Rancho Seco

Final Status Survey Summary Report

July 4, 2008

Rooms 109 and 110 AB+0'

Survey Unit F8130941

Prepared By: Erin L. Brown **Date:** 7/4/2008
FSS Engineer

Reviewed By: Robert F. Dreher **Date:** 7/7/08
Lead FSS Engineer

Approved By: E. J. [signature] **Date:** 7-24-08
Dismantlement Superintendent, Radiological

FINAL STATUS SURVEY SUMMARY REPORT

Survey Unit:

F8130941, Rooms 109 and 110 AB+0'

Survey Unit Description:

Operating History: The reinforced concrete structure contained the RadWaste processing and supporting systems. The building contained six main elevations. Residual radioactive material was known to be present on all levels of the interior of the building. Operating records and the HSA document several events with the potential for a release of radioactivity inside this structure. One report documented contamination of the auxiliary building roof. The roof was later replaced.

Site Characterization: Direct measurements were made of each of the interior elevation surfaces as well as the exterior surfaces of the structure. These measurements confirmed the presence of plant-derived radionuclides. Direct measurements on the –47' elevation showed a mean gross activity level of 320,071 dpm/100 cm^2 and a maximum value of 5,720,000 dpm/100 cm^2. Direct measurements on the –29' elevation showed a mean gross activity level of 544,756 dpm/100 cm^2 and a maximum value of 11,370,000 dpm/100 cm^2. Direct measurements on the –20' elevation showed a mean gross activity level of 247,831 dpm/100 cm^2 and a maximum value of 10,080,000 dpm/100 cm^2. Direct measurements on the grade elevation showed a mean gross activity level of 373,758 dpm/100 cm^2 and a maximum value of 5,800,000 dpm/100 cm^2. Direct measurements on the +20' elevation showed a mean gross activity level of 85,408 dpm/100 cm^2 and a maximum value of 1,900,000 dpm/100 cm^2. Direct measurements on the +40' elevation showed a mean gross activity level of 3,288 dpm/100 cm^2 and a maximum value of 24,781 dpm/100 cm^2. Direct measurements on the building exterior, including the mezzanine roof, showed a mean gross activity level of 1,897 dpm/100 cm^2 and a maximum value of 2,990 dpm/100 cm^2. (The roof had been replaced prior to the classification survey.) Based on the classification procedure (DSIP-0020) and levels of gross activity reported, the interior of the auxiliary building was determined to be a Class 1, 2 area and the exterior was a Class 2,3.

HSA Events: HSA Report pg. 63.

Survey Unit Design Information:

The Survey Unit Design Parameters are presented in Table 1 below. The survey unit and measurement locations are depicted on the maps in Attachment 1. Direct measurement locations were determined using a random-start, fixed grid pattern and 204 m^2 were scanned for approximately 23% coverage. Samples of removable contamination were collected at each direct measurement location. The instrumentation used for the survey along with the MDC values are listed in Tables 2-1 and 2-2 in Attachment 2.

Table 1. Survey Unit Design Parameters

Survey Design Parameter	Value	Comment
Survey Area:	F813	Rooms 109 and 110 AB+0'
Survey Unit:	0941	Structure Surface
Class:	2	LTP Table 5-4
SU Area (m^2)**:**	898	
Evaluator:	Erin L. Brown	
DCGL (dpm/100 cm^2)**:**	43000	Gross Activity DCGL
Area Factor:	N/A	Class 2
Design DCGLemc (dpm/100 cm^2)**:**	N/A	Class 2
LBGR (dpm/100 cm^2)**:**	21500	Default = 50% DCGL
Design Sigma (dpm/100 cm^2)**:**	6935	
Type I Error:	0.05	
Type II Error:	0.05	
Predominant Nuclide:	Cs-137	
Sample Area (m^2)**:**	64	Class 2
Scan Area (m^2)**:**	204	
Scan Coverage (%):	23%	Class 2
$Z_{1-\alpha}$ **:**	1.645	
$Z_{1-\beta}$ **:**	1.645	
Sign P:	0.99865	
Calculated Relative Shift:	3.1	
Relative Shift Used:	3	Uses 3.0 if Relative Shift is >3
N-Value:	11	
Design N-Value + 20%:	14	NUREG-1575 Table 5-5
Design Min Samples N:	14	Class 2
Grid Spacing L:	8.0	Class 2

Survey Results:

A total of 14 direct measurements were made in F8130941. The results including mean, median, standard deviation and range are shown in Table 2. All direct measurements were less than the DCGL. None of the scan measurements indicated areas of elevated activity. The highest ISOCS gamma measurement was 3835 dpm/100cm^2 Cs-137; Co-60 was not identified above the MDA. Scan activity ranged from 790 to 18644 dpm/100 cm^2, based on a surveyor efficiency of 0.5 and no background subtracted. Samples for removable surface activity were all less than 10% of the DCGL as shown in Table 3. Removable surface activity samples were counted for alpha activity and none was detected at the MDC shown in Table 2-1 of Attachment 2.

Table 2. Direct Measurement Results

Measurement ID	Gross Activity (dpm/100 cm^2)
F8130941-C0001BD	2789
F8130941-C0002BD	2877
F8130941-C0003BD	2767
F8130941-C0004BD	2359
F8130941-C0005BD	2557
F8130941-C0006BD	2976
F8130941-C0007BD	2634
F8130941-C0008BD	2756
F8130941-C0009BD	2888
F8130941-C0010BD	2282
F8130941-C0011BD	2568
F8130941-C0012BD	18364
F8130941-C0013BD	2910
F8130941-C0014BD	3538
Mean:	3876
Median:	2778
Standard Deviation:	4181
Range:	2282 - 18364

Table 3. Removable Surface Activity Results

Measurement ID	Surface Beta Activity (dpm/100 cm^2)
F8130941C0001SM	-2.24
F8130941C0002SM	-2.24
F8130941C0003SM	-0.95
F8130941C0004SM	-2.24
F8130941C0005SM	-3.53
F8130941C0006SM	-3.53
F8130941C0007SM	0.34
F8130941C0008SM	-3.53
F8130941C0009SM	-3.53
F8130941C0010SM	-2.24
F8130941C0011SM	-0.95
F8130941C0012SM	-3.53
F8130941C0013SM	-3.53
F8130941C0014SM	-0.95
Mean:	-2.33
Median:	-2.24
Standard Deviation:	1.29
Range:	-3.53 to 0.34

Survey Unit Data Assessment:

The survey design required 14 direct measurements for the Sign Test. The critical value and the results of the Sign Test are presented in Table 4. The sample mean and median values were less than the DCGL. The sample standard deviation was less than the design standard deviation so no additional samples were required.

Table 4. Data Assessment Results

Survey Results Parameter	Value	Comment
Material Background Used (dpm/100 cm²):	N/A	
Ambient Background Used (dpm/100 cm²):	N/A	Average Ambient BKG = 0
Actual Direct Measurements (N):	14	
Median (dpm/100 cm²):	2778	
Mean (dpm/100 cm²):	3876	
Direct Measurement Standard Deviation (dpm/100 cm²):	4181	
Total Standard Deviation (dpm/100 cm²):	4181	Based on samples and backgrounds.
Maximum (dpm/100 cm²):	18364	
Material Type:	N/A	Background Subtract Not Applied
Sign Test Final N Value:	14	
S+ Value:	14	
Critical Value:	10	
Sufficient Samples Collected:	Yes	
Maximum Value < DCGL:	Yes	
Median Value < DCGL:	Yes	
Mean Value < DCGL:	Yes	
Maximum Value < DCGLemc:	N/A	Class 2
Total Standard Deviation <= Sigma:	Yes	
Pass the Sign Test?	Yes	
Reject the Null Hypothesis?	Yes	
Does the Survey Unit Pass All Criteria?	Yes	

Survey Unit Investigations and Results:

No investigations were required for either direct or scan measurements and no investigation results are reported.

ALARA Statement:

As stated in Chapter 4 of the LTP, as long as the residual activity within the survey unit is less than the DCGL (i.e. the survey unit average activity is less than the DCGL), the ALARA criterion has been met.

Changes in Initial Survey Unit Assumptions:

The survey unit was designed as a Class 2 structure survey and the sample results are consistent with that classification. The variability of the survey results was less than the characterization data used for survey design. No potential areas of elevated activity were detected.

Conclusion:

The FSS of this survey unit was properly designed as a Class 2 survey based on Table 5-4 of the LTP. The required number of direct measurements was made and the scan coverage met the requirement of Table 5-6 of the LTP. No direct measurements exceeded the DCGL of 43000 dpm/100 cm^2 and none of the removable surface activity measurements exceeded 10% of the DCGL. No investigations were required.

The direct measurement data support rejection of the null hypothesis, providing high confidence that the survey unit satisfied the release criteria and that the data quality objectives were met.

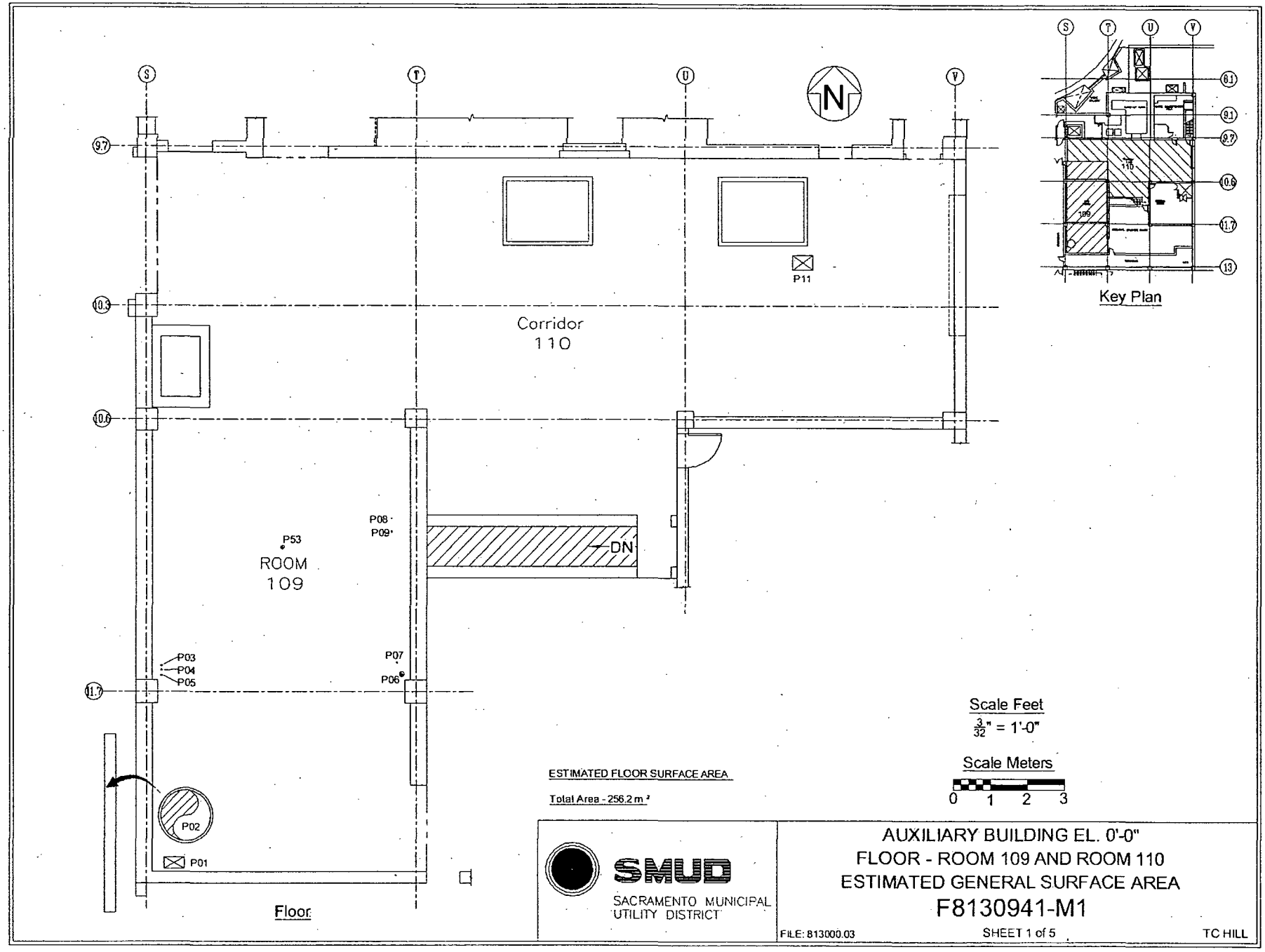
It is concluded that survey unit F8130941 meets the release criteria of 10CFR20.1402.

