Rancho Seco

Final Status Survey Summary Report

March 3, 2008

Reactor Coolant Drain Tank (V-600) Room Upper)

Survey Unit F8130061

Prepared By: Dan A. Tallman _____ **Date:** March 3, 2008

FSS Engineer

Reviewed By: _____ **Date:** 3/12/08

Lead FSS Engineer

Approved By: _____ **Date:** 4-8-08

Dismantlement Superintendent, Radiological

FINAL STATUS SURVEY SUMMARY REPORT

Survey Unit:

F8130061, Reactor Coolant Drain Tank (V-600) Room (Upper)

Survey Unit Description:

Operating History: The Auxiliary Building, a 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.

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. Based on the classification procedure (DSIP-0020) and levels of gross activity reported, the upper walls and ceiling of the Reactor Coolant Drain Tank (V-600) Room of the auxiliary building was determined to be a Class 1 survey unit.

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 302 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	Reactor Coolant Drain Tank (V-600) Room (Upper)
Survey Unit:	0061	Structure Surface
Class:	1	LTP Table 5-4
SU Area (m^2)**:**	302	
Evaluator:	D.A.Tallman	
DCGL (dpm/100 cm^2)**:**	43000	Gross Activity DCGL
Area Factor:	3.5	Class 1
Design DCGLemc (dpm/100 cm^2)**:**	154800	Class 1
LBGR (dpm/100 cm^2)**:**	21500	Default = 50% DCGL
Design Sigma (dpm/100 cm^2)**:**	9976	
Type I Error:	0.05	
Type II Error:	0.05	
Predominant Nuclide:	Cs-137	
Sample Area (m^2)**:**	6.86	Class 1
Scan Area (m^2)**:**	302	
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:	44	Class 1
Grid Spacing L:	2.6	Class 1

Survey Results:

A total of 44 direct measurements were made in F8130061. The results including mean, median, standard deviation and range are shown in Table 2. All direct measurements were less than the DCGL. Two of the scan measurements indicated areas of elevated activity. Scan activity ranged from 767 to 107627 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)
F8130061-C0001BD	1655
F8130061-C0002BD	1919
F8130061-C0003BD	1987
F8130061-C0004BD	1655
F8130061-C0005BD	2153
F8130061-C0006BD	2324
F8130061-C0007BD	2770
F8130061-C0008BD	2454
F8130061-C0009BD	2786
F8130061-C0010BD	2422
F8130061-C0011BD	2640
F8130061-C0012BD	2723
F8130061-C0013BD	2334
F8130061-C0014BD	2526
F8130061-C0015BD	4046
F8130061-C0016BD	2713
F8130061-C0017BD	2220
F8130061-C0018BD	2386
F8130061-C0019BD	3050
F8130061-C0020BD	3003
F8130061-C0021BD	2682
F8130061-C0022BD	3107
F8130061-C0023BD	1764
F8130061-C0024BD	1624
F8130061-C0025BD	2967
F8130061-C0026BD	2422
F8130061-C0027BD	2044
F8130061-C0028BD	4373
F8130061-C0029BD	2090
F8130061-C0030BD	1909
F8130061-C0031BD	1982
F8130061-C0032BD	2391
F8130061-C0033BD	1209
F8130061-C0034BD	1535
F8130061-C0035BD	1976
F8130061-M0036BD	575
F8130061-M0037BD	615
F8130061-M0038BD	1089
F8130061-M0039BD	1390
F8130061-M0040BD	775
F8130061-M0041BD	671
F8130061-M0042BD	652
F8130061-M0043BD	886
F8130061-M0044BD	843
Mean:	2076
Median:	2122
Standard Deviation:	869
Range:	575 - 4373

Table 3. Removable Surface Activity Results

Measurement ID	Surface Beta Activity (dpm/100 cm^2)
F8130061C0001SM	17.13
F8130061C0002SM	85.58
F8130061C0003SM	19.72
F8130061C0004SM	14.55
F8130061C0005SM	30.05
F8130061C0006SM	71.37
F8130061C0007SM	175.98
F8130061C0008SM	55.88
F8130061C0009SM	139.82
F8130061C0010SM	68.79
F8130061C0011SM	208.27
F8130061C0012SM	125.61
F8130061C0013SM	107.53
F8130061C0014SM	86.87
F8130061C0015SM	102.37
F8130061C0016SM	112.7
F8130061C0017SM	133.36
F8130061C0018SM	68.79
F8130061C0019SM	216.02
F8130061C0020SM	175.98
F8130061C0021SM	190.19
F8130061C0022SM	148.86
F8130061C0023SM	49.42
F8130061C0024SM	50.71
F8130061C0025SM	35.21
F8130061C0026SM	8.09
F8130061C0027SM	4.22
F8130061C0028SM	17.13
F8130061C0029SM	30.05
F8130061C0030SM	8.09
F8130061C0031SM	31.34
F8130061C0032SM	49.42
F8130061C0033SM	53.29
F8130061C0034SM	31.34
F8130061C0035SM	-2.24
F8130061C0036SM	4.22
F8130061C0037SM	1.64
F8130061C0038SM	30.05
F8130061C0039SM	0.34
F8130061C0040SM	5.51
F8130061C0041SM	-0.95
F8130061C0042SM	6.8
F8130061C0043SM	42.96
F8130061C0044SM	39.09
Mean:	64.8
Median:	46.19
Standard Deviation:	62.32
Range:	-2.24 to 216.02

