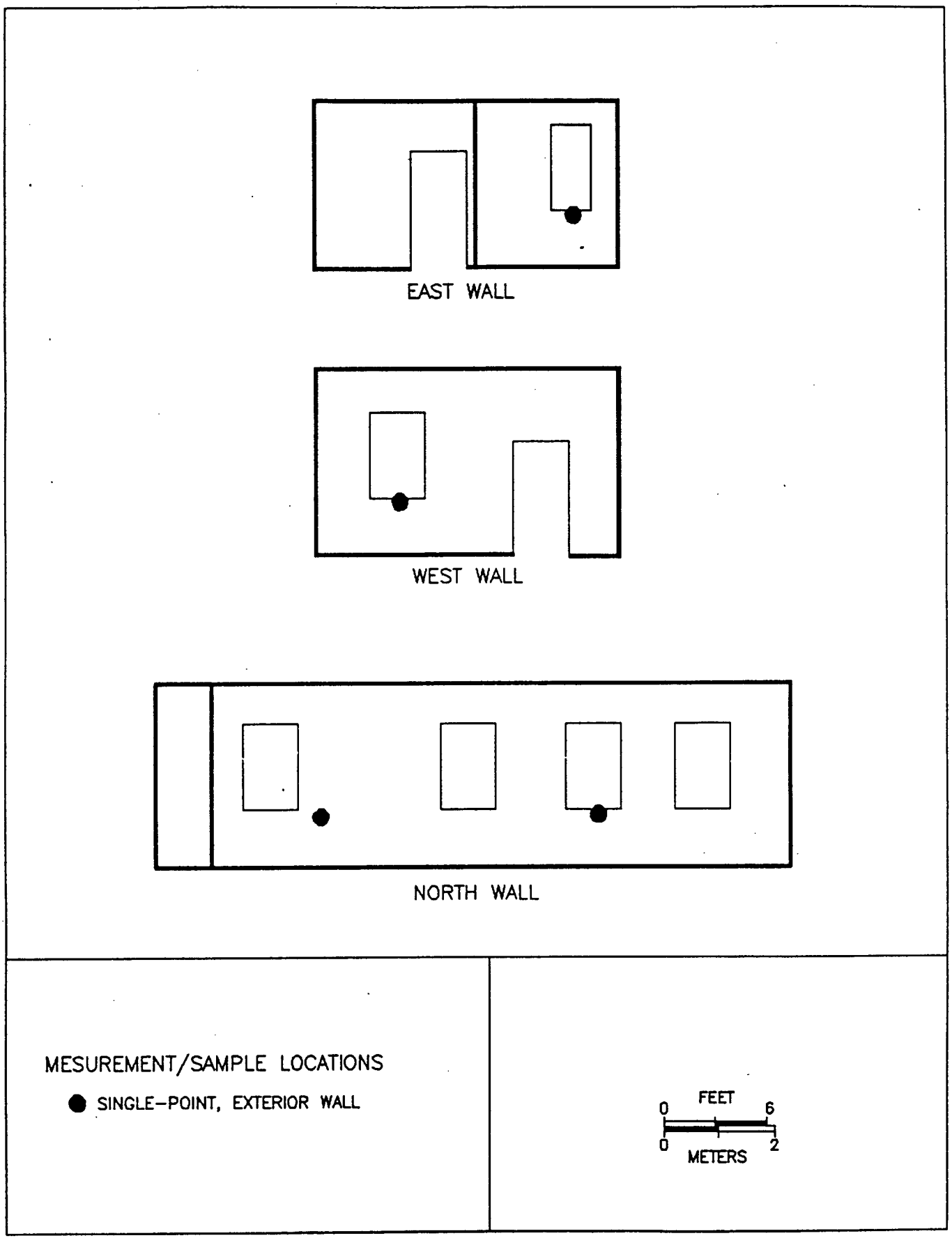

FIGURE 38: Building 429, Exterior Walls – Measurement and Sampling Locations

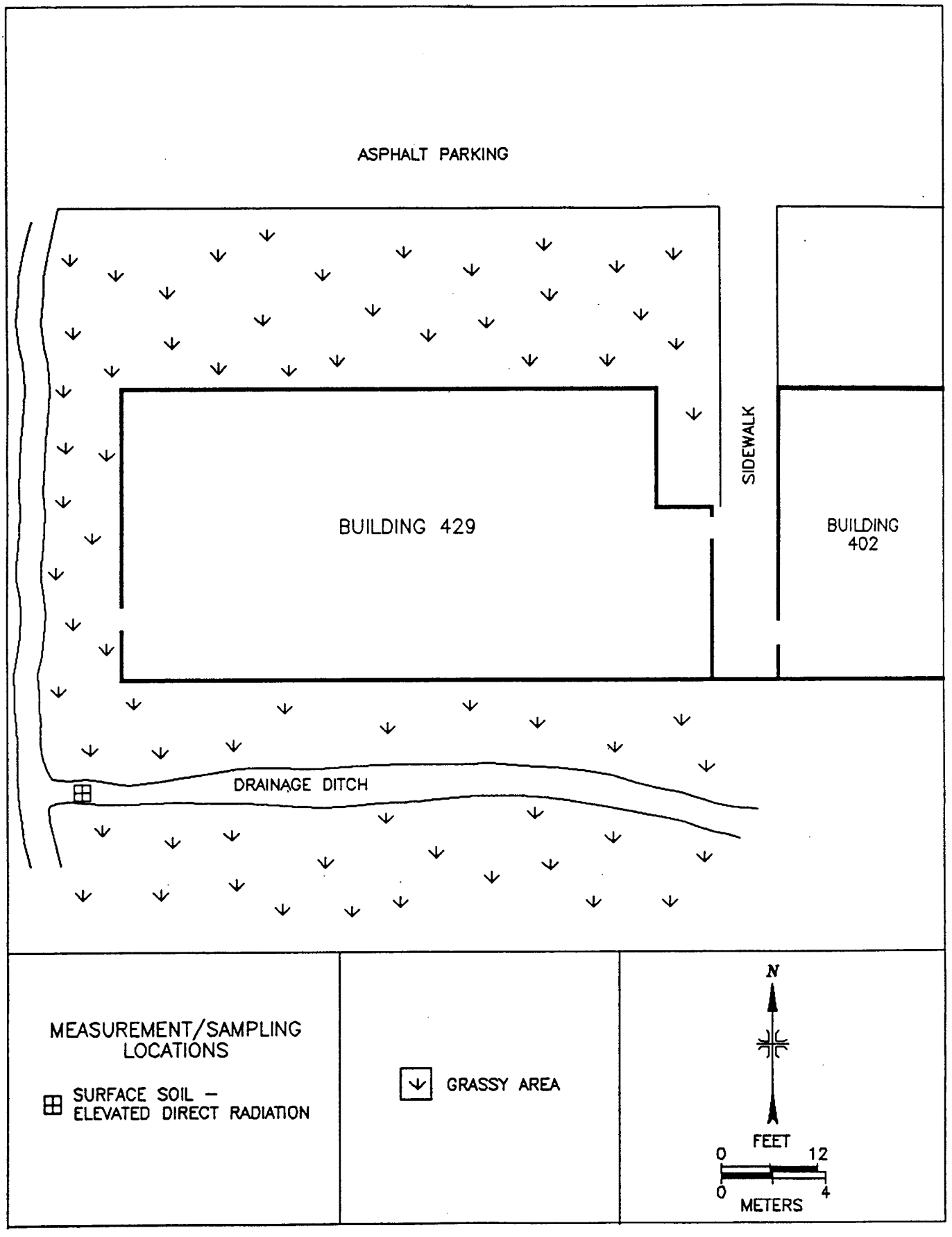

FIGURE 39: Building 429, Exterior – Measurement and Sampling Locations

TABLE 1

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

Location[a]	Number of Measurement Locations		Range of Total Activity (dpm/100 cm²)				Range of Removable Activity (dpm/100 cm²)	
			Individual Measurements		Grid Block Average			
	Single-Pt.	Grid Blocks	Alpha	Beta	Alpha	Beta	Alpha	Beta
BUILDING 401A ROOM 1								
Floor and Lower Walls	N/A[b]	1	<37	<430	<37	<430	<12	<15
Upper Walls and Ceiling	1	N/A	<31	<310	N/A	N/A	<12	<15
ROOM 2								
Floor and Lower Walls	N/A	8	<37	<430	<37	<430	<12	<15
Upper Walls and Ceiling	4	N/A	<31	<310	N/A	N/A	<12	<15
ROOM 3								
Floor and Lower Walls	N/A	5	<47	<310	<47	<310	<12	<15
Upper Walls and Ceiling	4	N/A	<31-33	<310	N/A	N/A	<12	<15

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