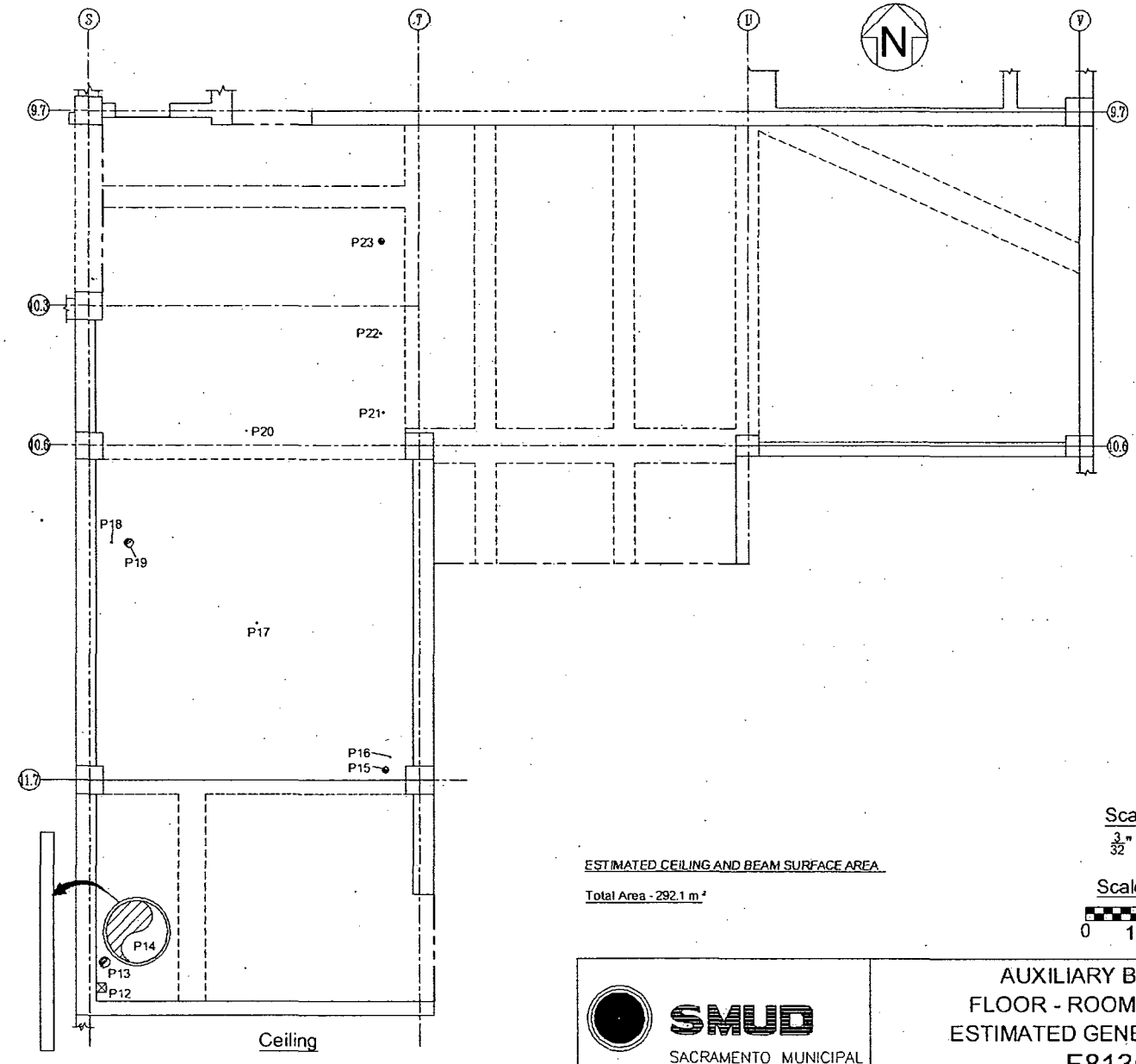
Attachment 1

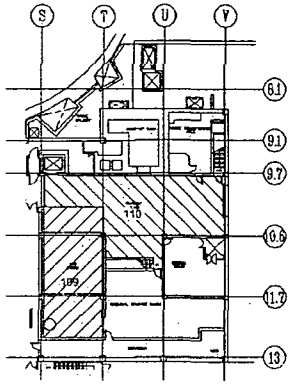
Maps

July 4, 2008

Survey Unit F8130941


S
T
U
V
N
9.7
10.3
10.6
11.7
P11
Corridor
110
P53
ROOM
109
P08
P09
DN
P03
P04
P05
P07
P06
P02
P01
Floor
Key Plan
Scale Feet
3/32" = 1'-0"
Scale Meters
0 1 2 3
ESTIMATED FLOOR SURFACE AREA
Total Area - 256.2 m²
SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT
AUXILIARY BUILDING EL. 0'-0"
FLOOR - ROOM 109 AND ROOM 110
ESTIMATED GENERAL SURFACE AREA
F8130941-M1
FILE: 813000.03
SHEET 1 of 5
TC HILL





Key Plan

ESTIMATED CEILING AND BEAM SURFACE AREA

Total Area - 292.1 m²

Scale Feet

$\frac{3}{32}$" = 1'-0"

Scale Meters

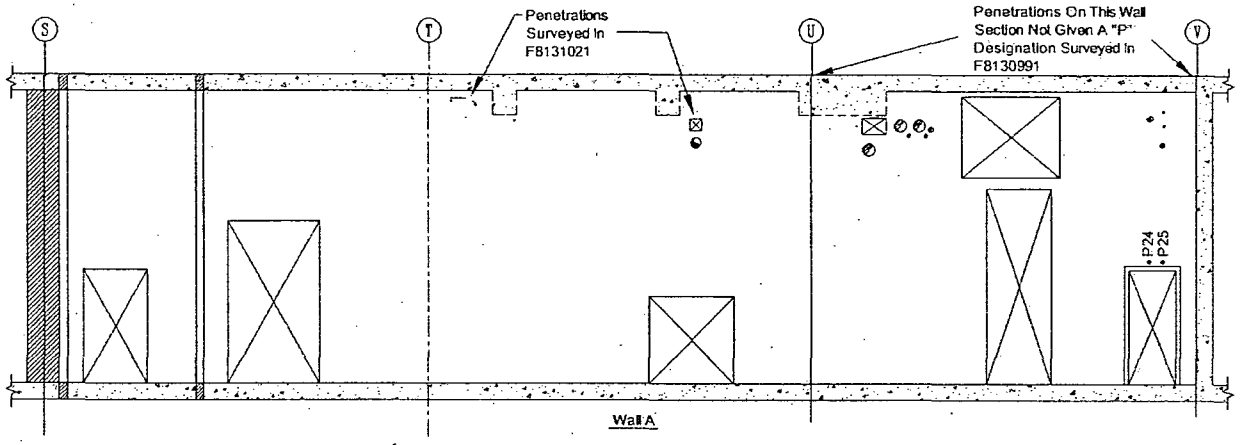
0 1 2 3

SMUD

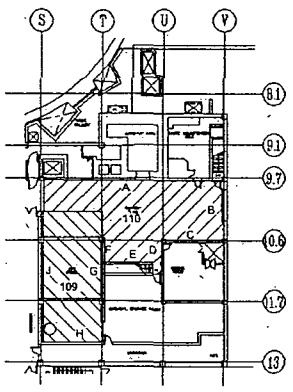
SACRAMENTO MUNICIPAL UTILITY DISTRICT

AUXILIARY BUILDING EL. 0'-0"
FLOOR - ROOM 109 AND ROOM 110
ESTIMATED GENERAL SURFACE AREA
F8130941-M1

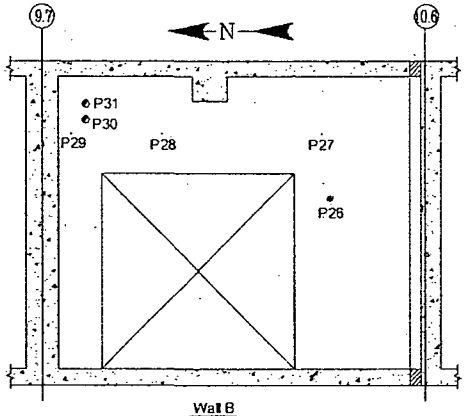
FILE: 813000.03 SHEET 2 of 5 TC HILL



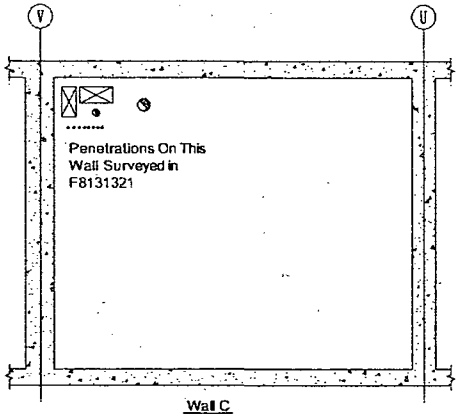
Wall A



Key Plan

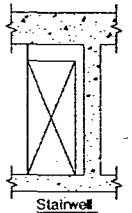


Wall B

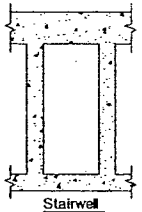


Wall C
Looking South

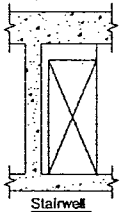
Stairwell Landing Ceiling



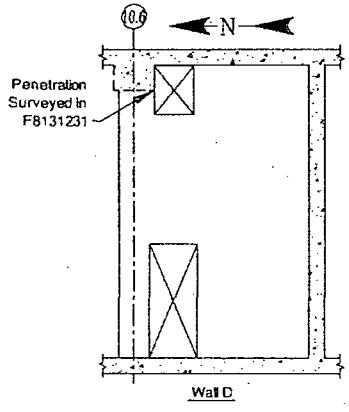
Stairwell Landing Wall Looking North



Stairwell Landing Wall Looking East



Stairwell Landing Wall Looking South



Wall D

ESTIMATED WALL SURFACE AREA
Walls - 180.9 m²

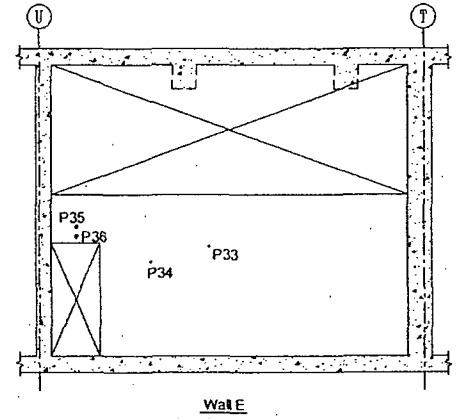
Scale Feet
$\frac{3}{32}$" = 1'-0"

