Rancho Seco

Final Status Survey Summary Report

Revision 1

May 1, 2008

Room 37 Lower Walls and Floor

Survey Unit F8130481

Prepared By: _____ **Date:** 6-26-2008

FSS Engineer

Reviewed By: _____ **Date:** 6/28/08

Lead FSS Engineer

Approved By: _____ **Date:** 2-27-09

Dismantlement Superintendent, Radiological

FINAL STATUS SURVEY SUMMARY REPORT

Survey Unit:

F8130481, Room 37 Lower Walls and Floor

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 236 m^2 were scanned for 100% 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	Room 37 Lower Walls and Floor
Survey Unit:	0481	Structure Surface
Class:	1	LTP Table 5-4
SU Area (m^2)**:**	236	
Evaluator:	Frank	
DCGL (dpm/100 cm^2)**:**	43000	Gross Activity DCGL
Area Factor:	3.3	Class 1
Design DCGLemc (dpm/100 cm^2)**:**	141900	Class 1
LBGR (dpm/100 cm^2)**:**	21500	Default = 50% DCGL
Design Sigma (dpm/100 cm^2)**:**	10204	
Type I Error:	0.05	
Type II Error:	0.05	
Predominant Nuclide:	Cs-137	Co-60 used for Area Factor and emc
Sample Area (m^2)**:**	6.94	Class 1
Scan Area (m^2)**:**	236	
Scan Coverage (%):	100%	Class 1
$Z_{1-\alpha}$ **:**	1.645	
$Z_{1-\beta}$ **:**	1.645	
Sign P:	0.97725	
Calculated Relative Shift:	2.1	
Relative Shift Used:	2.1	Uses 3.0 if Relative Shift is >3
N-Value:	12	
Design N-Value + 20%:	15	NUREG-1575 Table 5-5
Design Min Samples N:	34	Class 1
Grid Spacing L:	2.6	Class 1

Survey Results:

A total of 40 direct measurements were made in F8130481. 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. Scan activity ranged from 3045 to 95059 dpm/100 cm², based on a surveyor efficiency of 0.5 and no background subtracted. Scan grids 21 and 72 were above the investigation level which is based on 100 cm^2 and not the actual area of the probe which is 584cm^2. The grids in question were rescanned with a 43-68B with the results for grid 21 at 8263 cpm and the results for grid 72 at 6058 cpm which are well below the investigation level of 19200 cpm. 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)
F8130481-C0001BD	1945
F8130481-C0002BD	2070
F8130481-C0003BD	2142
F8130481-C0004BD	3865
F8130481-C0005BD	2381
F8130481-C0006BD	4420
F8130481-C0007BD	2075
F8130481-C0008BD	2355
F8130481-C0009BD	4425
F8130481-C0010BD	2563
F8130481-C0011BD	2526
F8130481-C0012BD	2163
F8130481-C0013BD	2433
F8130481-C0014BD	2656
F8130481-C0015BD	4228
F8130481-C0016BD	4155
F8130481-C0017BD	2749
F8130481-C0018BD	2308
F8130481-C0019BD	2588
F8130481-C0020BD	2065
F8130481-C0021BD	2210
F8130481-C0022BD	1774
F8130481-C0023BD	2345
F8130481-C0024BD	2127
F8130481-C0025BD	1634
F8130481-C0026BD	1691
F8130481-C0027BD	1800
F8130481-C0028BD	1655
F8130481-C0029BD	1515
F8130481-C0030BD	1556
F8130481-C0031BD	1655

Measurement ID	Gross Activity (dpm/100 cm^2)
F8130481-C0032BD	1520
F8130481-C0033BD	1478
F8130481-C0034BD	1707
F8130481-C0035BD	1515
F8130481-C0036BD	1738
F8130481-C0037BD	1738
F8130481-C0038BD	1515
F8130481-C0039BD	2573
F8130481-C0040BD	1935
Mean:	2295
Median:	2101
Standard Deviation:	826
Range:	1478 - 4425

Table 3. Removable Surface Activity Results

Measurement ID	Surface Beta Activity (dpm/100 cm^2)
F8130481C0001SM	4.86
F8130481C0002SM	12.55
F8130481C0003SM	9.98
F8130481C0004SM	38.19
F8130481C0005SM	67.67
F8130481C0006SM	98.44
F8130481C0007SM	1.01
F8130481C0008SM	67.67
F8130481C0009SM	61.26
F8130481C0010SM	7.42
F8130481C0011SM	81.77
F8130481C0012SM	7.42
F8130481C0013SM	2.29
F8130481C0014SM	63.82
F8130481C0015SM	35.62
F8130481C0016SM	6.14
F8130481C0017SM	12.55
F8130481C0018SM	9.98
F8130481C0019SM	9.98
F8130481C0020SM	15.11
F8130481C0021SM	3.58
F8130481C0022SM	3.58
F8130481C0023SM	20.24
F8130481C0024SM	9.98
F8130481C0025SM	9.98
F8130481C0026SM	11.27
F8130481C0027SM	22.8
F8130481C0028SM	7.42
F8130481C0029SM	17.68
F8130481C0030SM	38.19
F8130481C0031SM	13.83
F8130481C0032SM	9.98
F8130481C0033SM	11.27
F8130481C0034SM	18.96
F8130481C0035SM	9.98
F8130481C0036SM	16.39
F8130481C0037SM	4.86
F8130481C0038SM	16.39
F8130481C0039SM	18.96
F8130481C0040SM	-1.55
Mean:	21.94
Median:	11.91
Standard Deviation:	24.16
Range:	-1.55 to 98.44

Survey Unit Data Assessment:

The survey design required 40 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):	40	
Median (dpm/100 cm²):	2101	
Mean (dpm/100 cm²):	2295	
Direct Measurement Standard Deviation (dpm/100 cm²):	826	
Total Standard Deviation (dpm/100 cm²):	826	Based on samples and backgrounds.
Maximum (dpm/100 cm²):	4425	
Material Type:	N/A	Background Subtract Not Applied
Sign Test Final N Value:	40	
S+ Value:	40	
Critical Value:	25	
Sufficient Samples Collected:	Yes	
Maximum Value < DCGL:	Yes	
Median Value < DCGL:	Yes	
Mean Value < DCGL:	Yes	
Maximum Value < DCGLemc:	Yes	Class 1
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:

One investigation (Grid 106) was required with results reported in Attachment 3. The EMC unity rule was not exceeded as shown in Table 3-1.

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 and the EMC criterion has been met), the ALARA criterion has been met.

Changes in Initial Survey Unit Assumptions:

The survey unit was designed as a Class 1 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. One potential area of elevated activity was detected and evaluated as shown in Attachment 3. Therefore the EMC criterion was met.

Conclusion:

The FSS of this survey unit was properly designed as a Class 1 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. The investigation results while exceeding the DCGL are less than 5% of the $DCGL_{emc}$ and pass unity.

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 F8130481 meets the release criteria of 10CFR20.1402.

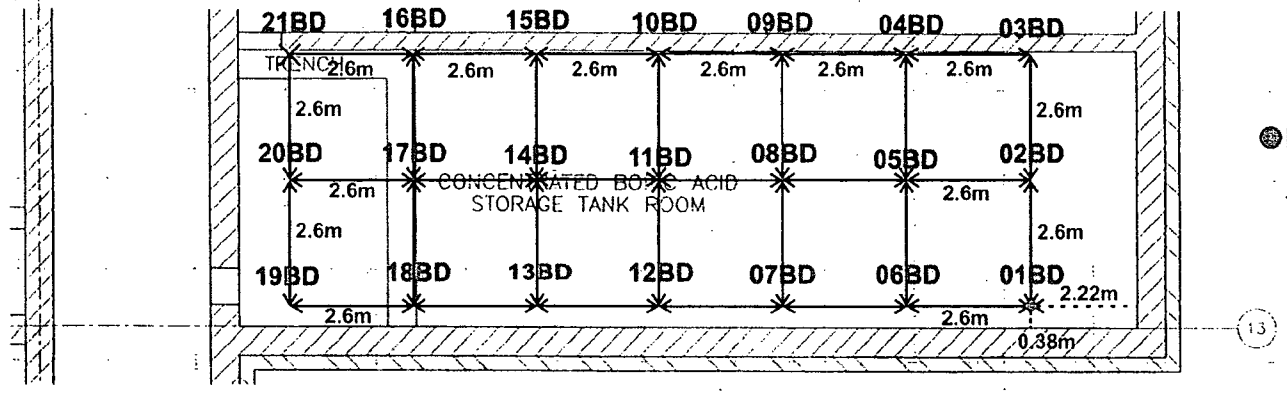
Attachment 1

Revision 1

Maps

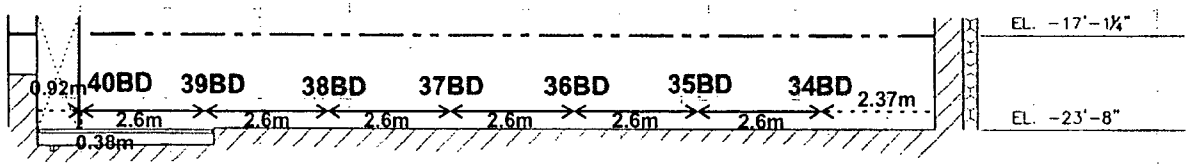
May 1, 2008

Survey Unit F8130481

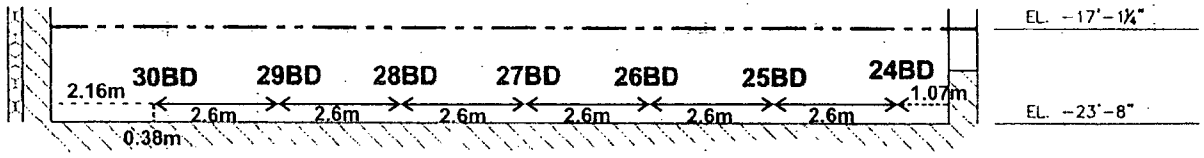


FLOOR PLAN

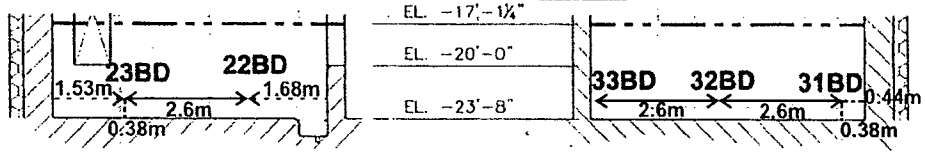
● Random start point 123 WE and 116 SN generated on Random Trials spreadsheet. Attached