Location[a]	Number of Measurement Locations		Range of Total Activity (dpm/100 cm²)				Range of Removable Activity (dpm/100 cm²)	
			Individual Measurements		Grid Block Average			
	Single-Pt.	Grid Blocks	Alpha	Beta	Alpha	Beta	Alpha	Beta
BUILDING 401A ROOM 4								
Floor and Lower Walls	N/A	4	<37	<430	<37	<430	<12	<15
Upper Walls and Ceiling	3	N/A	<31	<310	N/A	N/A	<12	<15
ROOM 5								
Floor and Lower Walls	N/A	4	<37-55	<430	<37	<430	<12	<15
Upper Walls and Ceiling	3	N/A	<31	<310	N/A	N/A	<12	<15
ROOM 6								
Floor and Lower Walls	N/A	5	<31	<310	<31	<310	<12	<15
Upper Walls and Ceiling	3	N/A	<31	<310	N/A	N/A	<12	<15

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

Location[a]	Number of Measurement Locations		Range of Total Activity (dpm/100 cm²)				Range of Removable Activity (dpm/100 cm²)	
			Individual Measurements		Grid Block Average			
	Single-Pt.	Grid Blocks	Alpha	Beta	Alpha	Beta	Alpha	Beta
BUILDING 401A ROOM 7								
Floor and Lower Walls	N/A	1	<47	<310	<47	<310	<12	<15