Scale Meters
0 1 2 3

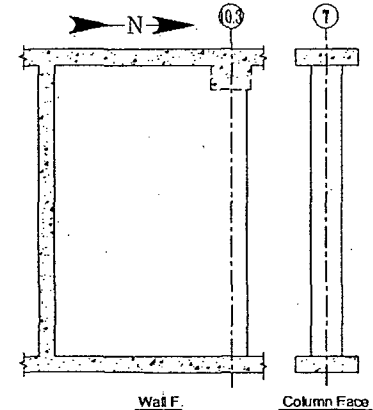
SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT

AUXILIARY BUILDING EL. 0'-0"
FLOOR - ROOM 109 AND ROOM 110
ESTIMATED GENERAL SURFACE AREA
F8130941-M1

FILE: 813000.03 SHEET 3 of 5 TC HILL

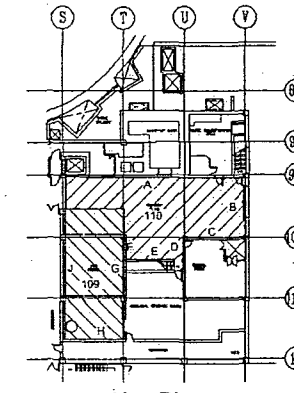


Wall E
Looking South

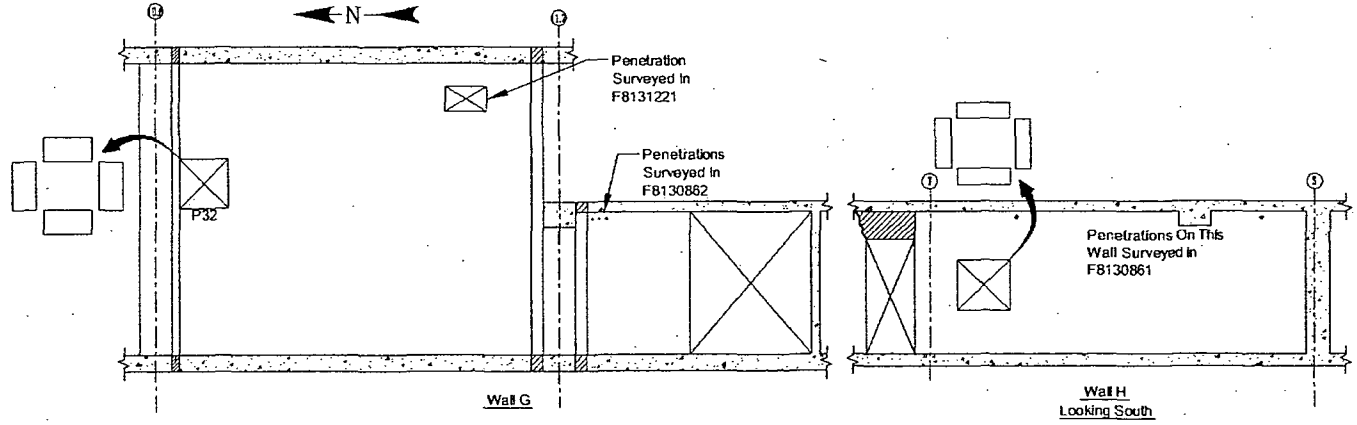


Wall F

Column Face
Looking South



Key Plan



Wall G

Wall H
Looking South

Scale Feet
$\frac{3}{32}$" = 1'-0"

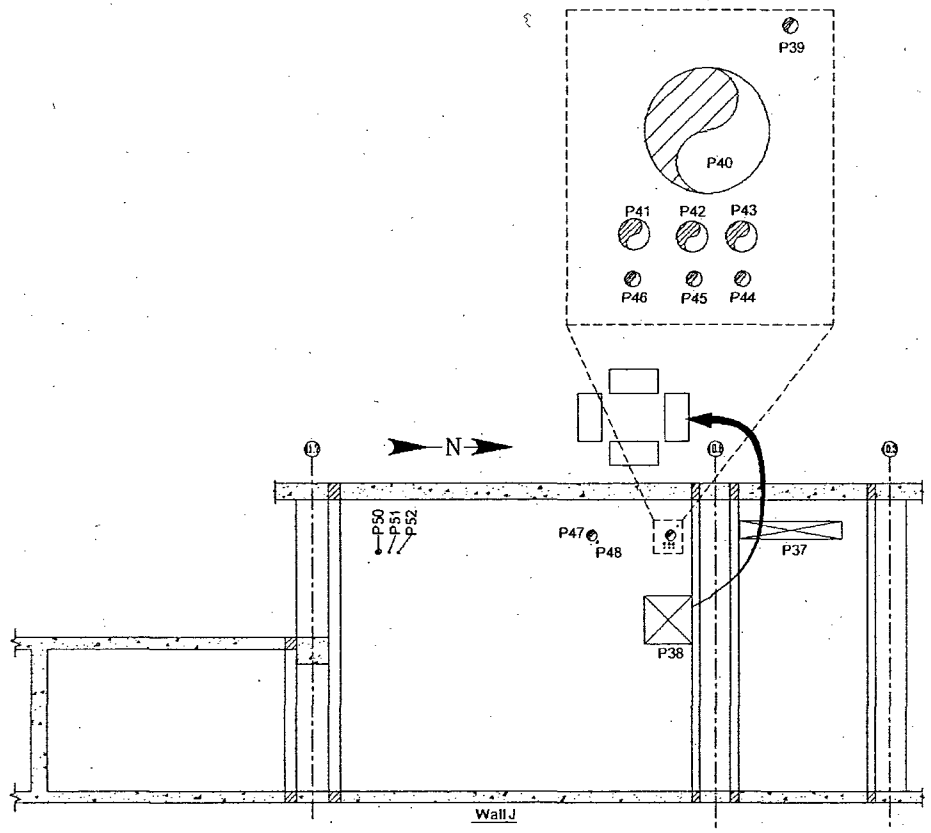
Scale Meters
0 1 2 3

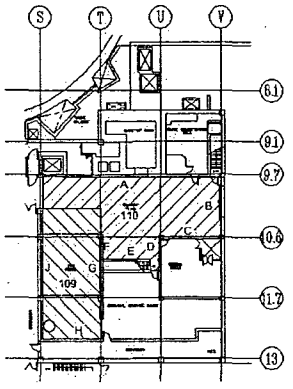
ESTIMATED WALL SURFACE AREA
Walls - 92.1 m²

SMUD
SACRAMENTO MUNICIPAL
UTILITY DISTRICT

AUXILIARY BUILDING EL. 0'-0"
FLOOR - ROOM 109 AND ROOM 110
ESTIMATED GENERAL SURFACE AREA
F8130941-M1

FILE: 813000.03 SHEET 4 of 5 TC HILL





Key Plan

Scale Feet
$\frac{3}{32}$" = 1'-0"