ELEVATION LOOKING NORTH



ELEVATION LOOKING SOUTH



ELEVATION LOOKING WEST

ELEVATION LOOKING EAST

SCALE METERS

SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT

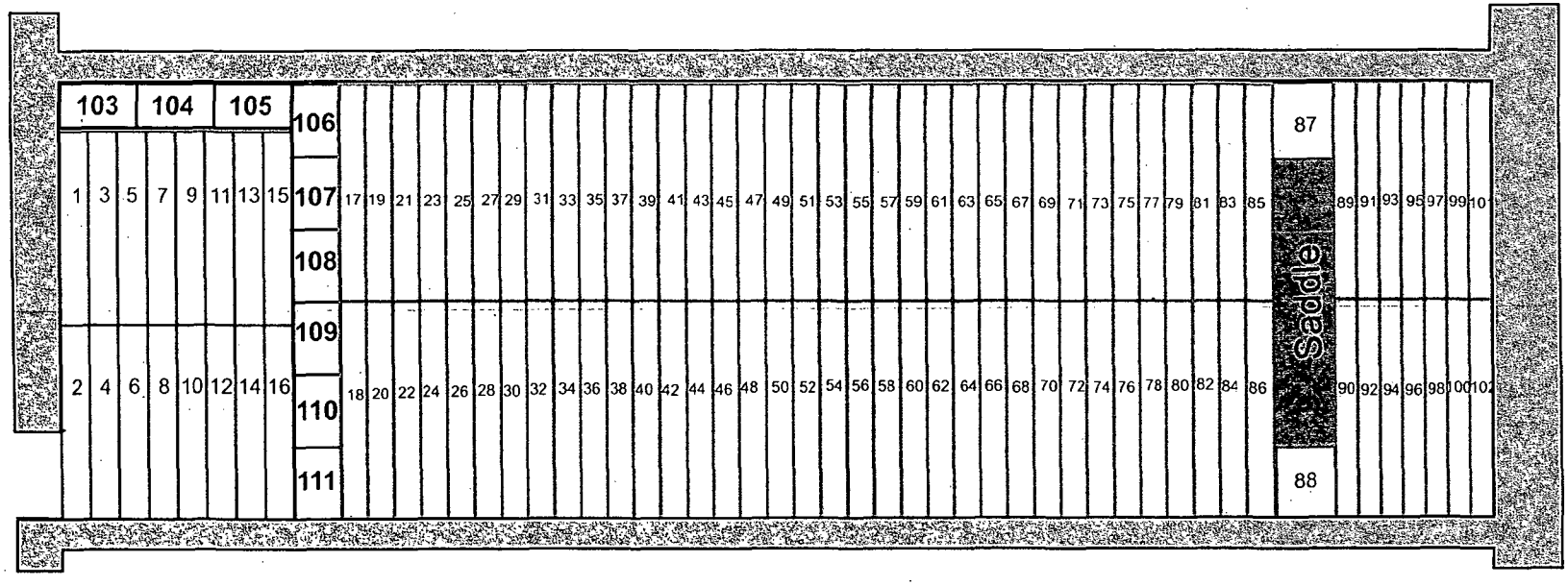
AUXILIARY BUILDING EL. −20'
ROOM 37 FLOOR & LOWER WALLS
BETA DIRECT
RANDOM START LOCATION
MAP F8130481 - M1