Upper Walls and Ceiling	2	N/A	<31	<310	N/A	N/A	<12	<15
ROOM 8								
Floor and Lower Walls	N/A	4	<47	<310	<47	<310	<12	<15
Upper Walls and Ceiling	3	N/A	<31	<310	N/A	N/A	<12	<15
ROOM 9								
Floor and Lower Walls	N/A	7	<47-85	<310	<47	<310	<12	<15
Upper Walls and Ceiling	2	N/A	<31	<310	N/A	N/A	<12	<15

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

Location[a]	Number of Measurement Locations		Range of Total Activity (dpm/100 cm²)				Range of Removable Activity (dpm/100 cm²)	
			Individual Measurements		Grid Block Average			
	Single-Pt.	Grid Blocks	Alpha	Beta	Alpha	Beta	Alpha	Beta
BUILDING 401A ROOM 10								
Floor and Lower Walls	N/A	9	<47	<310	<47	<310	<12	<15
Upper Walls and Ceiling	6	N/A	<31	<310	N/A	N/A	<12	<15
ROOM 11								
Floor and Lower Walls Pre-Remediation	N/A	8	<47-200	<310-760	<47-110	<310	<12	<15
Upper Walls and Ceiling	4	N/A	<31-38	<310	N/A	N/A	<12	<15
ROOM 12								
Floor and Lower Walls	N/A	7	<37-45	<430	<37	<430	<12	<15
Upper Walls and Ceiling	3	N/A	<31	<310	N/A	N/A	<12	<15