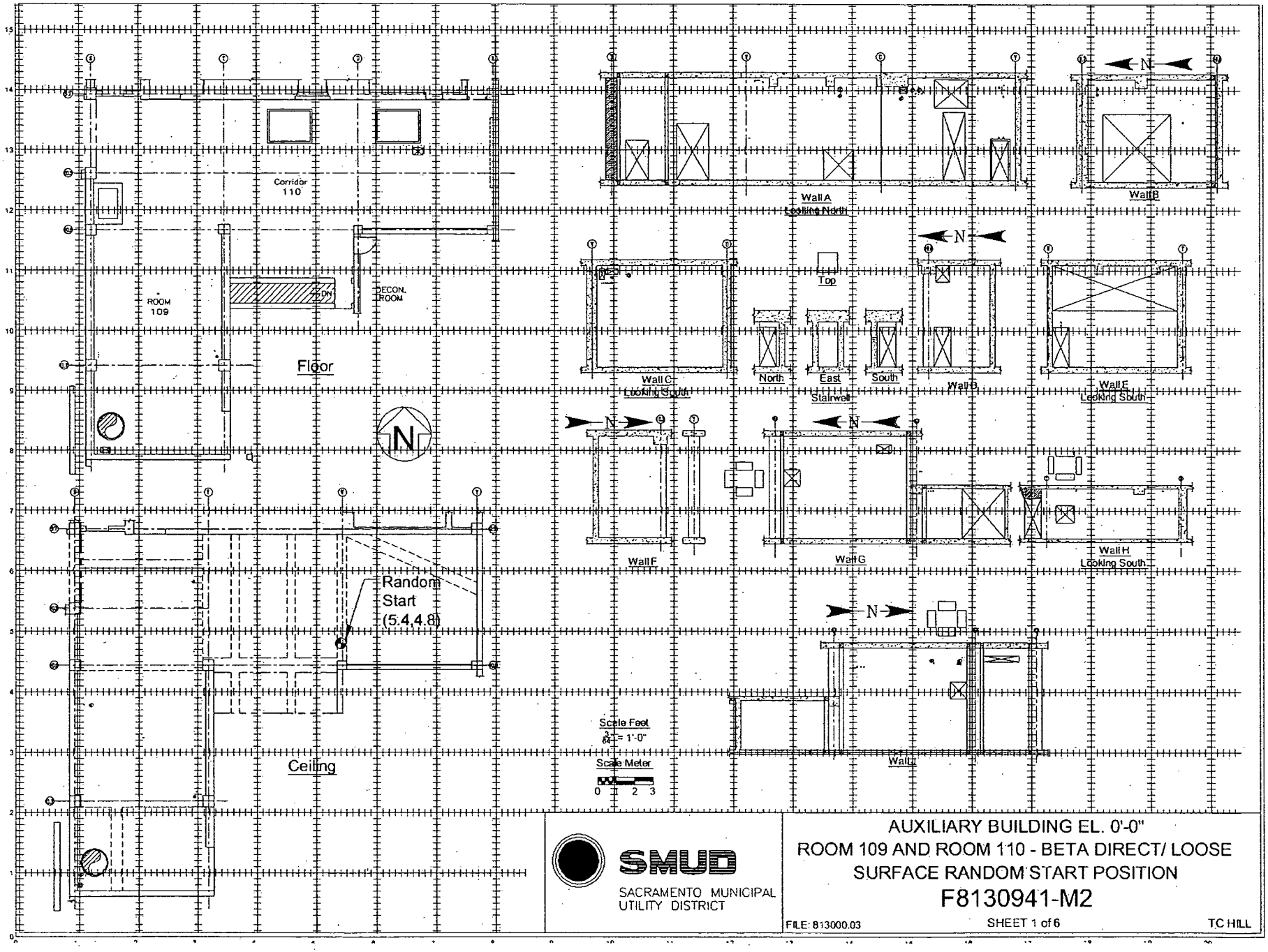
Scale Meters
0 1 2 3

ESTIMATED WALL SURFACE AREA
Walls - 77.0 m²

SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT

AUXILIARY BUILDING EL. 0'-0"
FLOOR - ROOM 109 AND ROOM 110
ESTIMATED GENERAL SURFACE AREA
F8130941-M1

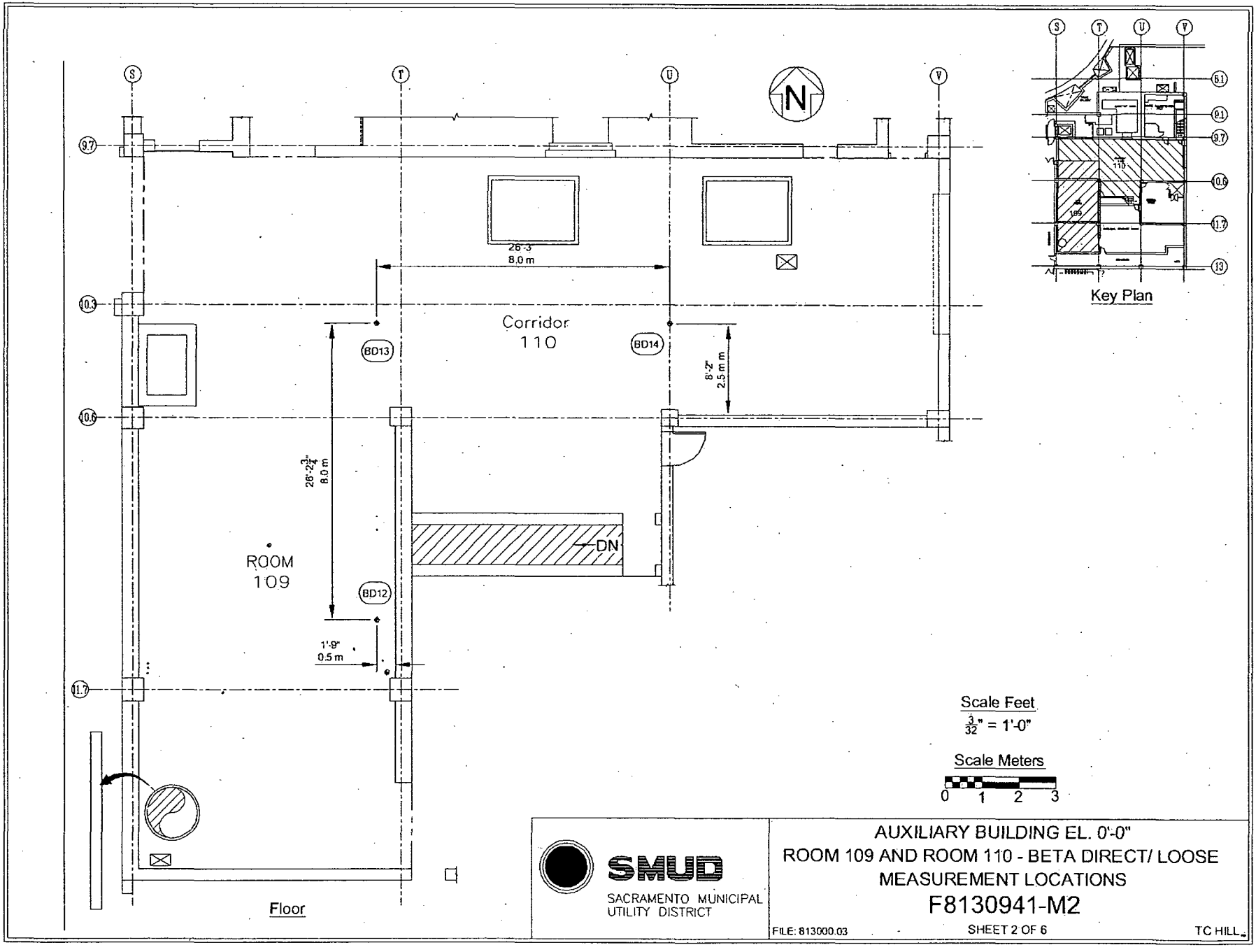
FILE: 813000.03 SHEET 5 of 5 TC HILL

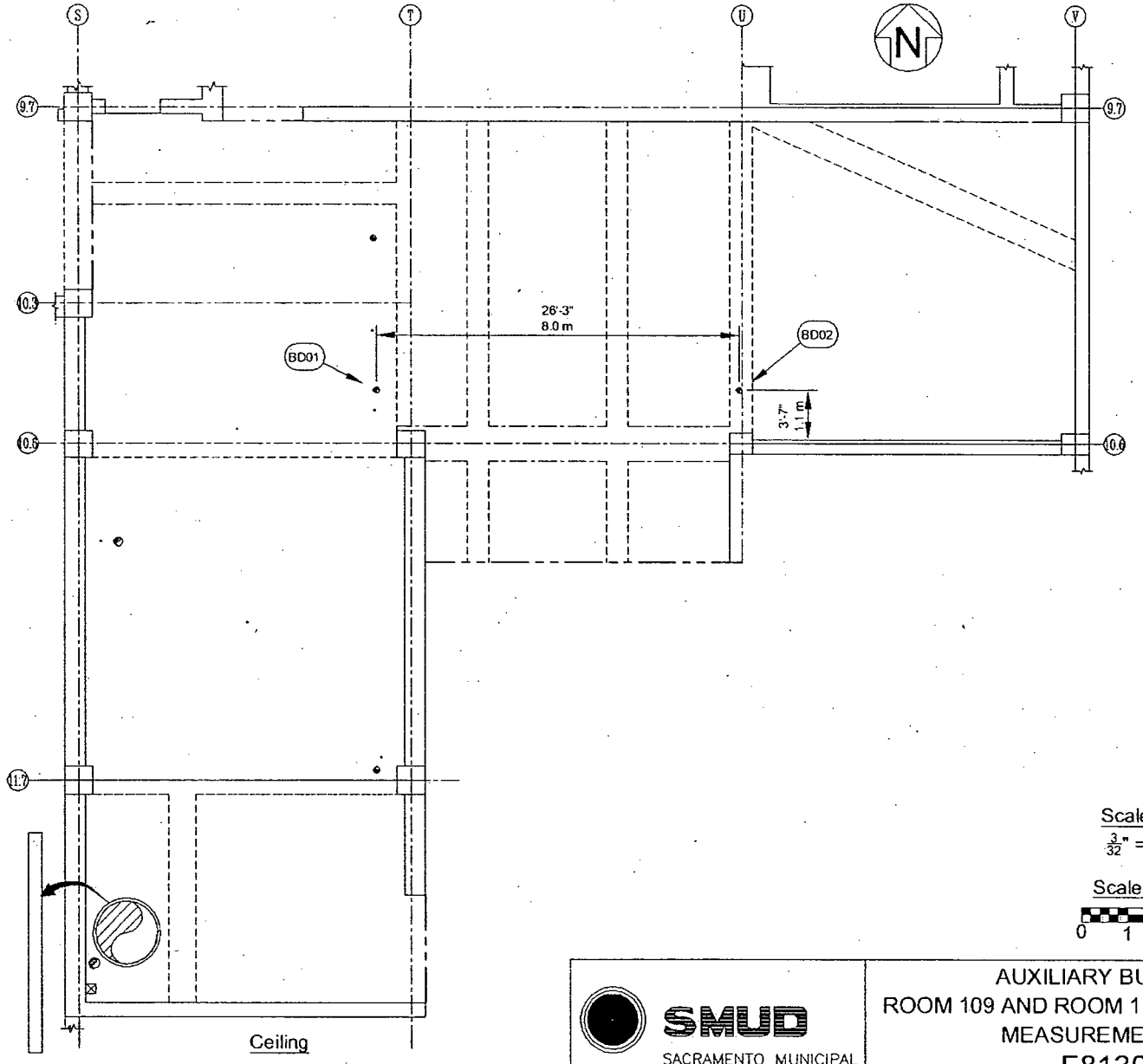


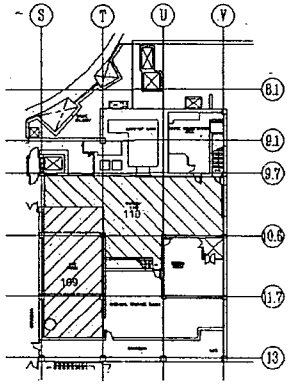
SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT

AUXILIARY BUILDING EL. 0'-0"
ROOM 109 AND ROOM 110 - BETA DIRECT/ LOOSE SURFACE RANDOM START POSITION
F8130941-M2

FILE: 813000.03 SHEET 1 of 6 TC HILL


S
T
U
V
N
9.7
10.3
10.6
11.7
26'-3"
8.0 m
Corridor
110
BD13
BD14
8'-2"
2.5 m m
26'-2 3/4"
8.0 m
ROOM
109
DN
BD12
1'-9"
0.5 m
Floor
Key Plan
Scale Feet
3/32" = 1'-0"
Scale Meters
0 1 2 3
SMUD
SACRAMENTO MUNICIPAL
UTILITY DISTRICT
AUXILIARY BUILDING EL. 0'-0"
ROOM 109 AND ROOM 110 - BETA DIRECT/ LOOSE
MEASUREMENT LOCATIONS
F8130941-M2
FILE: 813000.03
SHEET 2 OF 6
TC HILL





Key Plan

Scale Feet

$\frac{3}{32}$" = 1'-0"

Scale Meters

0 1 2 3

SMUD

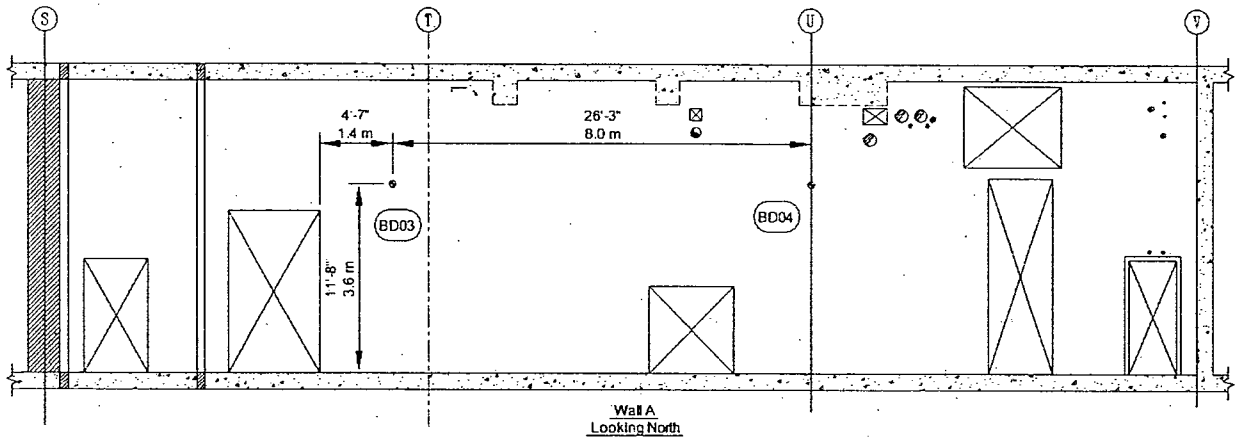
SACRAMENTO MUNICIPAL UTILITY DISTRICT

AUXILIARY BUILDING EL. 0'-0"