F.C. 81300.02c

RC RAYMOND

RM 42
RM 41
RM 40
RM 39
RM 38
RM 37

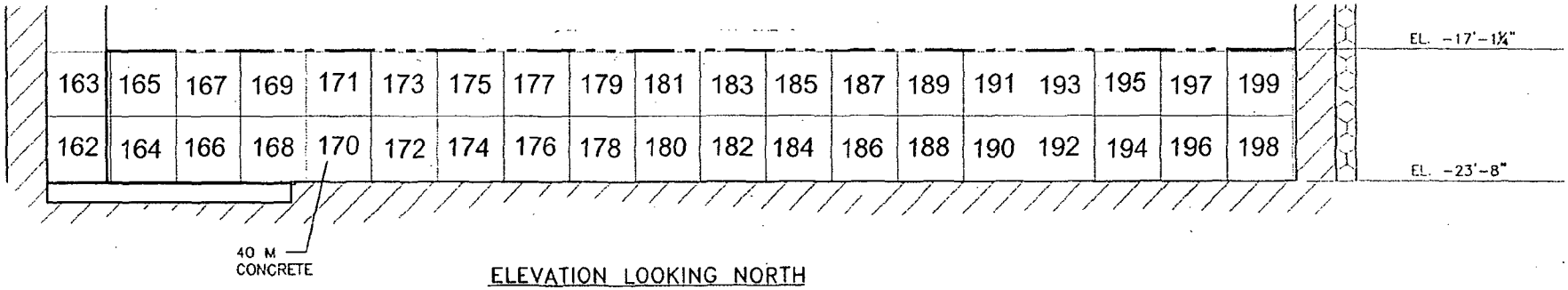
Room 37 Floor and Trench Scans



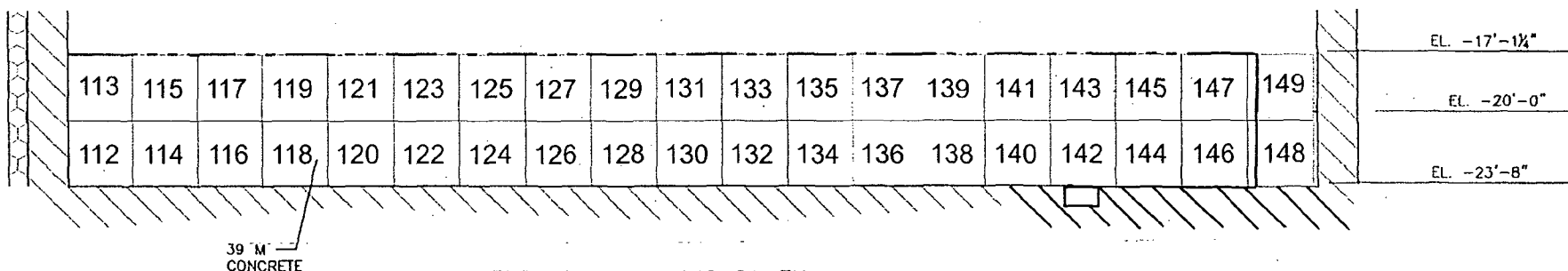
SMUD

Room 37 Floor
Beta Scans
MAP F8130481 - M2

Room 37 Wall Beta Scans

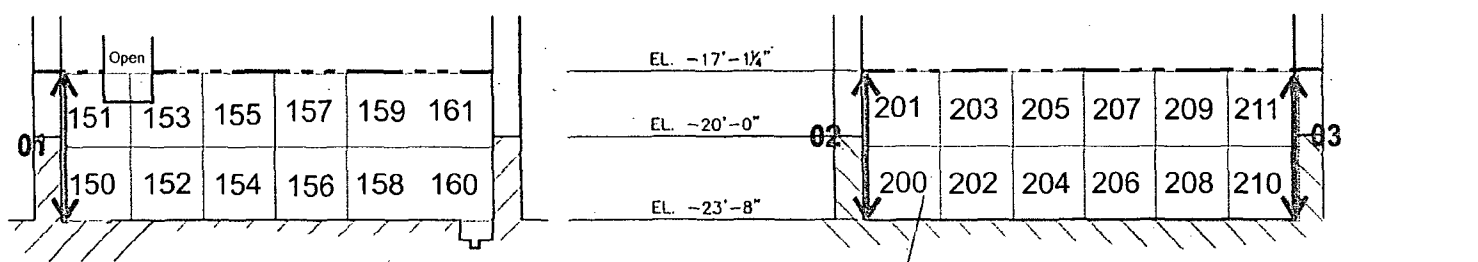


ELEVATION LOOKING NORTH



ELEVATION LOOKING SOUTH

Wall juncture scans in blue



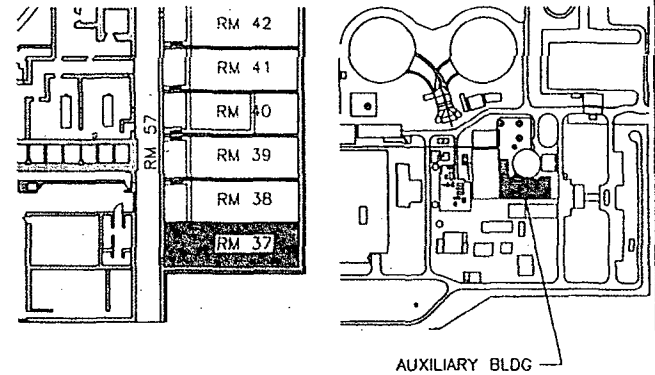
ELEVATION LOOKING WEST

ELEVATION LOOKING EAST

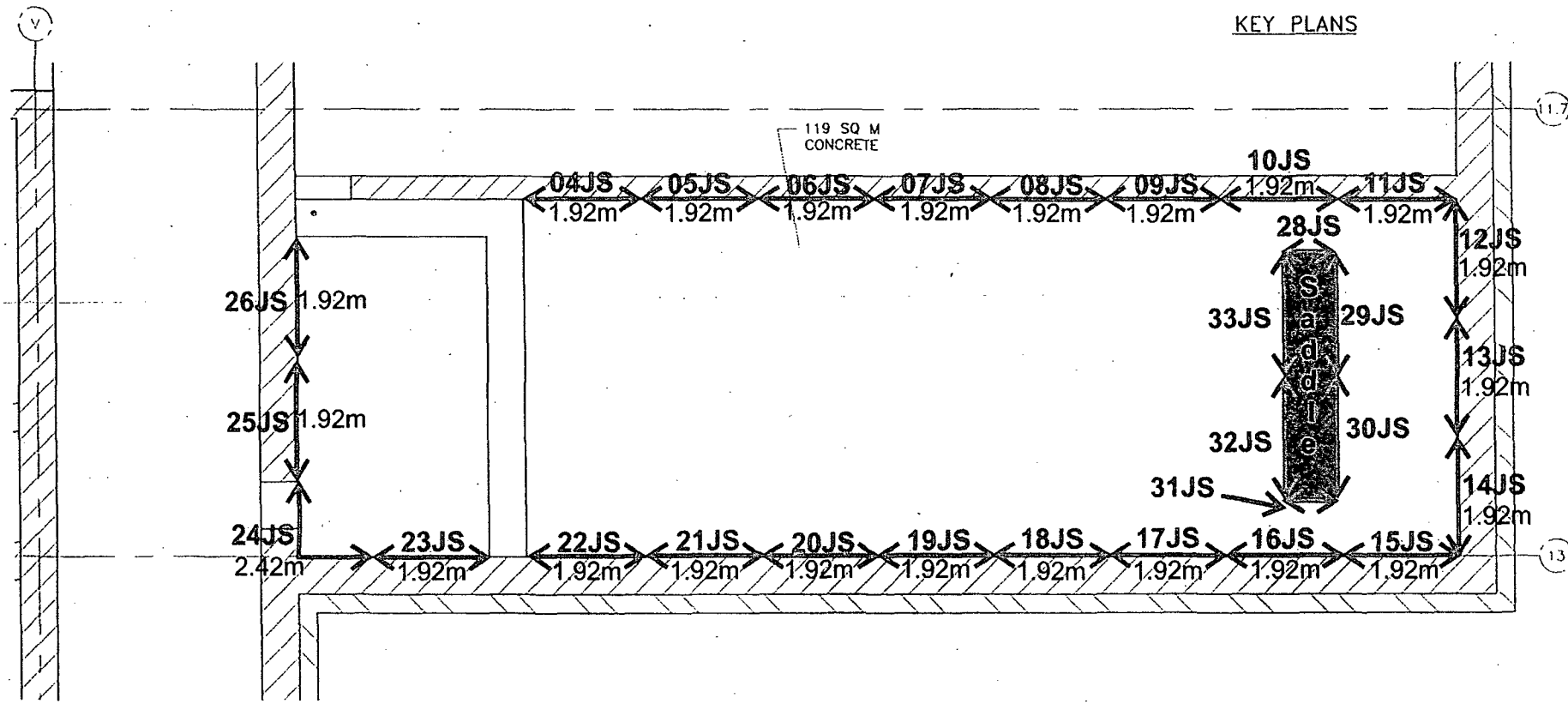
SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT

AUXILIARY BUILDING EL. -20
ROOM 37 LOWER WALLS
Beta Scans
F8130481 - M3

FILE B1300.02e SHT 2 OF 2 RC RAYMOND



KEY PLANS



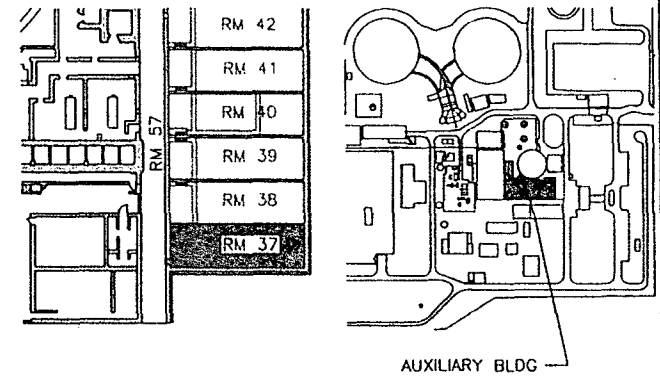
FLOOR PLAN

SCALE METERS

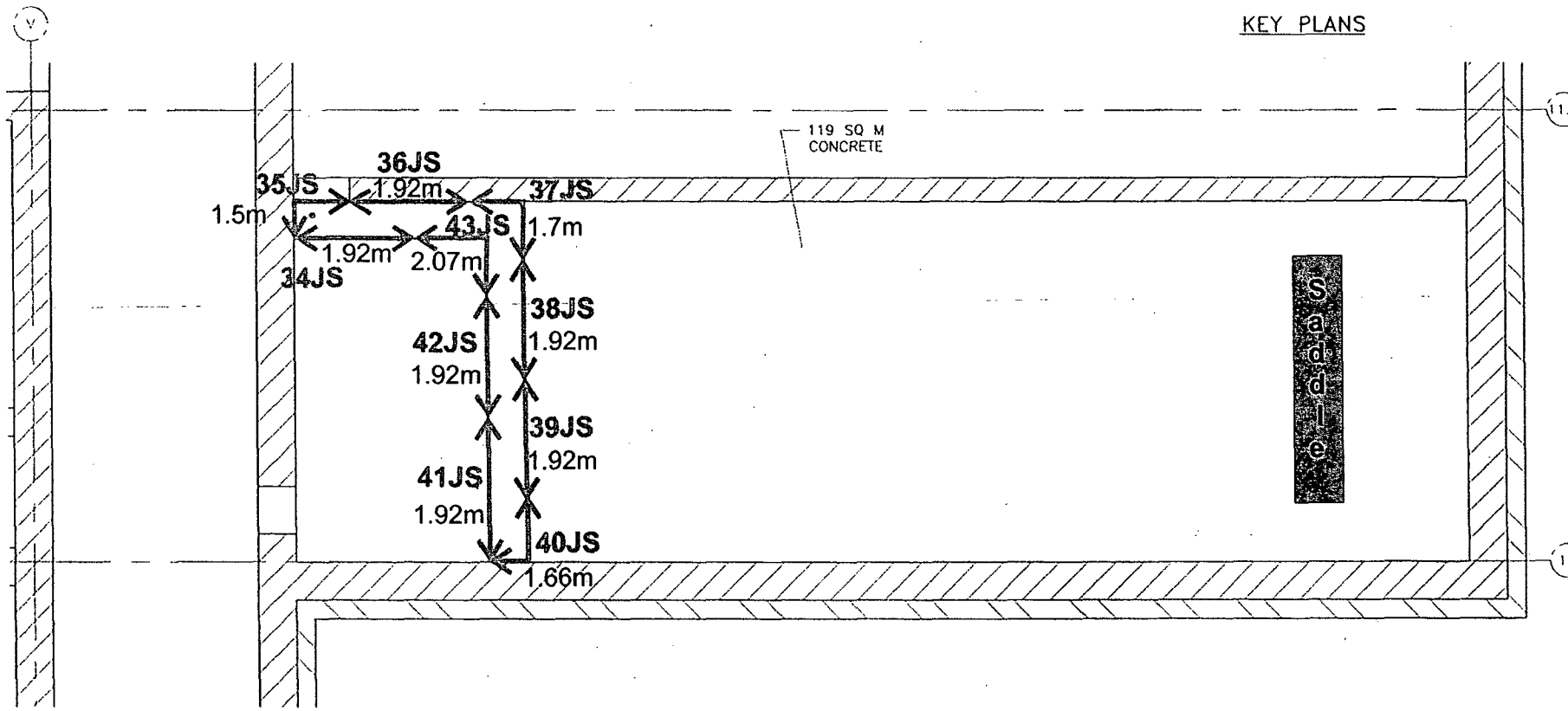
SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT