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

Location[a]	Number of Measurement Locations		Range of Total Activity (dpm/100 cm²)				Range of Removable Activity (dpm/100 cm²)	
			Individual Measurements		Grid Block Average			
	Single-Pt.	Grid Blocks	Alpha	Beta	Alpha	Beta	Alpha	Beta
BUILDING 401A ROOM 13								
Floor and Lower Walls	N/A	4	<37	<430	<37	<430	<12	<15
Upper Walls and Ceiling	3	N/A	<31	<310	N/A	N/A	<12	<15
ROOM 14								
Floor and Lower Walls	N/A	4	<37-75	<430	<37	<430	<12	<15
Upper Walls and Ceiling	3	N/A	<37	<430	N/A	N/A	<12	<15
ROOM 15								
Floor and Lower Walls	N/A	4	<31	<311	<31	<311	<12	<15
Upper Walls and Ceiling	3	N/A	<31	<310	N/A	N/A	<12	<15

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

Location[a]	Number of Measurement Locations		Range of Total Activity (dpm/100 cm²)				Range of Removable Activity (dpm/100 cm²)	
			Individual Measurements		Grid Block Average			
	Single-Pt.	Grid Blocks	Alpha	Beta	Alpha	Beta	Alpha	Beta
BUILDING 401A ROOM 16								
Floor and Lower Walls	N/A	4	<37-55	<430	<37	<430	<12	<15
Upper Walls and Ceiling	3	N/A	<31	<310	N/A	N/A	<12	<15
Exterior Walls	4	N/A	<47-100	<320	N/A	N/A	<12	<15
BUILDING 402 ROOM 1								
Floor and Lower Walls	5	N/A	<37	<430	N/A	N/A	<12	<15
Upper Walls and Ceiling	2	N/A	<31	<310-470	N/A	N/A	<12	<15
ROOM 2								
Floor and Lower Walls	N/A	6	<47	<320	<47	<320	<12	<15
Upper Walls and Ceiling	3	N/A	<31	<310	N/A	N/A	<12	<15

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

Location[a]	Number of Measurement Locations		Range of Total Activity (dpm/100 cm²)				Range of Removable Activity (dpm/100 cm²)	
			Individual Measurements		Grid Block Average			
	Single-Pt.	Grid Blocks	Alpha	Beta	Alpha	Beta	Alpha	Beta
BUILDING 402 ROOM 3								
Floor and Lower Walls	5	N/A	<47	<320	N/A	N/A	<12	<15
Upper Walls and Ceiling	1	N/A	<47	<320	N/A	N/A	<12	<15
ROOM 4								
Floor and Lower Walls	N/A	8	<37	<430	<37	<430	<12	<15-25
Upper Walls and Ceiling	1	N/A	<31	<370	N/A	N/A	<12	<15
ROOM 5								
Floor and Lower Walls	5	N/A	<37	<430	N/A	N/A	<12	<15
Upper Walls and Ceiling	1	N/A	<31	<310	N/A	N/A	<12	<15

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

Location[a]	Number of Measurement Locations		Range of Total Activity (dpm/100 cm²)				Range of Removable Activity (dpm/100 cm²)	
			Individual Measurements		Grid Block Average			
	Single-Pt.	Grid Blocks	Alpha	Beta	Alpha	Beta	Alpha	Beta
BUILDING 402 ROOM 6 and 8								
Floor and Lower Walls	N/A	N/A	<47	<320	<47	<320	<12	<15
Upper Walls and Ceiling	2	N/A	<31	<320	N/A	N/A	<12	<15
ROOM 7								
Lower Walls	2	N/A	<31-38	<310	N/A	N/A	<12	<15
Exterior Walls	4	N/A	<47	<320	N/A	N/A	<12	<15
BUILDING 416								<15
Floor and Lower Walls	N/A	5	<37-180	<430	<37-42	<430	<12	<15
Upper Walls and Ceiling	1	N/A	<37	<430	N/A	N/A	<12	<15