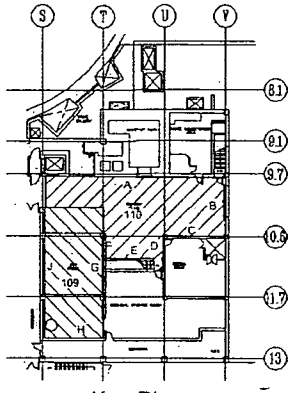
ROOM 109 AND ROOM 110 - BETA DIRECT/ LOOSE MEASUREMENT LOCATIONS

F8130941-M2

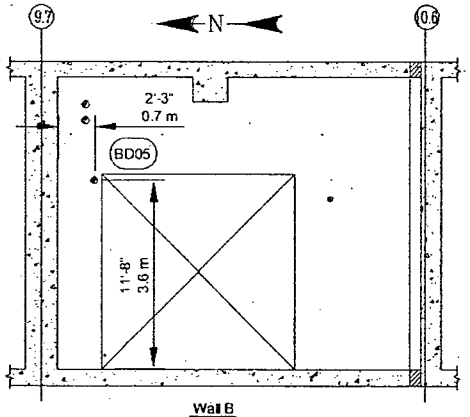
FILE: 813000.03 SHEET 3 OF 6 TC HILL



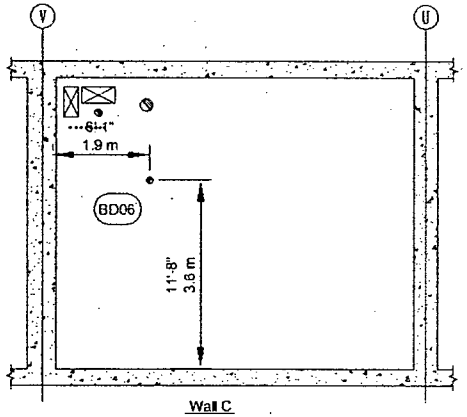
Wall A
Looking North



Key Plan

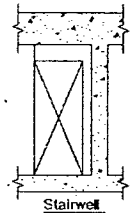


Wall B



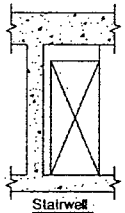
Wall C
Looking South

Stairwell
Landing
Ceiling

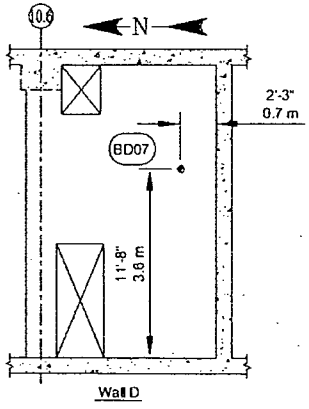


Stairwell
Landing Wall
Looking North

Stairwell
Landing Wall
Looking East



Stairwell
Landing Wall
Looking
South



Wall D

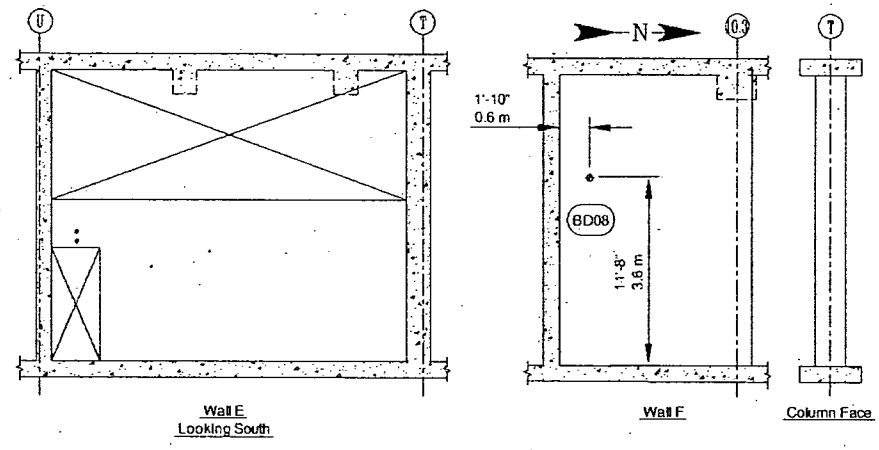
Scale Feet
$\frac{3}{32}$" = 1'-0"

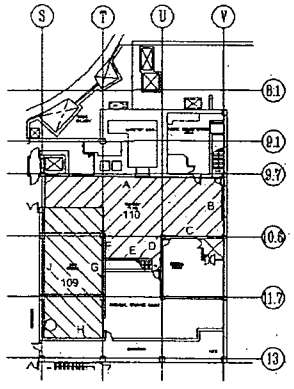
Scale Meters
0 1 2 3

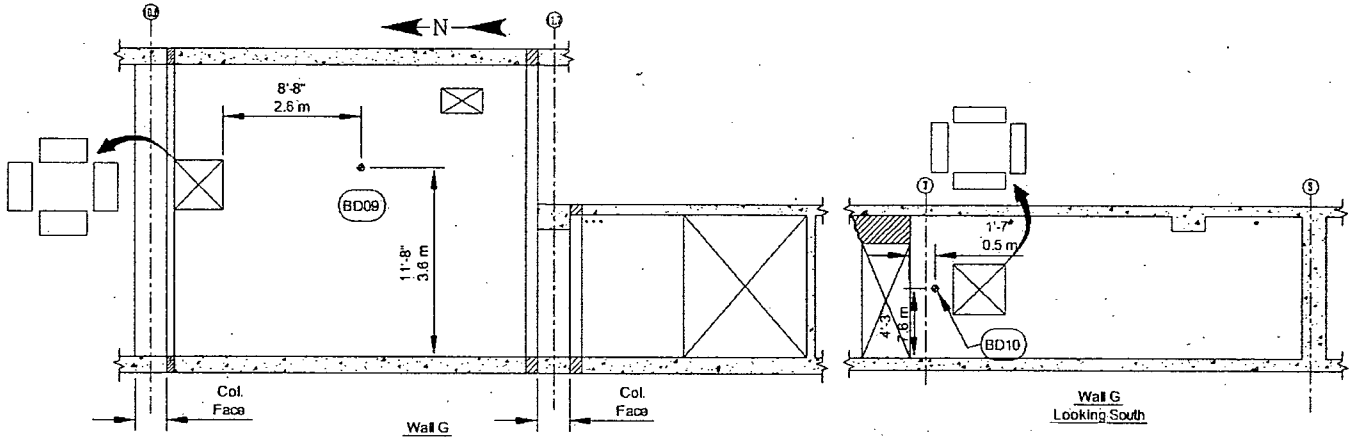
SMUD
SACRAMENTO MUNICIPAL
UTILITY DISTRICT

AUXILIARY BUILDING EL. 0'-0"
ROOM 109 AND ROOM 110 - BETA DIRECT/ LOOSE
MEASUREMENT LOCATIONS
F8130941-M2

FILE: 813000.03 SHEET 4 OF 6 TC HILL







Scale Feet

$\frac{3}{32}$" = 1'-0"

Scale Meters

0 1 2 3

SMUD

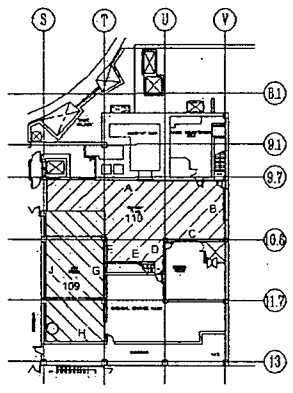
SACRAMENTO MUNICIPAL UTILITY DISTRICT

AUXILIARY BUILDING EL. 0'-0"

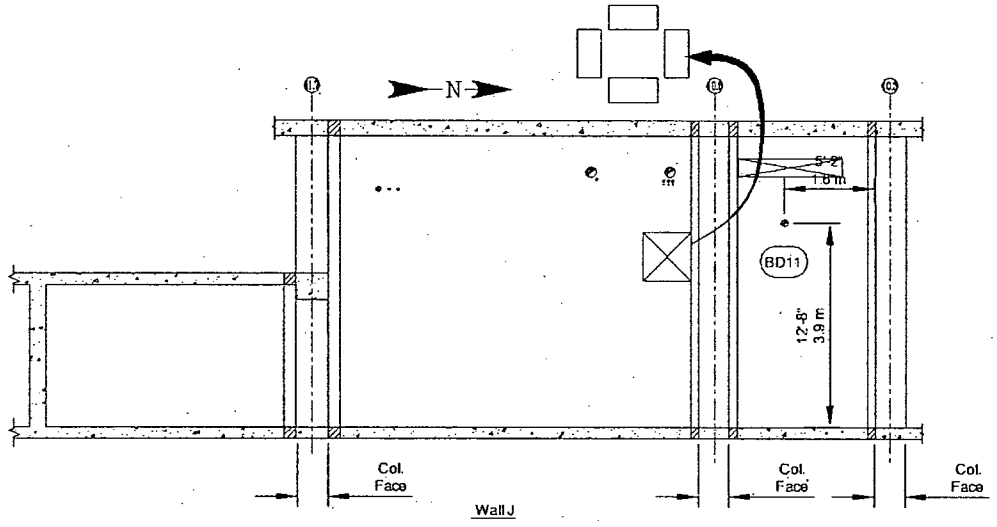
ROOM 109 AND ROOM 110 - BETA DIRECT/ LOOSE MEASUREMENT LOCATIONS

F8130941-M2

FILE: 813000.03 SHEET 5 OF 6 TC HILL



Key Plan



Scale Feet

$\frac{3}{32}$" = 1'-0"