Survey Unit Data Assessment:

The survey design required 44 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):	44	
Median (dpm/100 cm²):	2122	
Mean (dpm/100 cm²):	2076	
Direct Measurement Standard Deviation (dpm/100 cm²):	869	
Total Standard Deviation (dpm/100 cm²):	869	Based on samples and backgrounds.
Maximum (dpm/100 cm²):	4373	
Material Type:	N/A	Background Subtract Not Applied
Sign Test Final N Value:	44	
S+ Value:	44	
Critical Value:	27	
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:

Two investigations (scan grid 222 and penetration 029) were required for the scan measurements based on an investigation level set conservatively at the $DCGL_W$. The results are 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. Two potential areas of elevated activity were detected and evaluated as shown in Attachment 3 demonstrating 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 required investigations were performed and evaluated as necessary.

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.

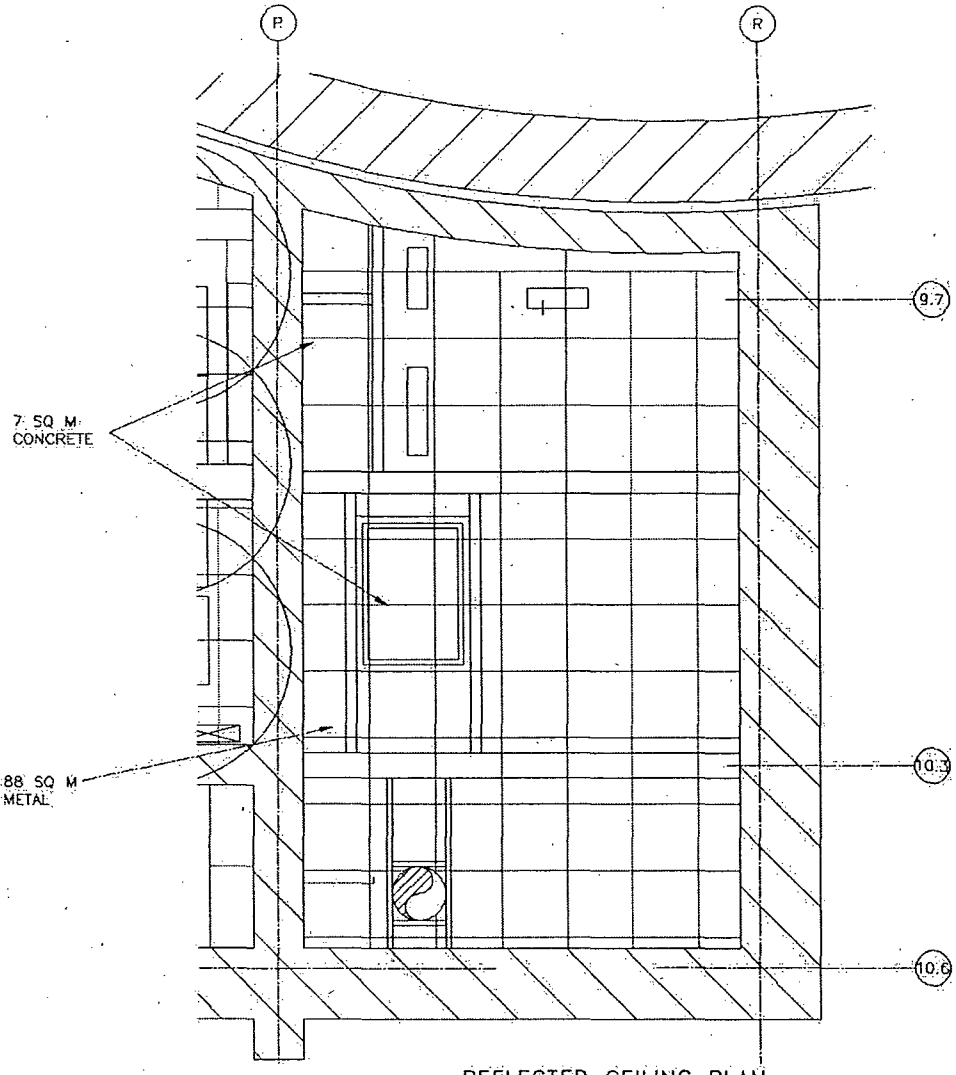
It is concluded that survey unit F8130061 meets the release criteria of 10CFR20.1402.