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

Location[a]	Number of Measurement Locations		Range of Total Activity (dpm/100 cm²)				Range of Removable Activity (dpm/100 cm²)	
			Individual Measurements		Grid Block Average			
	Single-Pt.	Grid Blocks	Alpha	Beta	Alpha	Beta	Alpha	Beta
BUILDING 429 ROOM 1								
Floor and Lower Walls	5	N/A	<37	<430	N/A	N/A	<12	<15-25
Upper Walls and Ceiling	4	N/A	<37	<440	N/A	N/A	<12	<15
ROOM 2								
Floor and Lower Walls	N/A	10	<47	<430	<47	<430	<12	<15
Upper Walls and Ceiling	5	N/A	<31	<310	N/A	N/A	<12	<15
ROOM 3								
Floor and Lower Walls	5	N/A	<47	<320	N/A	N/A	<12	<15
Upper Walls and Ceiling	1	N/A	<47	<320	N/A	N/A	<12	<15

TABLE 1 (Continued)

SUMMARY OF SURFACE ACTIVITY MEASUREMENTS
NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

Location[a]	Number of Measurement Locations		Range of Total Activity (dpm/100 cm²)				Range of Removable Activity (dpm/100 cm²)	
			Individual Measurements		Grid Block Average			
	Single-Pt.	Grid Blocks	Alpha	Beta	Alpha	Beta	Alpha	Beta
BUILDING 429 ROOM 4								
Floor and Lower Walls	N/A	4	<47	<320	<47	<320	<12	<15-25
Upper Walls and Ceiling	3	N/A	<31	<310	N/A	N/A	<12	<15
ROOM 5								
Floor and Lower Walls	5	N/A	<37	<430	N/A	N/A	<12	<15
Upper Walls and Ceiling	1	N/A	<31	<310	N/A	N/A	<12	<15
ROOM 6								
Floor and Lower Walls	5	N/A	<37	<430	N/A	N/A	<12	<15
Upper Walls and Ceiling	1	N/A	<31	<310	N/A	N/A	<12	<15
Exterior Walls	4	N/A	<47	<320	N/A	N/A	<12	<15

[a]Refer to Figures 7 through 39.
[b]N/A = Not Applicable.
[c]Data provided by BNI.

REFERENCES

1. Oak Ridge Associated Universities, "Radiological Survey of the Niagara Falls Storage Site, Lewiston, New York", December 1988.

2. U. S. Department of Energy, "Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Programs and Remote Surplus Facilities Management Program Sites", March 1987.

3. U. S. Department of Energy, Order 5400.5 "Radiation Protection of the Public and the Environment", February 8, 1990.

4. U. S. Department of Energy, DOEN 5480.6 "Radiological Control Manual", June 1992.

5. Memorandum, Peter J. Gross, Director Technical Services Division, Department of Energy, Oak Ridge Operations, to Jim Fiore, Department of Energy - Headquarters, "NFSS Residual Radioactive Material Guidelines", August 30, 1988.

APPENDIX A

MAJOR INSTRUMENTATION

APPENDIX A
MAJOR INSTRUMENTATION

The display of a specific product is not to be construed as an endorsement of the product or its manufacturer by the authors or their employers.

DIRECT RADIATION MEASUREMENT

Instruments

Eberline Pulse Ratemeter
Model PRM-6
(Eberline, Santa Fe, NM)

Ludlum Floor Monitor
Model 239-1
(Ludlum Measurements, Inc.,
Sweetwater, TX)

Ludlum Ratemeter-Scaler
Model 2221
(Ludlum Measurements, Inc.,
Sweetwater, TX)

Detectors

Ludlum Gas Proportional Detector
Model 43-37
Effective Area, 550 cm^2
(Ludlum Measurements, Inc.,
Sweetwater, TX)

Ludlum Gas Proportional Detector
Model 43-68
Effective Area, 100 cm^2
(Ludlum Measurements, Inc.,
Sweetwater, TX)

Victoreen NaI(Tl) Scintillation Detector
Model 489-55
3.2 cm x 3.8 cm Crystal
(Victoreen, Cleveland, OH)