AUXILIARY BUILDING EL. -20'
Room 37 Floor
Juncture Scans
MAP F8130481 - M4

DWG: 813000.02 SHT ' OF 2 RC RAYMOND



KEY PLANS



FLOOR PLAN

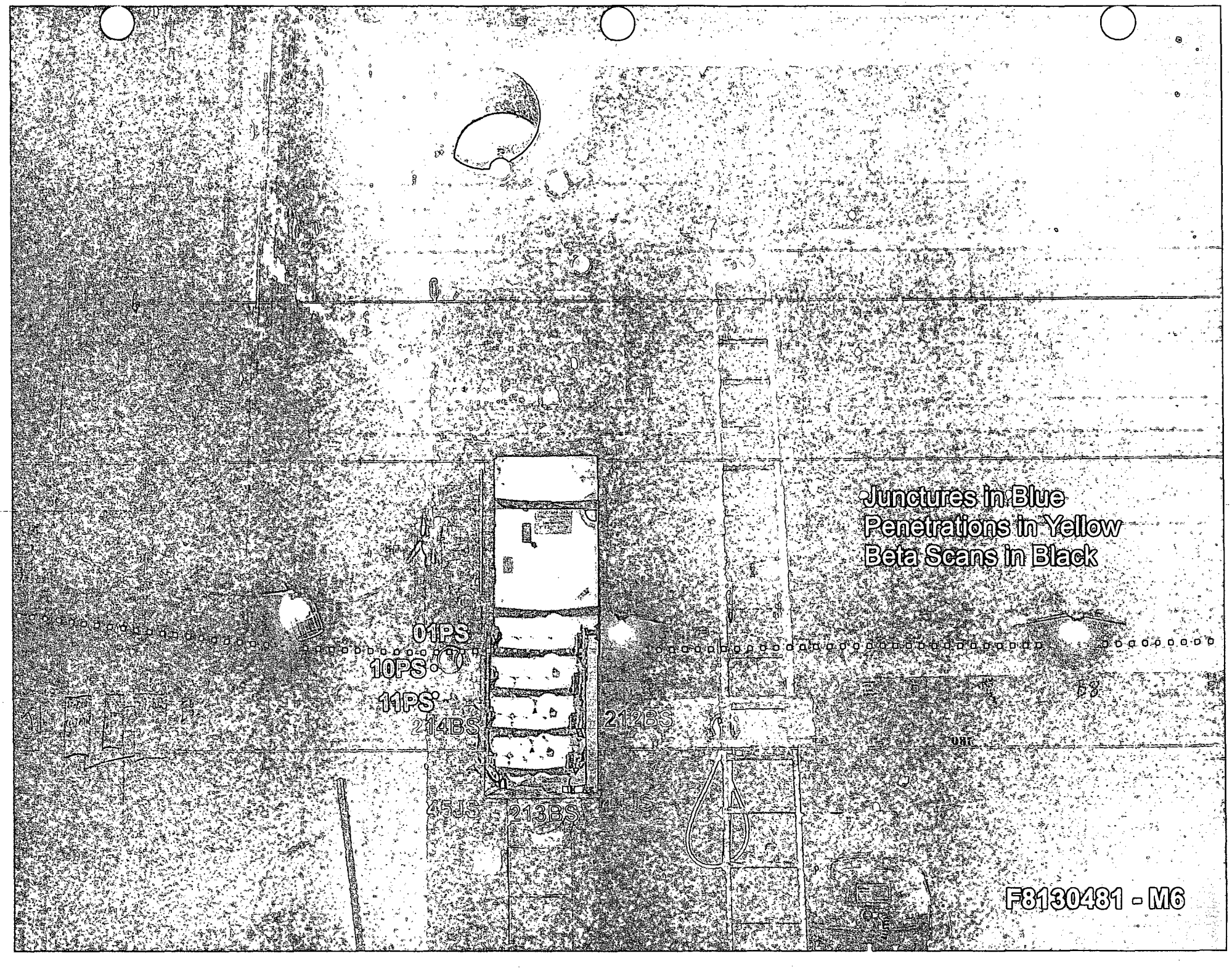
0 .5 1
SCALE
METERS

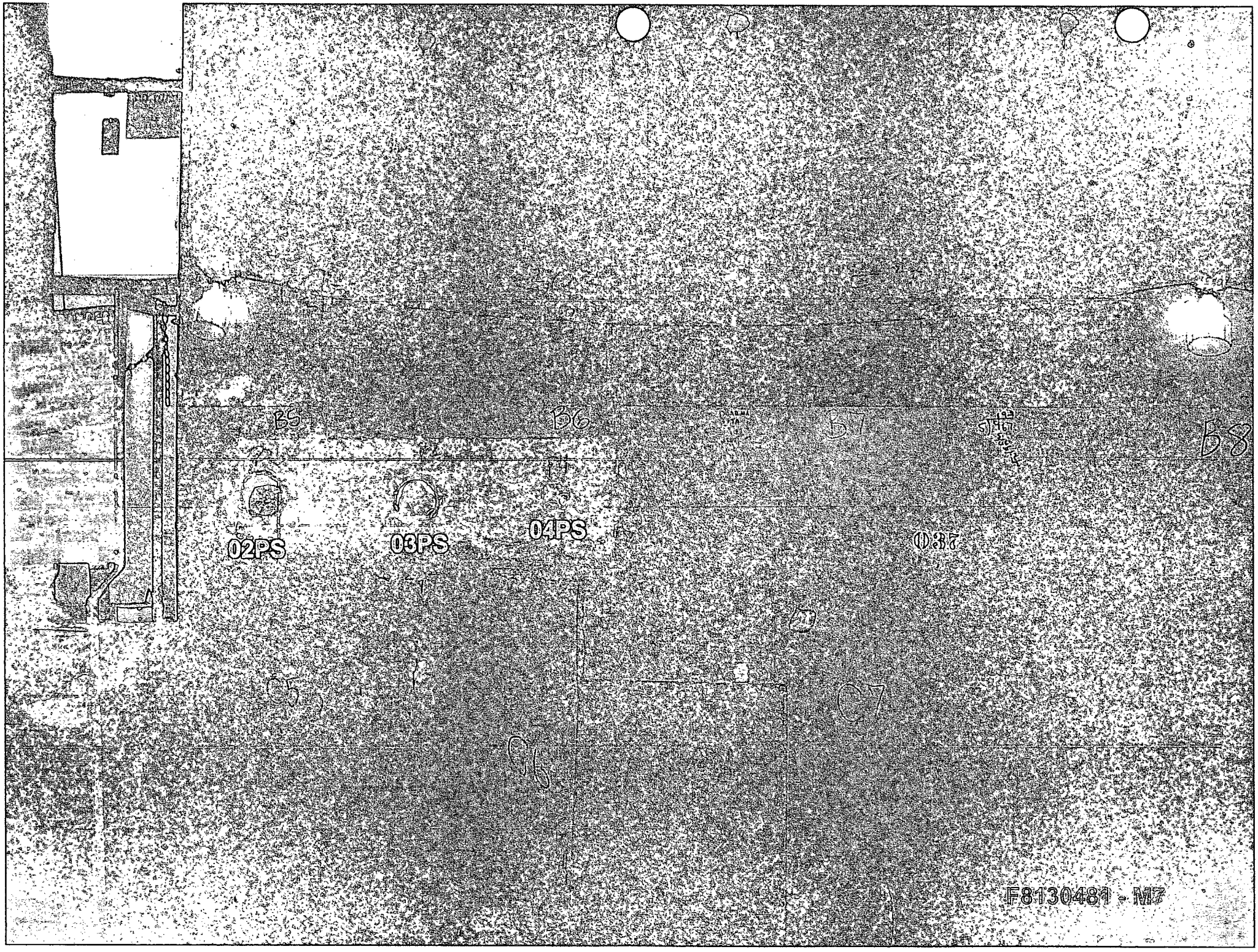