Scale Meters

0 1 2 3

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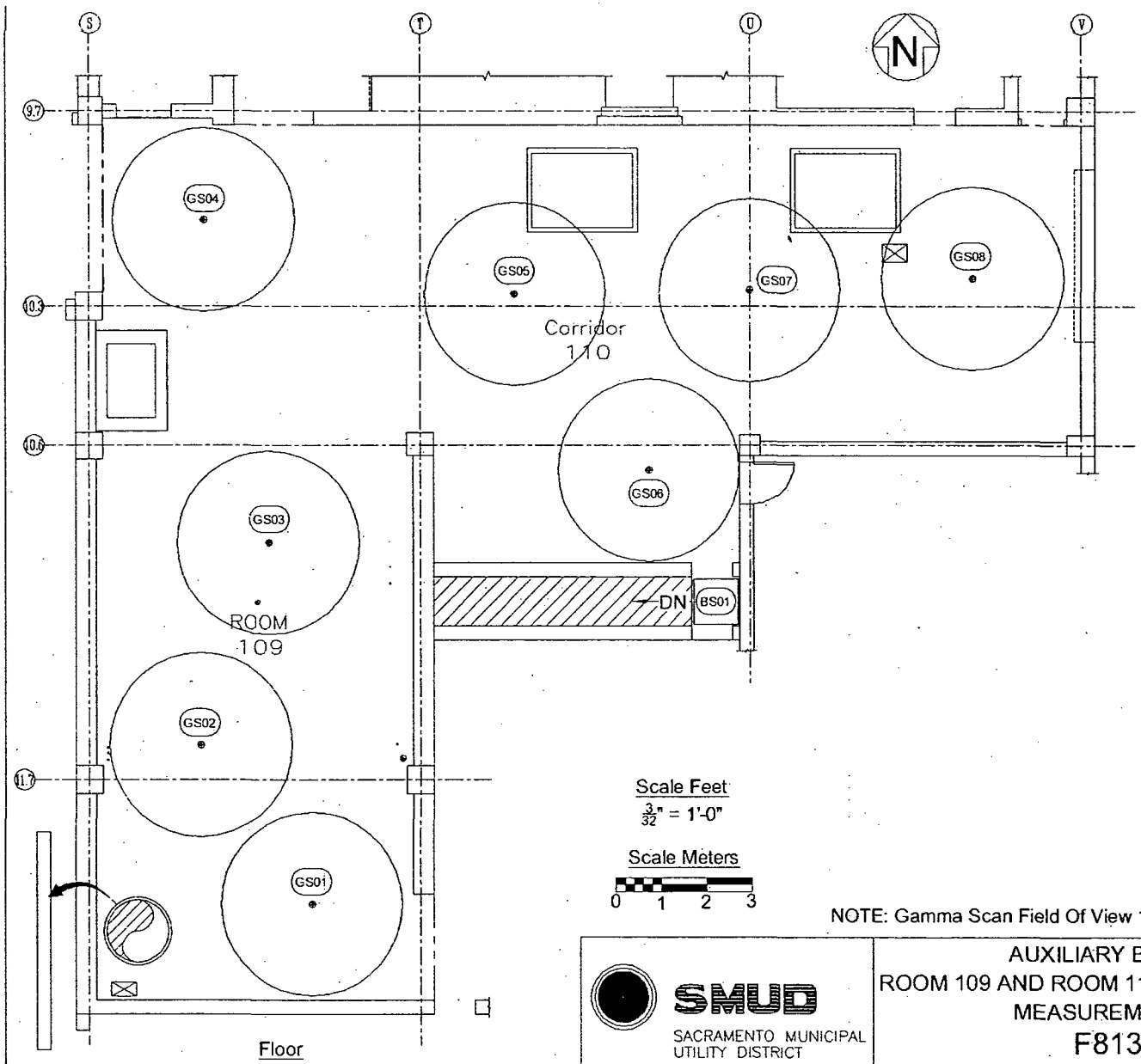
SACRAMENTO MUNICIPAL UTILITY DISTRICT

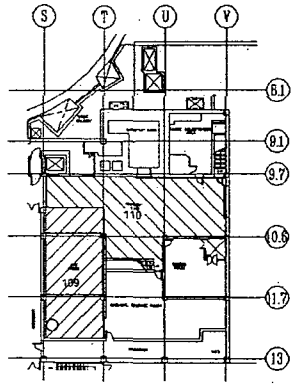
AUXILIARY BUILDING EL. 0'-0"

ROOM 109 AND ROOM 110 - BETA DIRECT/ LOOSE MEASUREMENT LOCATIONS

F8130941-M2

FILE: 813000.03 SHEET 6 OF 6 TC HILL





Key Plan

Scale Feet
$\frac{3}{32}$" = 1'-0"

Scale Meters
0 1 2 3

NOTE: Gamma Scan Field Of View 12.6 m²

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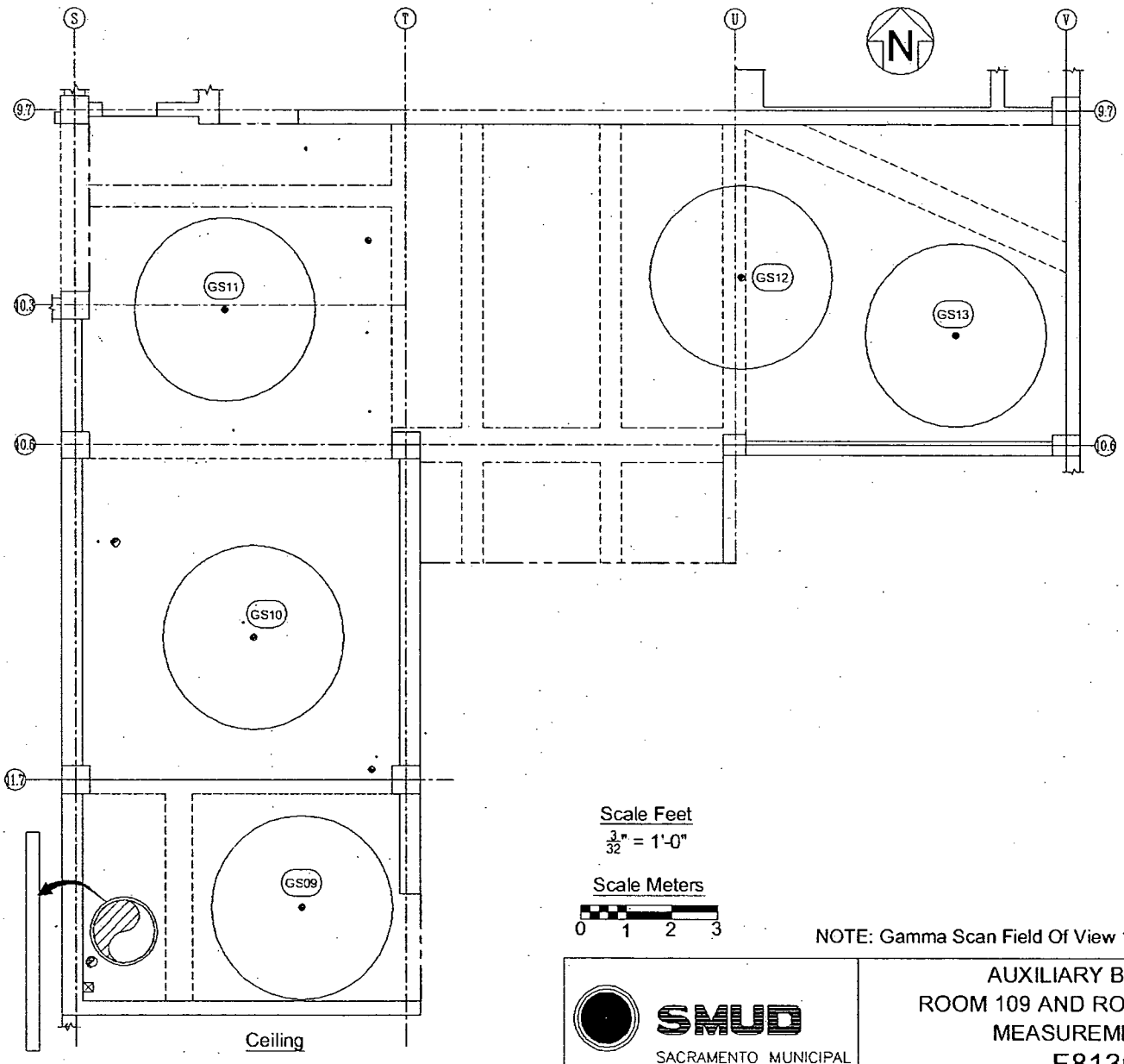
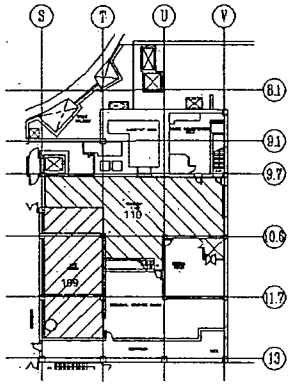
AUXILIARY BUILDING EL. 0'-0"
ROOM 109 AND ROOM 110 - GAMMA AND BETA SCAN MEASUREMENT LOCATIONS
F8130941-M3

FILE: 813000.03 SHEET 1 OF 5 TC HILL





Key Plan

Scale Feet

$\frac{3}{32}$" = 1'-0"

Scale Meters

0 1 2 3

NOTE: Gamma Scan Field Of View 12.6 m²

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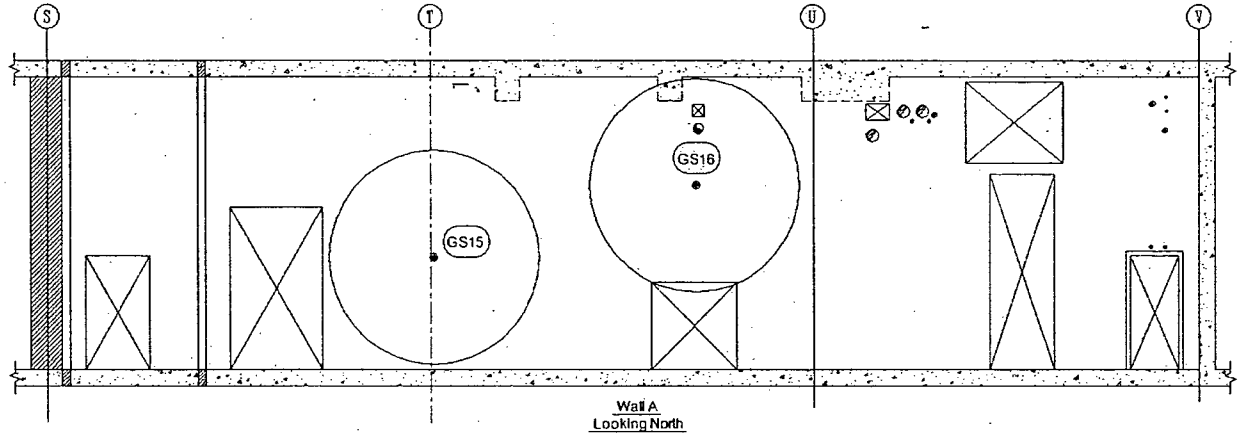
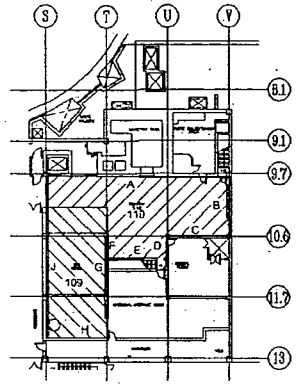
AUXILIARY BUILDING EL. 0'-0"
ROOM 109 AND ROOM 110 - GAMMA SCAN MEASUREMENT LOCATIONS