LABORATORY ANALYTICAL INSTRUMENTATION

High-Purity Germanium Coaxial Well Detector
Model GWO-110210-PWS-S, 23% Eff.
(EG&G ORTEC, Oak Ridge, TN)
Used in conjunction with:
Lead Shield Model G-16
(Applied Physical Technology, Atlanta, GA) and
Multichannel Analyzer
3100 Vax Workstation
(Canberra, Meriden, CT)

Low Background Gas Proportional Counter
Model LB-5110
(Tennelec, Oak Ridge, TN)

APPENDIX B

SURVEY AND ANALYTICAL PROCEDURES

APPENDIX B

SURVEY AND ANALYTICAL PROCEDURES

SURVEY PROCEDURES

Surface Scans

Surface scans were performed by passing the probes slowly over the surface; the distance between the probe and the surface was maintained at a minimum - nominally about 1 cm. A large surface area, gas proportional floor monitor was used to scan the floors of the surveyed areas. Other surfaces were scanned using small area (100 cm^2) hand-held detectors. Identification of elevated levels was based on increases in the audible signal from the recording and/or indicating instrument. Combinations of detectors and instruments used for the scans were:

Alpha	-	gas proportional detector with ratemeter-scaler
Beta	-	gas proportional detector with ratemeter-scaler
Gamma	-	NaI(Tl) scintillation detector with ratemeter

Surface Activity Measurements

Measurements of total alpha and total beta activity levels were performed using gas proportional detectors with portable ratemeter-scalers.

Count rates (cpm), which were integrated over 1 minute, with the detector in a static position were converted to activity levels (dpm/100 cm^2) by dividing the net rate by the 4 π efficiency and correcting for the active area of the detector. The alpha activity background count rates for the gas proportional detectors averaged approximately 1 cpm for each detector. Alpha efficiency factors ranged from 0.20 - 0.24. The beta activity background count rates for the proportional

detectors averaged approximately 310 cpm. Beta efficiency factors ranged from 0.20 - 0.27 for the gas proportional detectors. The effective window for the gas proportional detectors was 100 cm^2.

Removable Activity Measurements

Removable activity levels were determined using numbered filter paper disks, 47 mm in diameter. Moderate pressure was applied to the smear with two or three fingers, and approximately 100 cm^2 of the surface was wiped. Smears were placed in labeled envelopes with the location and other pertinent information recorded.

Soil Sampling

Approximately 1 kg of soil was collected from the sample location. The collected sample was placed in a plastic bag, sealed, and labeled in accordance with ESSAP survey procedures.

ANALYTICAL PROCEDURES

Gamma Spectrometry

Soil samples were dried, mixed and/or the samples were placed in an appropriate container chosen to reproduce the calibrated counting geometry. The net weights were determined and the samples counted using high purity intrinsic germanium detector coupled to a pulse height analyzer system. Background and Compton stripping, peak search, peak identification, and concentration calculations were performed using the computer capabilities inherent in the analyzer system. Energy peaks used for determination of radionuclides of concern were:

Cs-137	0.662 MeV
U-238	0.093 MeV from Th-234* (or 1.001 MeV from Pa-234 m)*
U-235	0.143 MeV/0.186 MeV

Th-232	0.911 MeV from Ac-228*
Ra-226	0.609 MeV from Bi-214*

*Secular equilibrium assumed.

Spectra were also reviewed for other identifiable photopeaks.

Removable Activity

Smears were counted on a low background gas proportional system for gross alpha and gross beta activity.

UNCERTAINTIES AND DETECTION LIMITS

The uncertainties associated with the analytical data presented in the tables of this report represent the 95% confidence level for that data. These uncertainties were calculated based on both the gross sample count levels and the associated background count levels. When the net sample count was less than the 95% statistical deviation of the background count, the sample concentration was reported as less than the detection limit of the measurement procedures. Because of variations in background levels, measurement efficiencies, and contributions from other radionuclides in samples, the detection limits differ from sample to sample and instrument to instrument. Additional uncertainties associated with sampling and measurement activities have not been propagated into the data presented in this report.