N

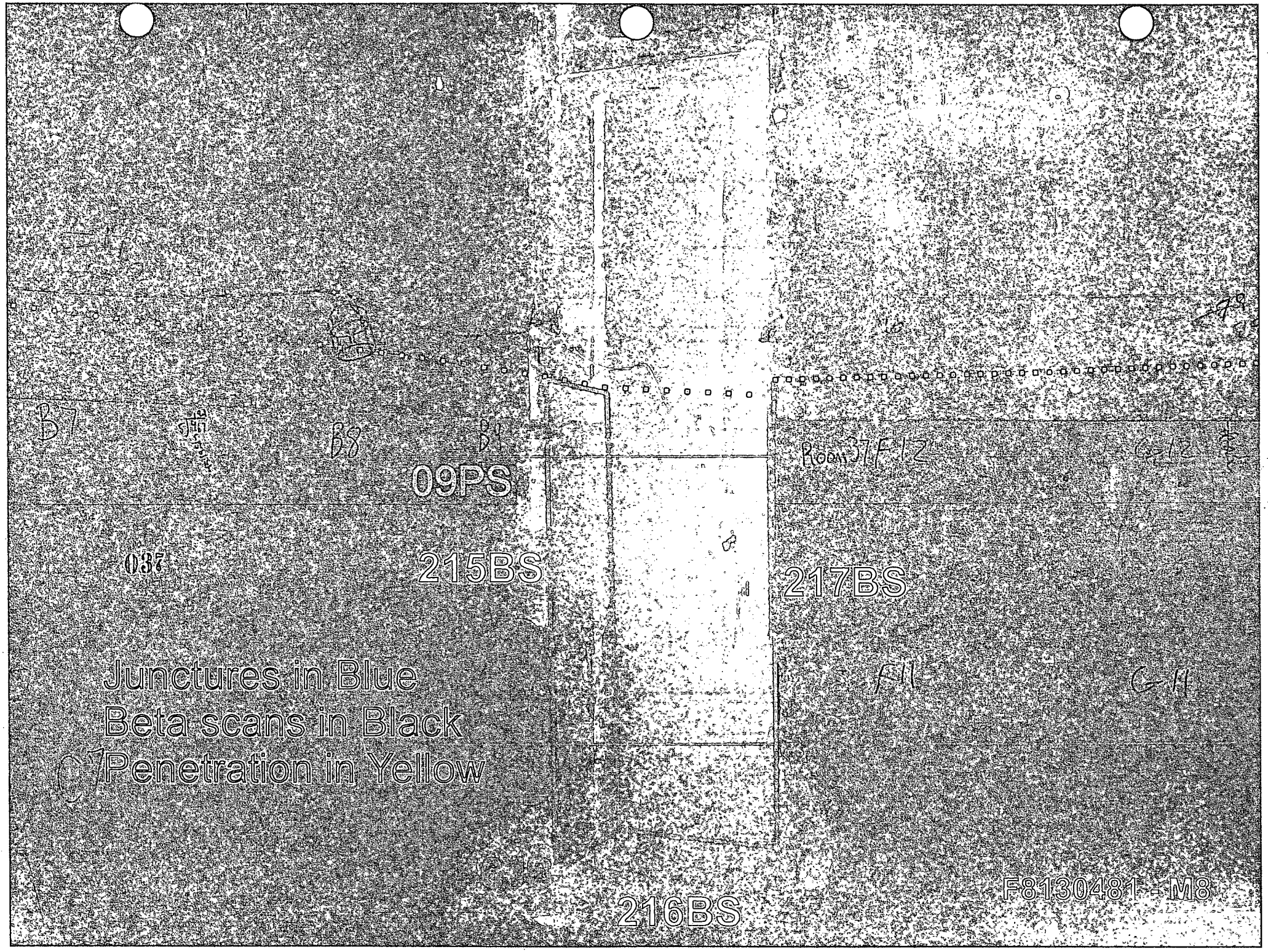
SMUD
SACRAMENTO MUNICIPAL
UTILITY DISTRICT

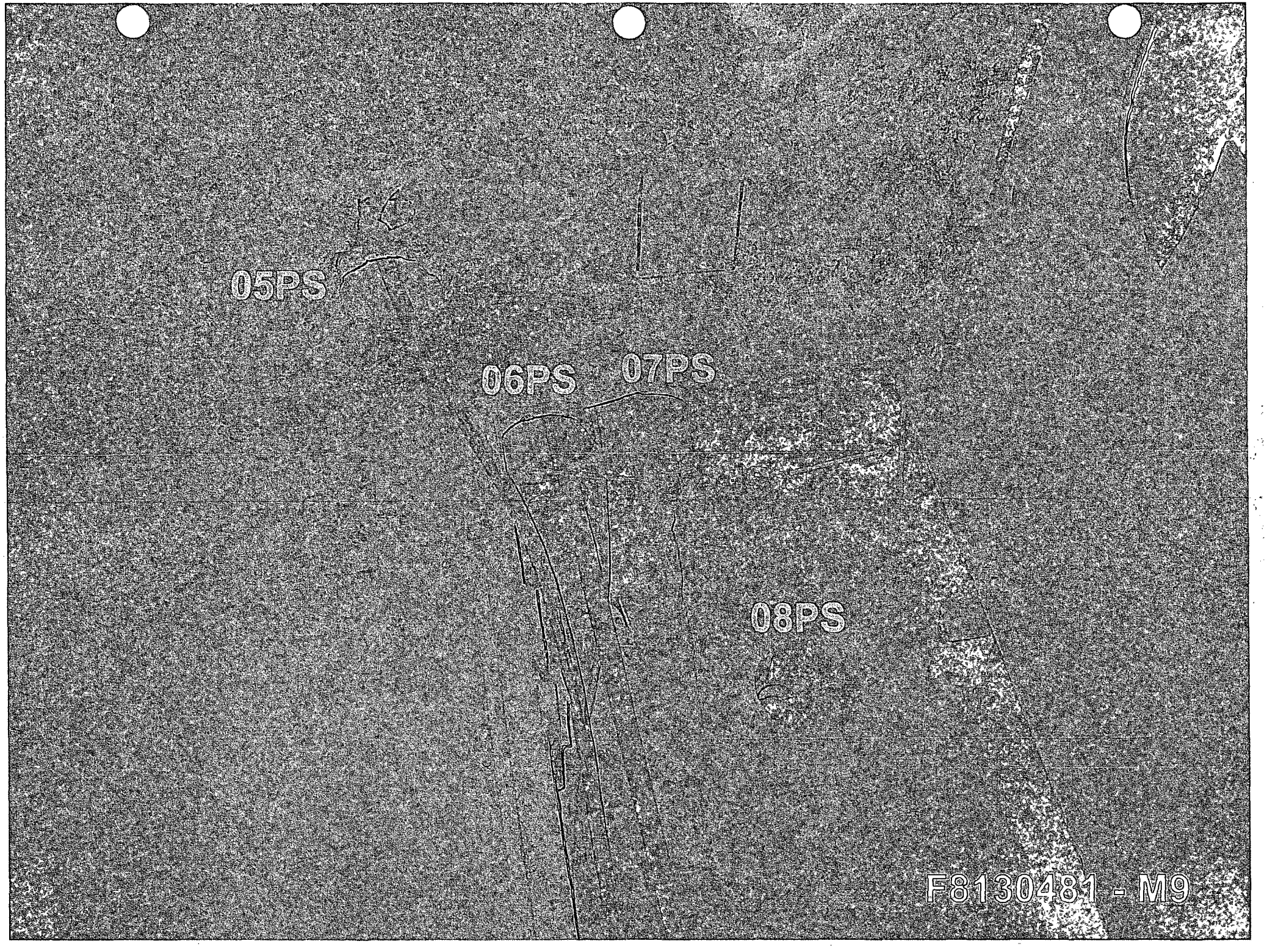
AUXILIARY BUILDING EL. −20'
Room 37 Floor
Trench Juncture Scans
MAP F8130481 - M5