F8130941-M3

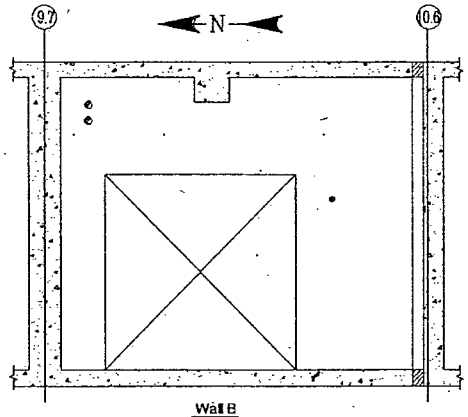
FILE: 813000.03 SHEET 2 OF 5 TC HILL



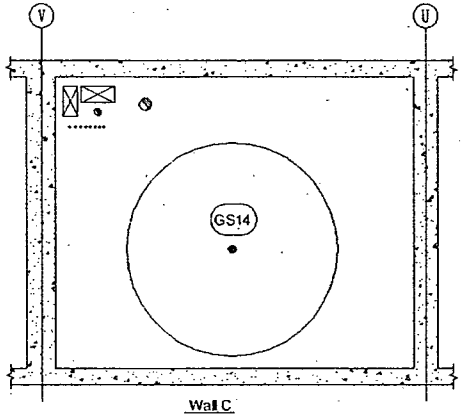
Wall A
Looking North



Key Plan

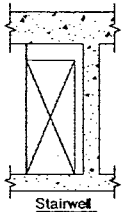


Wall B

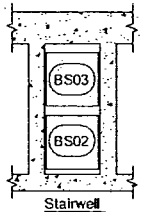


Wall C
Looking South

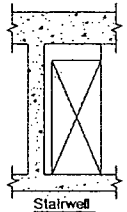
Stairwell
Landing
Ceiling



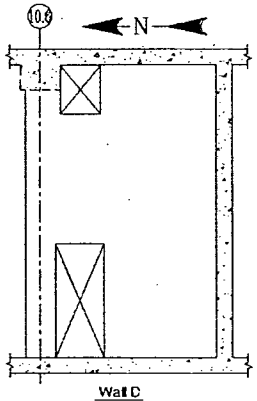
Stairwell
Landing Wall
Looking North



Stairwell
Landing Wall
Looking East



Stairwell
Landing Wall
Looking
South



Wall D

Scale Feet
$\frac{3}{32}$" = 1'-0"

Scale Meters
0 1 2 3

NOTE: Gamma Scan Field Of View 12.6 m²

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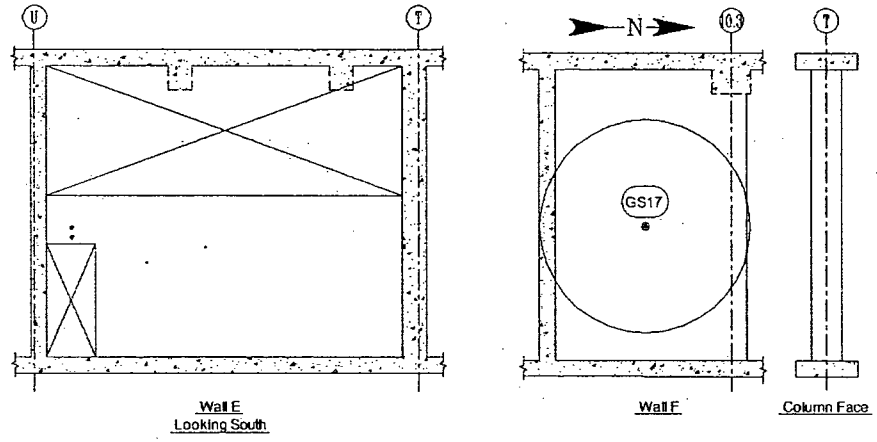
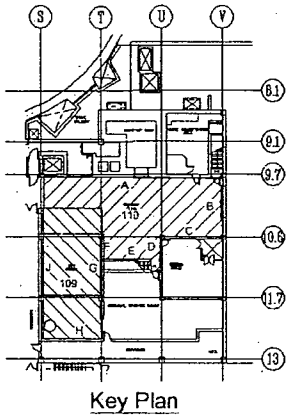
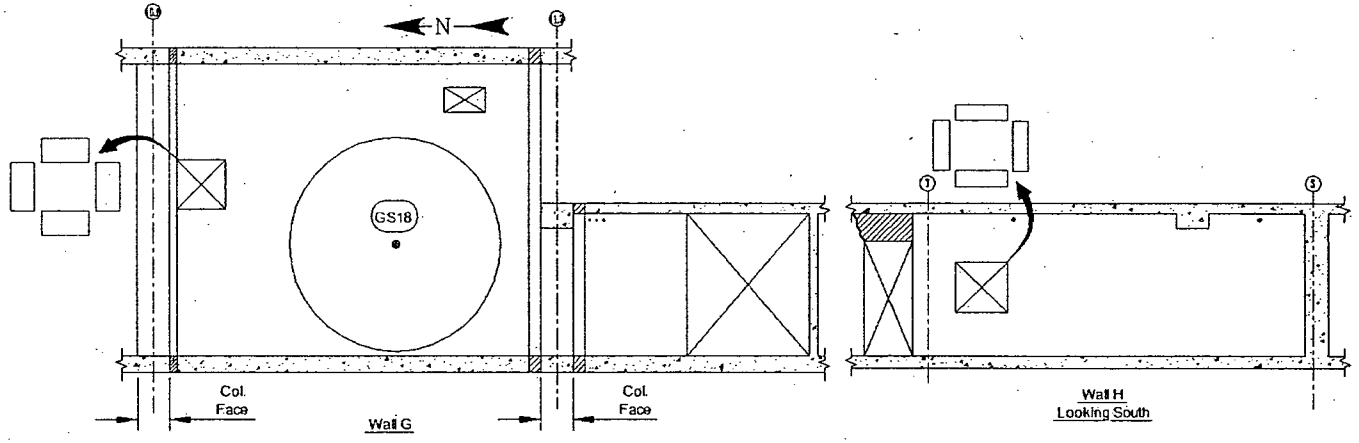
UTILITY DISTRICT

AUXILIARY BUILDING EL. 0'-0"
ROOM 109 AND ROOM 110 - GAMMA AND BETA SCAN
MEASUREMENT LOCATIONS
F8130941-M3

FILE: 813000.03 SHEET 3 OF 5 TC HILL







NOTE: Gamma Scan Field Of View 12.6 m²

Scale Feet

$\frac{3}{32}$" = 1'-0"

Scale Meters

0 1 2 3

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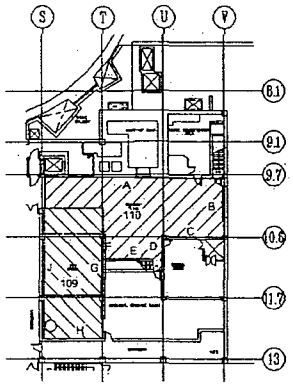
SACRAMENTO MUNICIPAL UTILITY DISTRICT

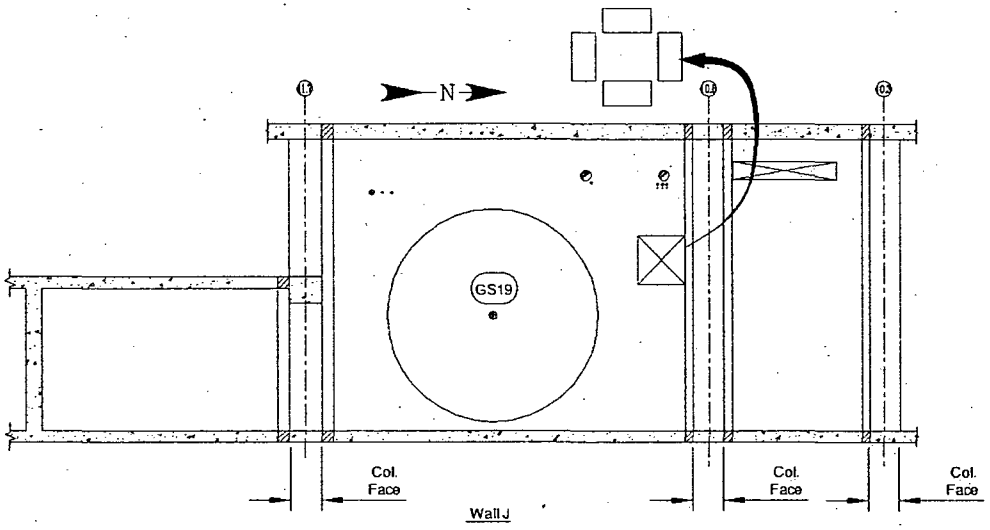
AUXILIARY BUILDING EL. 0'-0"
ROOM 109 AND ROOM 110 - GAMMA SCAN MEASUREMENT LOCATIONS

F8130941-M3

FILE: 813000.03 SHEET 4 OF 5 TC HILL



Key Plan



NOTE: Gamma Scan Field Of View 12.6 m²

Scale Feet

$\frac{3}{32}$" = 1'-0"

Scale Meters

0 1 2 3

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SACRAMENTO MUNICIPAL UTILITY DISTRICT

AUXILIARY BUILDING EL. 0'-0"

ROOM 109 AND ROOM 110 - GAMMA SCAN MEASUREMENT LOCATIONS

F8130941-M3

FILE: 813000.03 SHEET 5 OF 5 TC HILL

Attachment 2

Instrumentation

July 4, 2008

Survey Unit F8130941

Table 2-1. Survey Unit Instrumentation

Instrument Model; Serial No.	Detector Model; Serial No.	MDC Static (dpm/100 cm²)	MDC Scan (dpm/100 cm²)
M2350; 180733	43-98B; 148638	N/A	1680
M2350; 180733	43-94B; 148620	N/A	2800
M2350; 203486	43-68B; 190476	912	2176
M2350; 193700	43-68B; 160691	912	2176
M2350; 193700	43-116-1B; 216072	N/A	6854
M2350; 203486	43-116-1B; 190173	N/A	6854
M2350; 142514	43-111B; 148642	N/A	2230
M2350; 180733	43-111B; 148641	N/A	2230
ISOCS; 1983920	N/A	N/A	1080 Co^{60} 1310 Cs^{137}
Inspector; 08051294	N/A	N/A	2820 Co^{60} 2620 Cs^{137}
Tennelec; 0401171	N/A	5.9 dpm α, 11.7 dpm β	N/A

The MDC noted for the detector model 43-98B is for the 3" diameter piping and for the detector model 43-94B is for the 2" diameter piping which is the most conservative of the piping surveyed.