CALIBRATION AND QUALITY ASSURANCE

Calibration of all field and laboratory instrumentation was based on standards/sources, traceable to NIST, when such standards/sources were available. In cases where they were not available, standards of an industry recognized organization was used. Calibration of pressurized ionization chambers was performed by the manufacturer.

Analytical and field survey activities were conducted in accordance with procedures from the following documents:

-Survey Procedures Manual Revision 6 (February 1991)
-Laboratory Procedures Manual Revision 6 (April 1991)
-Quality Assurance Manual Revision 4 (April 1991)

The procedures contained in these manuals were developed to meet the requirements of DOE Order 5700.6B for Quality Assurance and contain measures to assess processes during their performance.

Calibration of all field and laboratory instrumentation was based on standards/sources, traceable to NIST, when such standards/sources were available. In cases where they were not available, standards of an industry recognized organization were used.

Quality control procedures include:

- Daily instrument background and check-source measurements to confirm that equipment operation is within acceptable statistical fluctuations.
- Participation in EPA and EML laboratory Quality Assurance Programs.
- Training and certification of all individuals performing procedures.
- Periodic internal and external audits.

APPENDIX C

RESIDUAL RADIOACTIVE MATERIAL GUIDELINES SUMMARIZED FROM DOE ORDER 5400.5

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BASIC DOSE LIMITS

The basic limit for the annual radiation dose (excluding radon) received by an individual member of the general public is 100 mrem/yr. In implementing this limit, DOE applies as low as reasonable achievable principles to set site-specific guidelines.

STRUCTURE GUIDELINES

Indoor/Outdoor Structure Surface Contamination

Radionuclides[a]	Allowable Total Residual Surface Contamination (dpm/100 cm^2)[b] Average[c,d]	Maximum[d,e]	Removable[f]
Transuranics, Ra-226, Ra-228, Th-230 Th-228, Pa-231, Ac-227, I-125, I-129 [g]	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	5,000α	15,000α	1,000α
Beta-gamma emitters (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above [h]	5,000β-γ	15,000β-γ	1,000β-γ

External Gamma Radiation

The average level of gamma radiation inside a building or habitable structure on a site that has no radiological restriction on its use shall not exceed the background level by more than 20 μR/h and will comply with the basic dose limits when an appropriate-use scenario is considered.

SOIL GUIDELINES

Radionuclides	Soil Concentration (pCi/g) Above Background[i,j,k]
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.
Uranium	Soil guidelines are calculated on a site-specific basis, using the DOE manual developed for this use.

[a] 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.

[b] 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 measured by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

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

[d] The average and maximum dose rates associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/h and 1.0 mrad/h, respectively, at a depth of 1 cm.

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

[f] The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping an area of that size 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. It is not necessary to use wiping techniques

to measure removable contamination levels, if direct scan surveys indicate that total residual surface contamination levels are within the limits for removable contamination.

[g] Guidelines for these radionuclides are not given in DOE Order 5400.5; however, these guidelines are considered applicable until guidance is provided.

[h] This category of radionuclides includes mixed fission products, including the Sr-90 which is present in them. It does not apply to Sr-90, which has been separated from the other fission products, or mixtures where the Sr-90 has been enriched.

[i] These guidelines take into account ingrowth of radium-226 from thorium-230 or thorium-232 and radium-228 and assume secular equilibrium. If either Th-230 and Ra-226 or Th-232 and Ra-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").

[j] 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.

[k] If the average concentration in any surface or below-surface area, less than or equal to 25 m^2, exceeds the authorized limit of guideline by a factor of $(100/A)^{1/2}$, where A is the area or the elevated region in square meters, limits for "hot spots" shall also be applicable. Procedures for calculating these hot spot limits, which depend on the extent of the elevated local concentrations, are given in the DOE Manual for Implementing Residual Radioactive Materials Guidelines, DOE/CH/890/. In addition, every reasonable effort shall be made to remove any source of radionuclide that exceeds 30 times the appropriate limit for soil, irrespective of the average concentration in the soil.