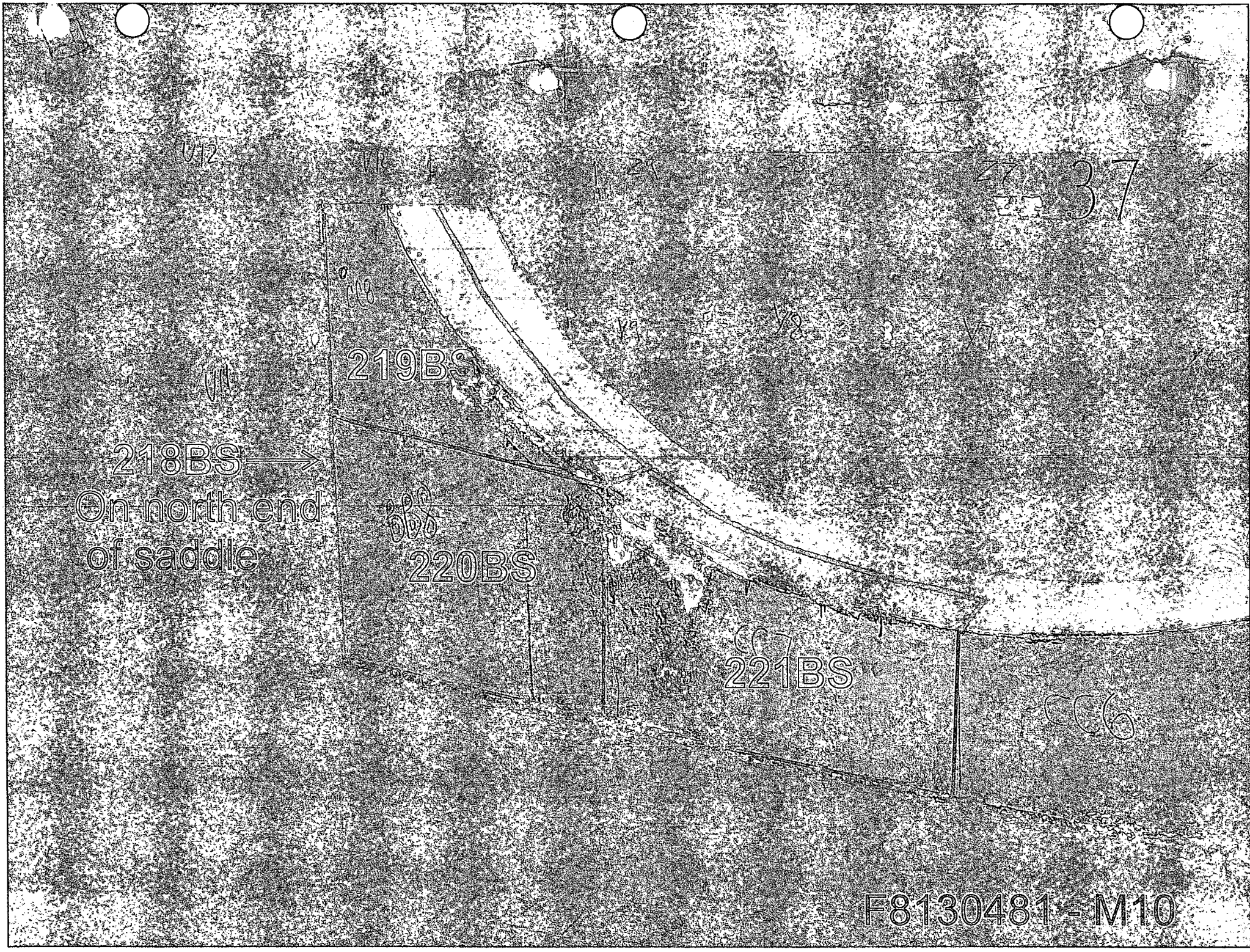
DWG: 813000.02 SHT OF 2 RC RAYMOND

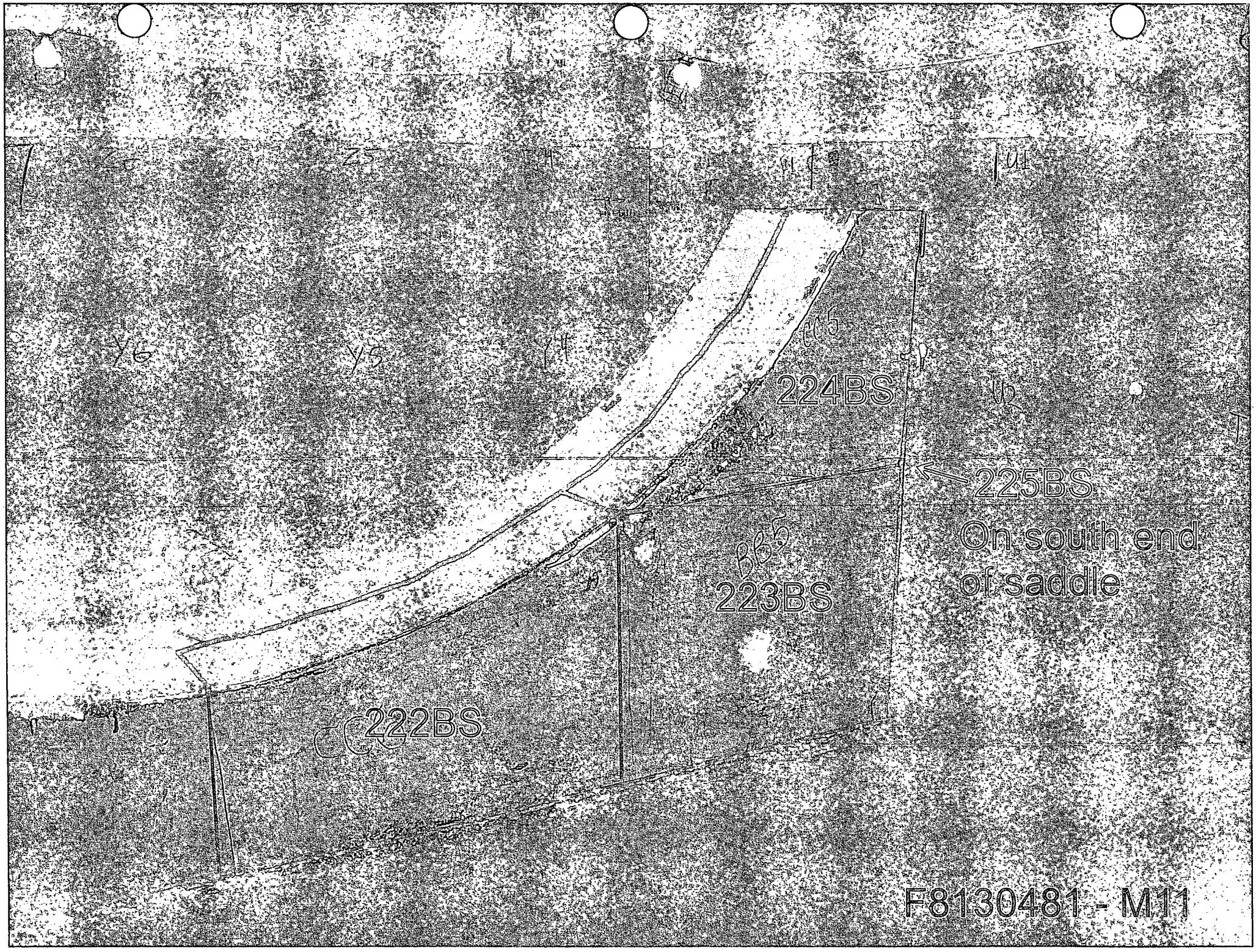

Junctures in Blue
Penetrations in Yellow
Beta Scans in Black
01PS
10PS
11PS
214BS
212BS
45JS
213BS
F8130481 - M6


B5
B6
B7
B8
02PS
03PS
04PS
C5
C6
C7
F8130481 - M7

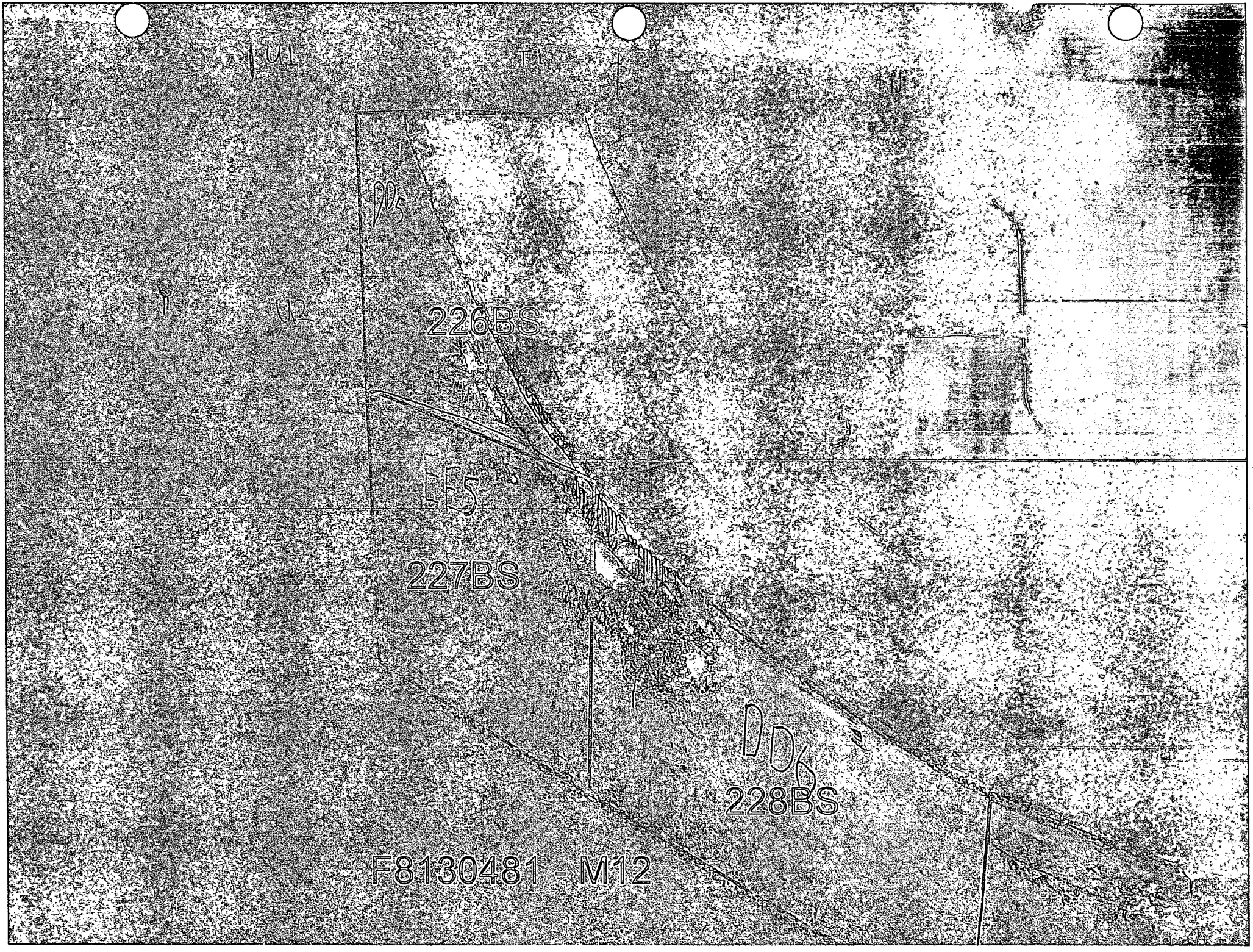

09PS
215BS
217BS
216BS
Junctures in Blue
Beta scans in Black
Penetration in Yellow
F8130481 - M8