Table 2-2. Investigation Criteria and DCGL

Parameter	Value (dpm/100 cm²)
Investigation Criteria - Direct	43000
Investigation Criteria – Scan	43000
$DCGL_W$	43000
$DCGL_{EMC}$	N/A

Attachment 3

Investigation

July 4, 2008

Survey Unit F8130941

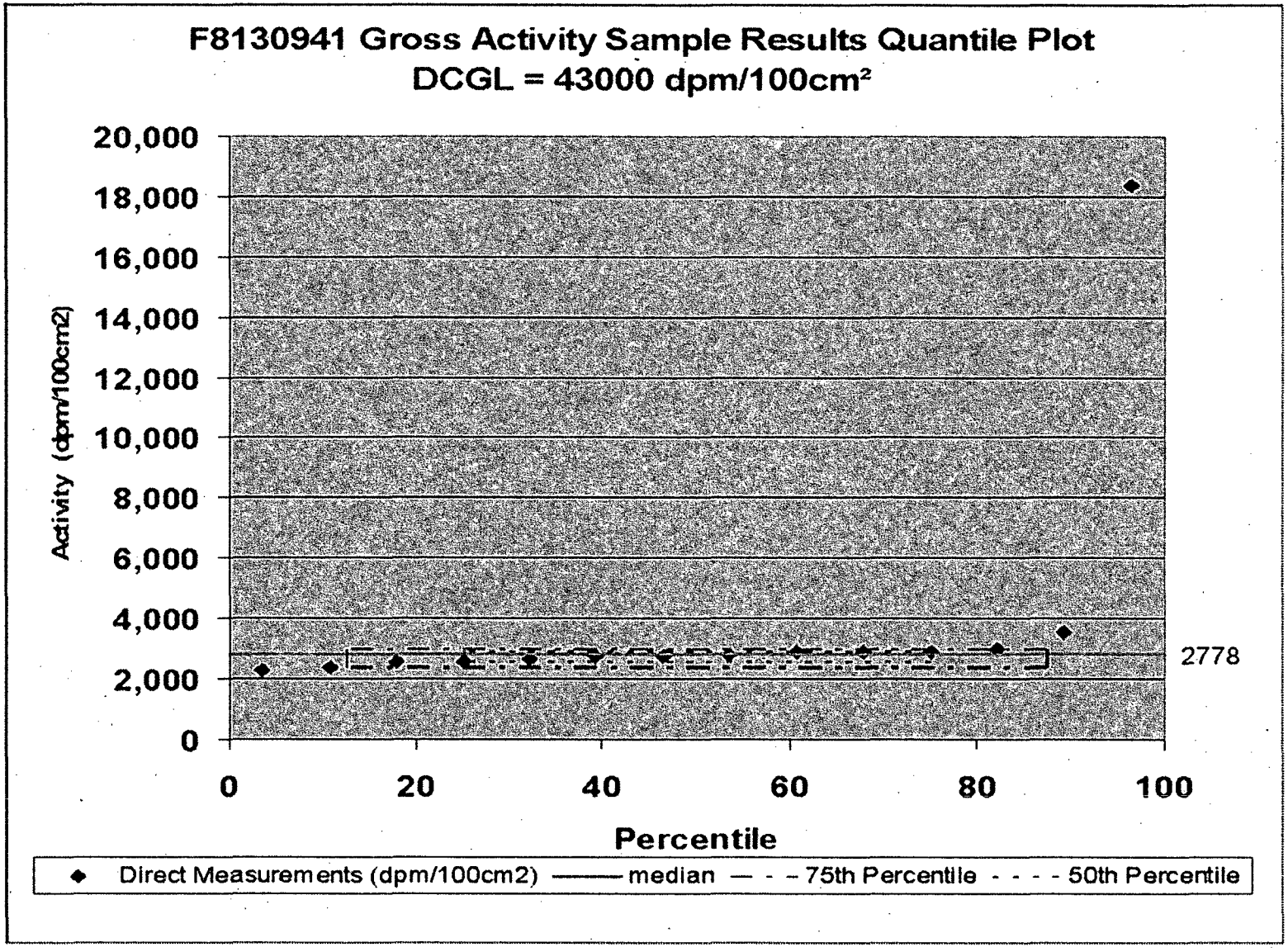
(none required)

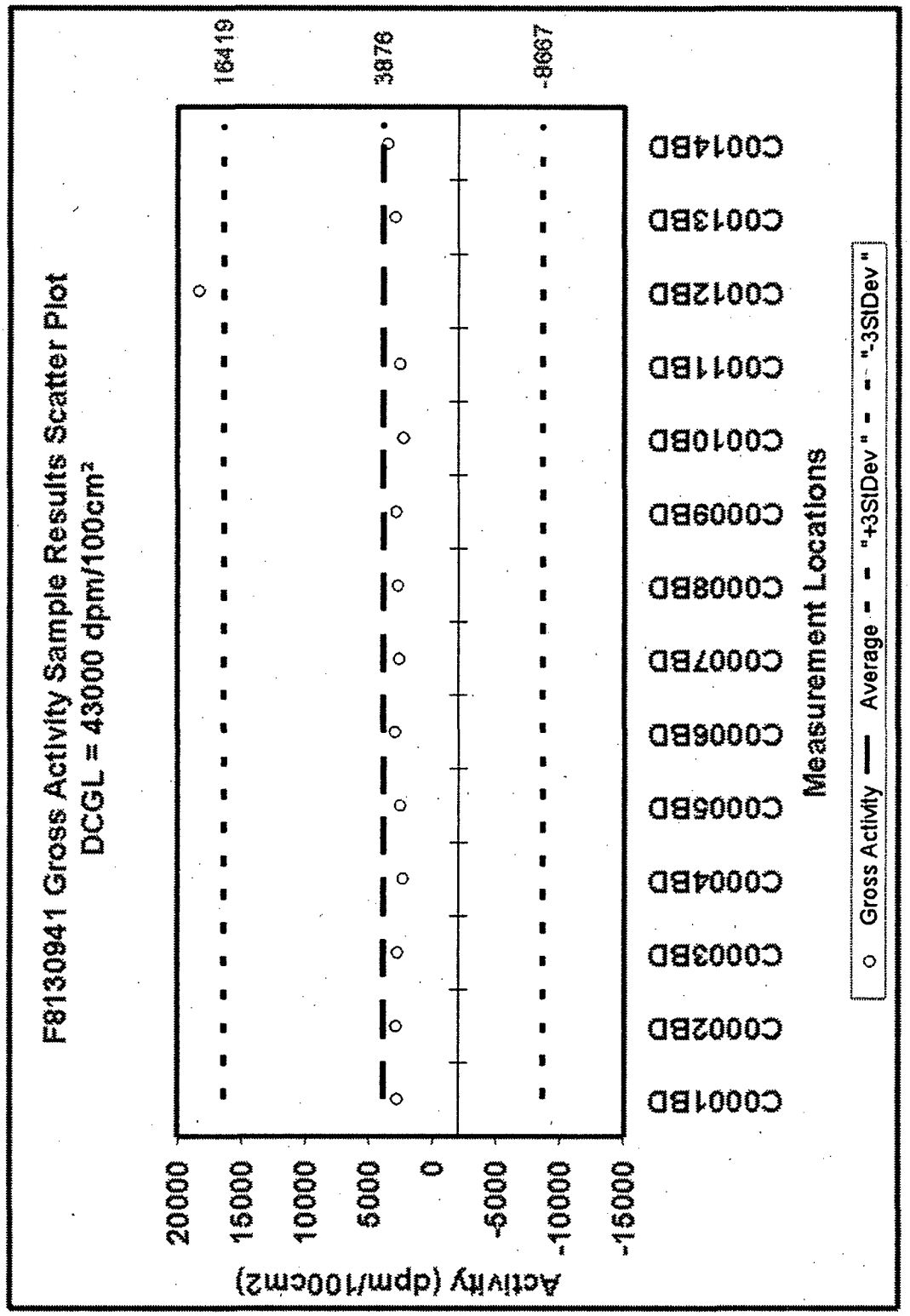
Attachment 4

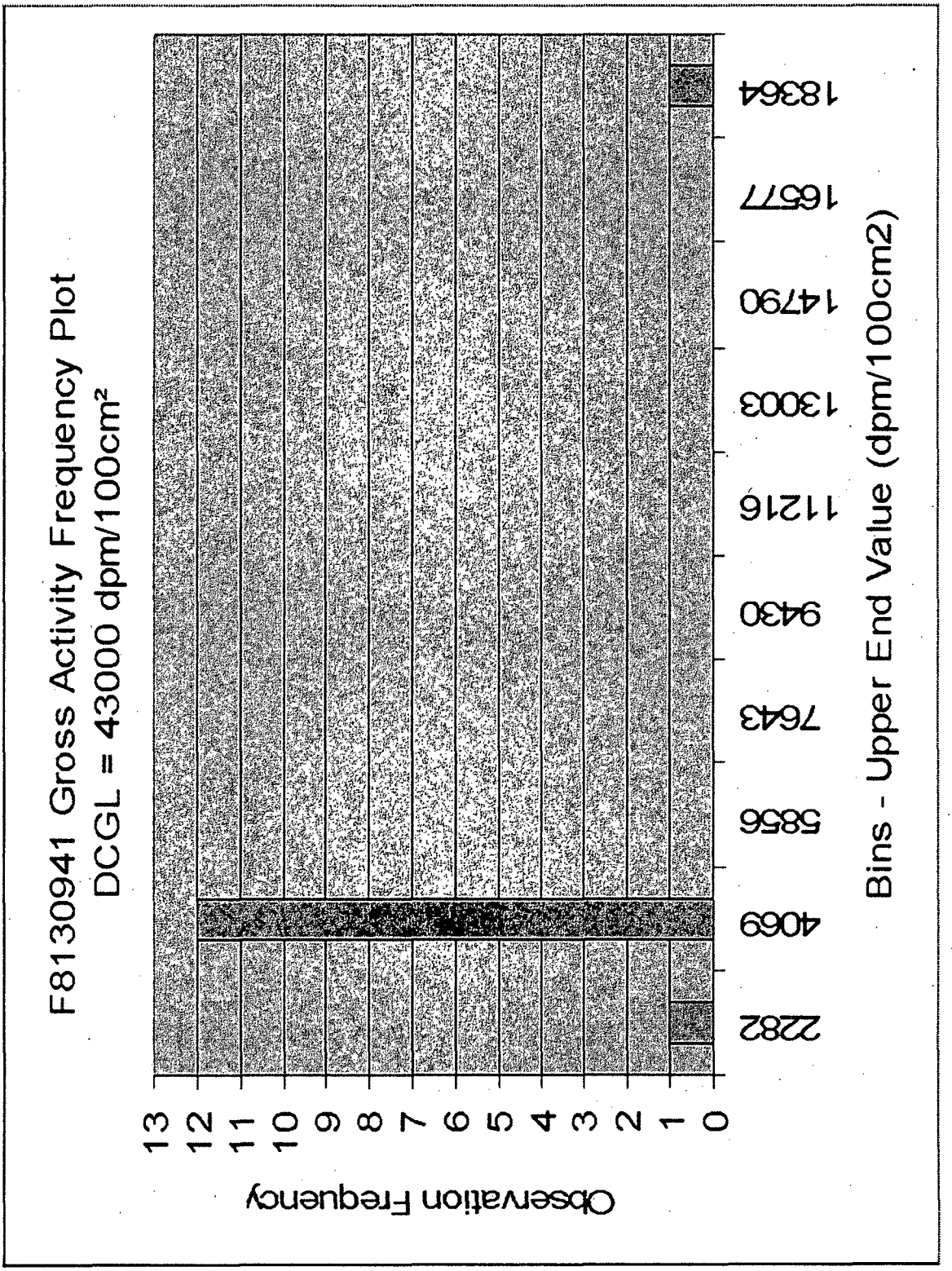
Data Assessment

July 4, 2008

Survey Unit F8130941


F8130941 Gross Activity Sample Results Quantile Plot
DCGL = 43000 dpm/100cm²
Activity (dpm/100cm2)
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
0
20
40
60
80
100
Percentile
2778
Direct Measurements (dpm/100cm2)
median
75th Percentile
50th Percentile


F8130941 Gross Activity Sample Results Scatter Plot
DCGL = 43000 dpm/100cm²
16419
3878
-8667
20000
15000
10000
5000
0
-5000
-10000
-15000
Activity (dpm/100cm2)
C00014BD
C00013BD
C00012BD
C00011BD
C00010BD
C00009BD
C00008BD
C00007BD
C00006BD
C00005BD
C00004BD
C00003BD
C00002BD
C00001BD
Measurement Locations
Gross Activity
Average
"+3SIDev"
"-3SIDev"


F8130941 Gross Activity Frequency Plot
DCGL = 43000 dpm/100cm²
Observation Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
Bins - Upper End Value (dpm/100cm2)
2282
4069
5856
7643
9430
11216
13003
14790
16577
18364