05PS
06PS
07PS
08PS
F8130481 - M9

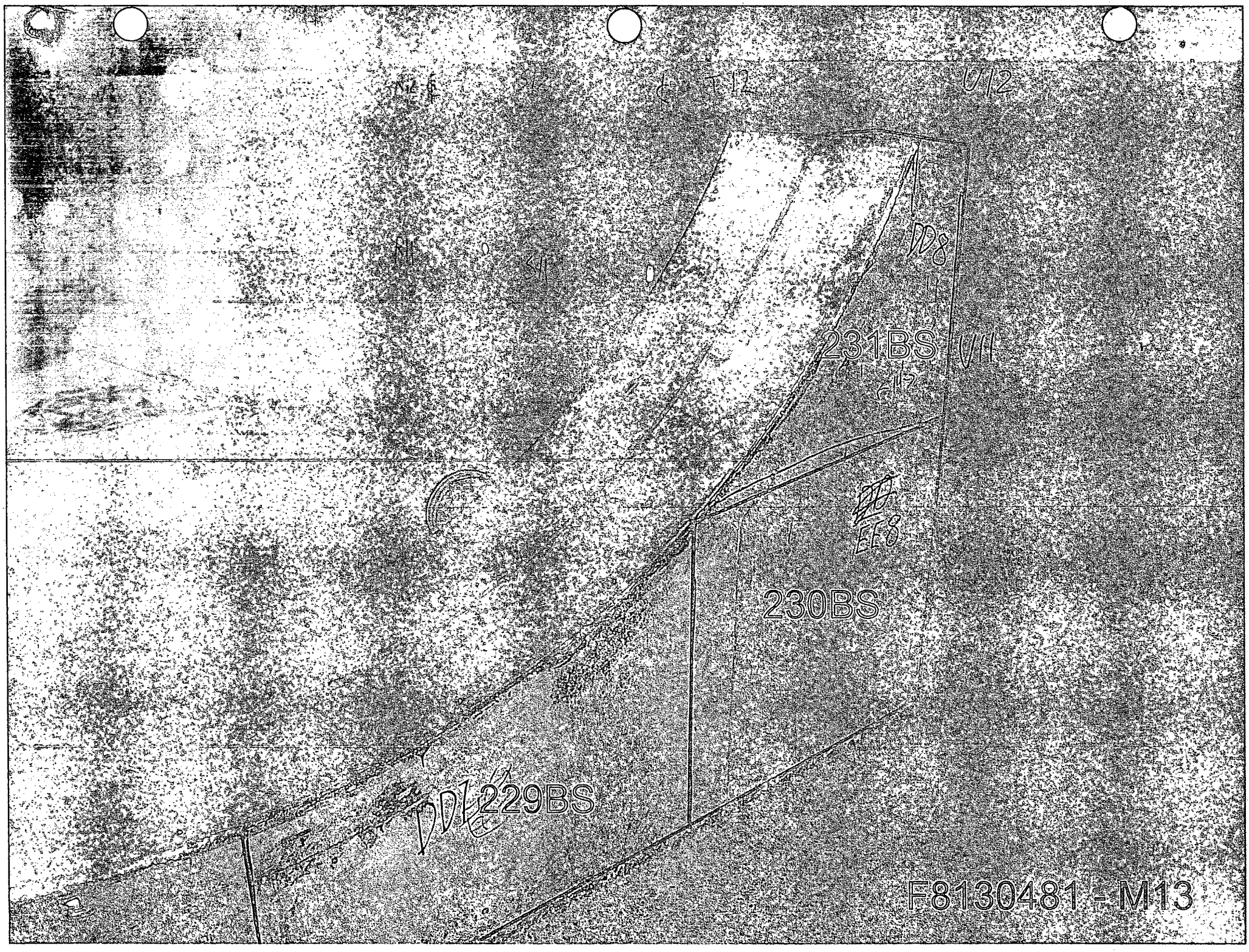

219BS
218BS
On north end
of saddle
220BS
221BS
F8130481 - M10



F8130481 - M11



F8130481 - M12


U12
D8
231BS
VH
230BS
229BS
F8130481 - M13

Attachment 2

Revision 1

Instrumentation

May 1, 2008

Survey Unit F8130481

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 Concrete	1400	2520
M2350, 180733	43-98B, 148638 Metal	820	1490
M2350; 180733	43-94; 148620 Concrete	590	1030
M2350, 180733	43-94, 148620 Metal	350	610
M2350; 203482	43-68B; 178510	433	1033
M2350; 142507	43-68B; 160781	433	1033
M2350; 142499	43-37; 148502	198	616
M2350; 193700	43-116-1B; 216071 Concrete	796	5895
M2350, 193700	43-116-1B, 216071 Metal	472	3492
M2350, 203482	44-10, 211672		5.2 pCi/g
Tennelec; 0401171	N/A	5 dpm α, 11 dpm β	N/A

Table 2-1, Survey Unit Instrumentation

Instrument	Detector Serial No.	MDC (dpm/100cm²)
InSpector 1000	10054579	7830 Cs-137 3140 C0-60

Table 2-2. Investigation Criteria and DCGL

Parameter	Value (dpm/100 cm^2)
Investigation Criteria - Direct	141900
Investigation Criteria – Scan	141900
$DCGL_W$	43000
$DCGL_{EMC}$	141900

Instrument	Parameter	Value (dpm/100cm^2)
InSpector 1000	$DCGL_{emc}$ for 0.01 m^2	5.55e7

Attachment 3

Revision 1

Investigation

May 1, 2008

Survey Unit F8130481

Table 3-1 Survey Unit Investigation

Grid/Location	*Investigation Level (cpm)*	*Initial Value (cpm)*	*Investigation Result (cpm)*	*Elevated Area (m^2)*	*Area Factor*	*$DCGL_{emc}$*	*Investigation Result ($dpm/100cm^2$)*	*$DCGL_{emc}$ Unity Fraction*
*(1) Grid 106	36000	38266	N/A	.01	1290	5.55e7	1.35e5	0.0024
Survey Unit Remainder						DCGL = 43,000	SU Mean = 2295	0.0534
							EMC Unity Sum	0.0558

Gamma scans were performed to complete the particle survey and one elevated area were identified. The identified area was further bounded and analyzed with InSpector 1000.

*Locations on map attached to Download 08-220

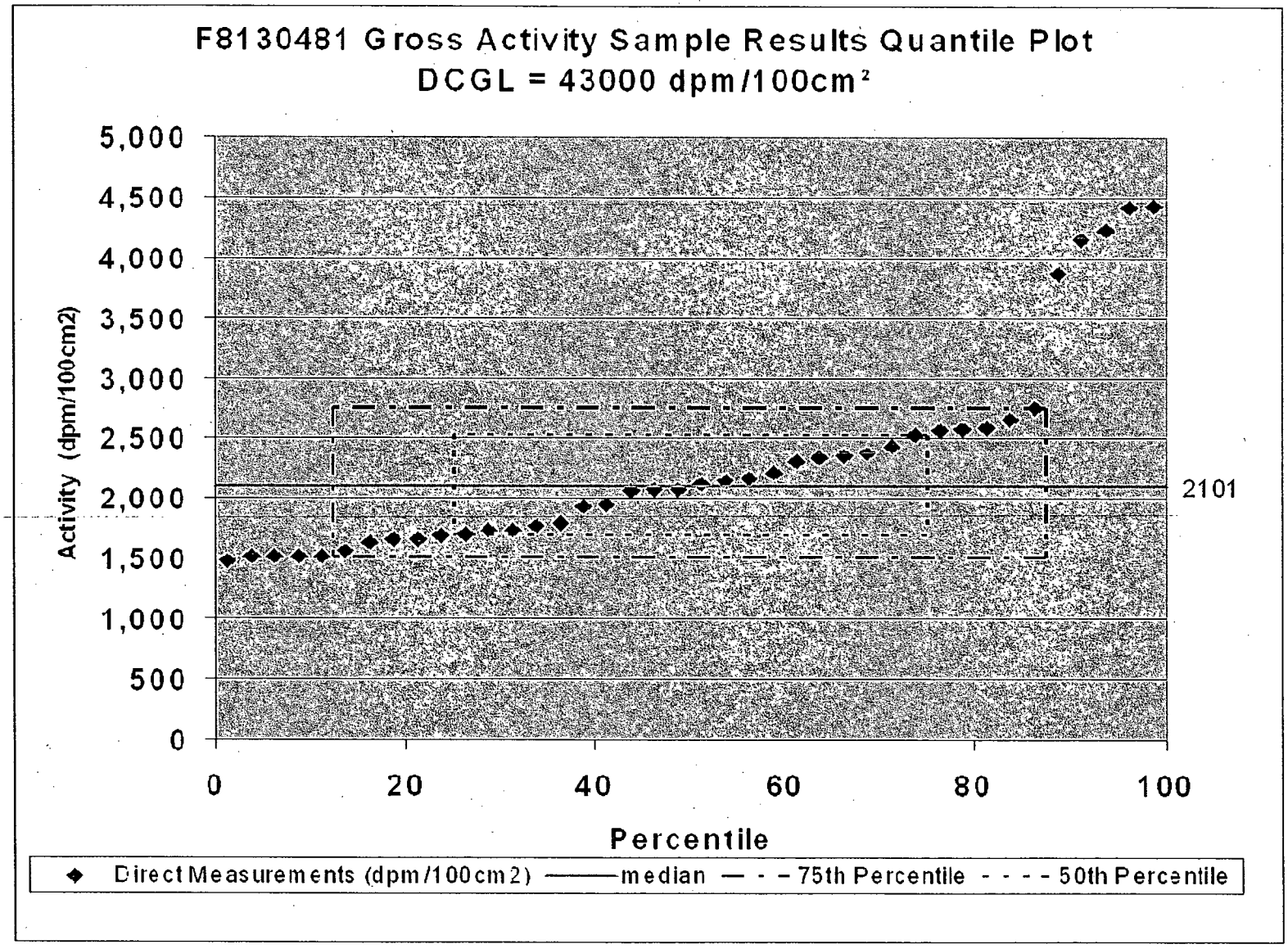
The results are shown in Table 3-1 with results less than unity.

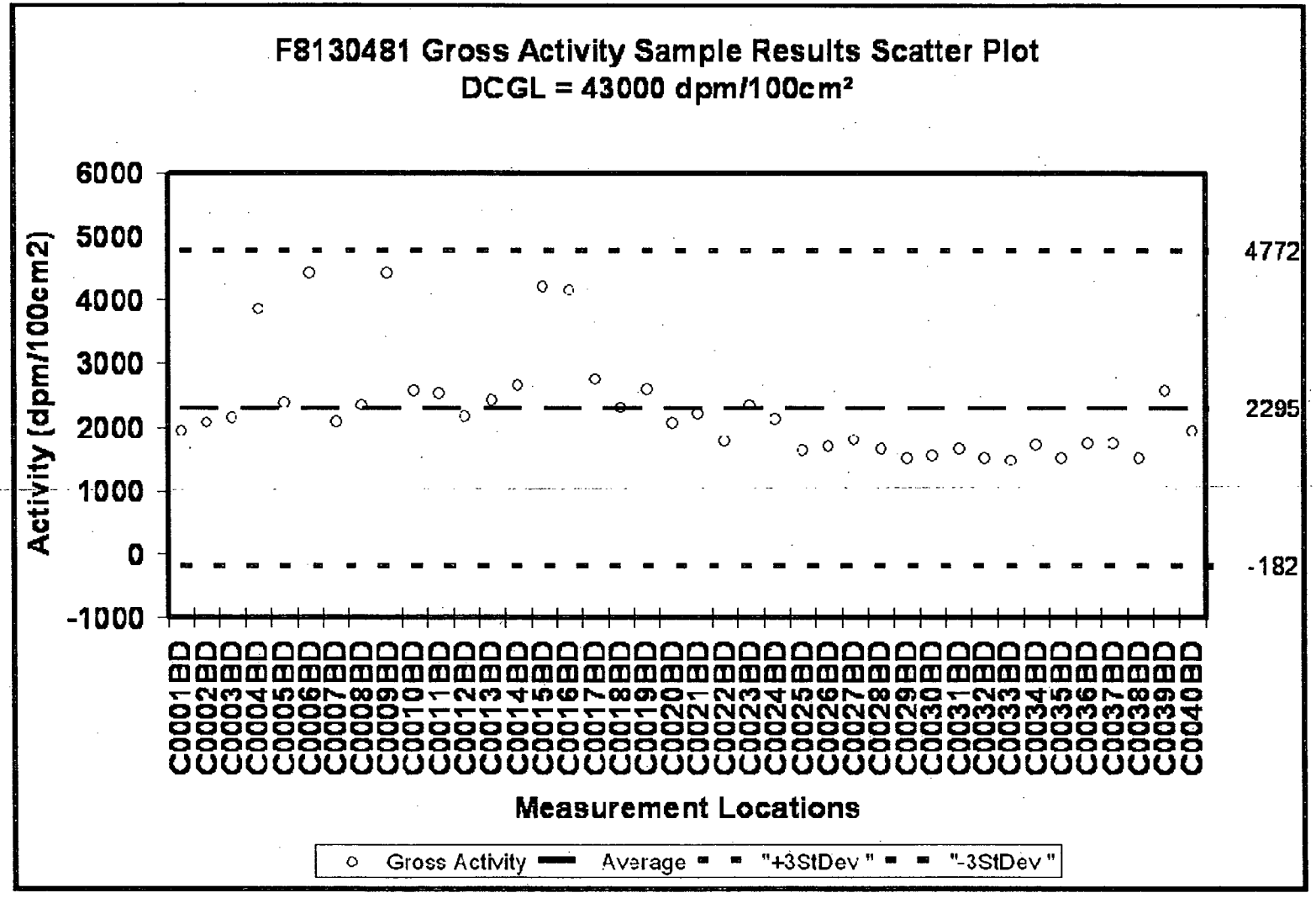
Attachment 4

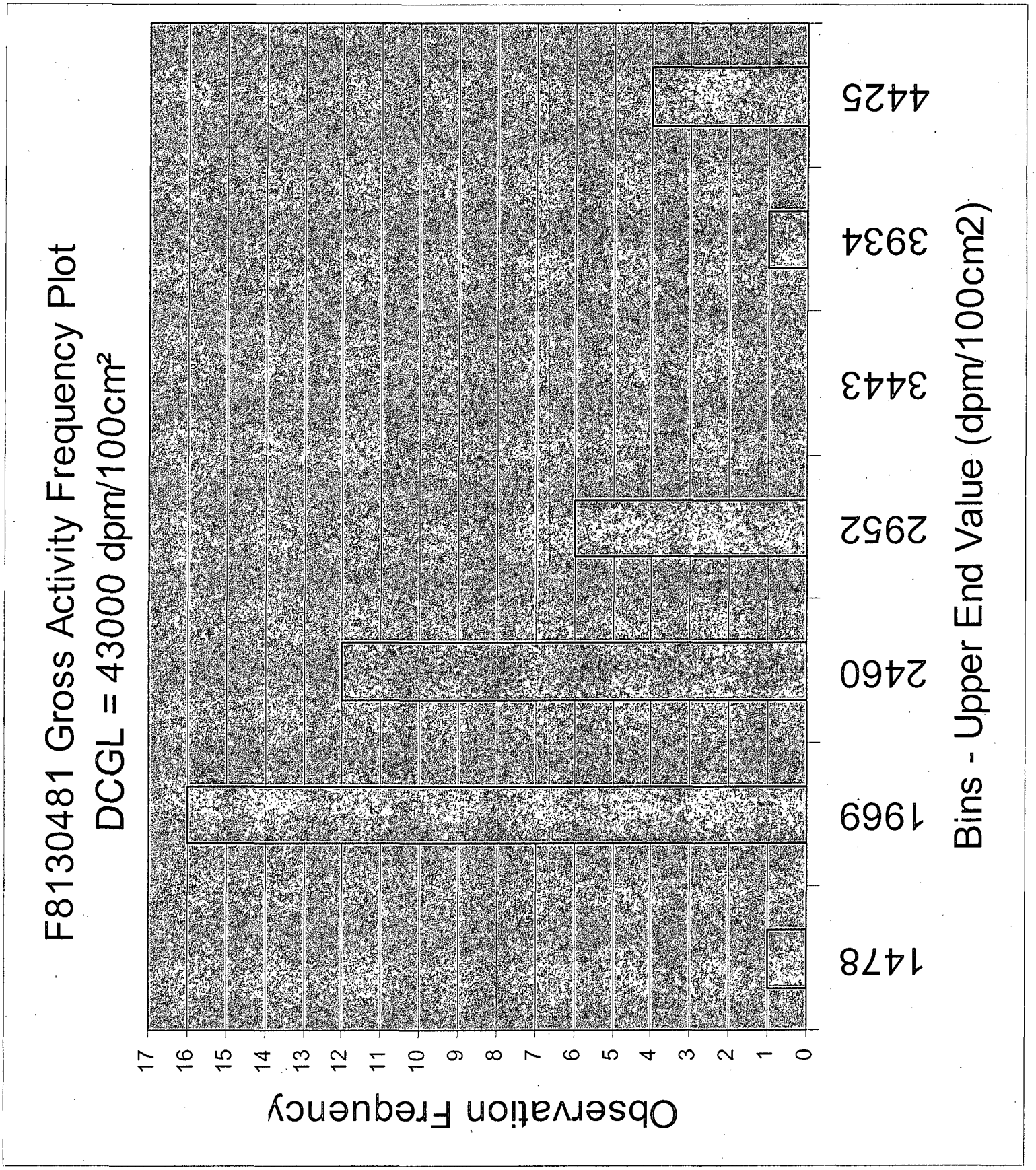
Data Assessment

November 26, 2007

Survey Unit F8130481


F8130481 Gross Activity Sample Results Quantile Plot
DCGL = 43000 dpm/100cm²
Activity (dpm/100cm2)
5,000
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2101
0
20
40
60
80
100
Percentile
Direct Measurements (dpm/100cm2)
median
75th Percentile
50th Percentile


F8130481 Gross Activity Sample Results Scatter Plot
DCGL = 43000 dpm/100cm²
Activity (dpm/100cm2)
6000
5000
4000
3000
2000
1000
0
-1000
4772
2295
-182
C0001BD
C0002BD
C0003BD
C0004BD
C0005BD
C0006BD
C0007BD
C0008BD
C0009BD
C0010BD
C0011BD
C0012BD
C0013BD
C0014BD
C0015BD
C0016BD
C0017BD
C0018BD
C0019BD
C0020BD
C0021BD
C0022BD
C0023BD
C0024BD
C0025BD
C0026BD
C0027BD
C0028BD
C0029BD
C0030BD
C0031BD
C0032BD
C0033BD
C0034BD
C0035BD
C0036BD
C0037BD
C0038BD
C0039BD
C0040BD
Measurement Locations
Gross Activity
Average
"+3StDev"
"-3StDev"


F8130481 Gross Activity Frequency Plot
DCGL = 43000 dpm/100cm²
Observation Frequency
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
1478
1969
2460
2952
3443
3934
4425
Bins - Upper End Value (dpm/100cm2)