Attachment 1

Maps

March 3, 2008

Survey Unit F8130061



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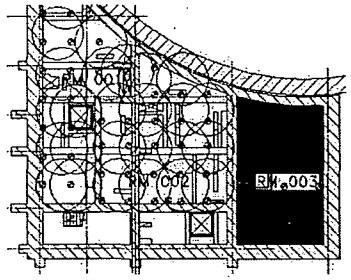


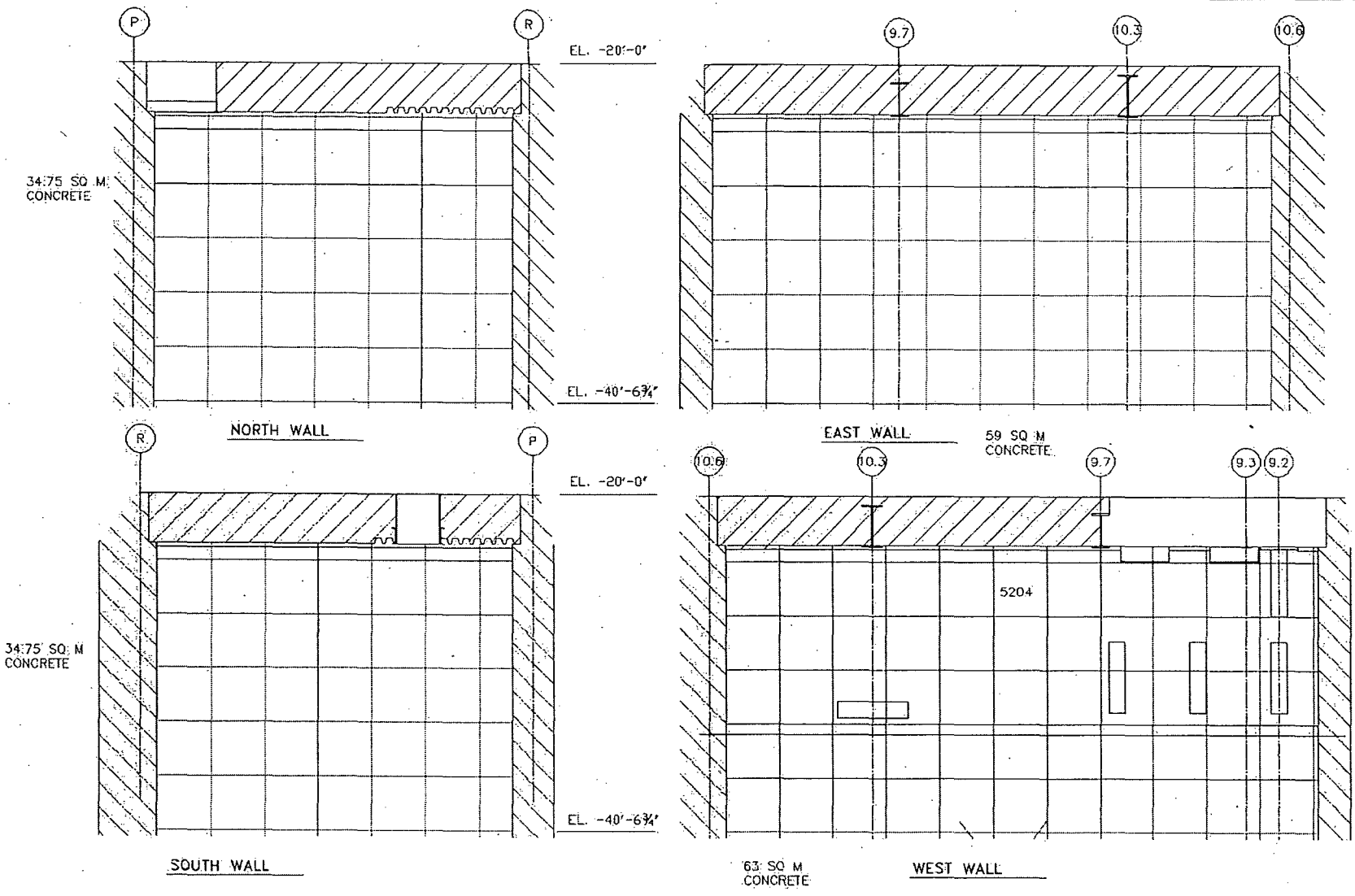
KEY PLAN

N

SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT

REACTOR COOLANT DRAIN TANK (V-600)
ROOM 003 CEILING & UPPER WALLS
GEN ARRGMNT SURFACE AREA ESTIMATE
F8130061-M1

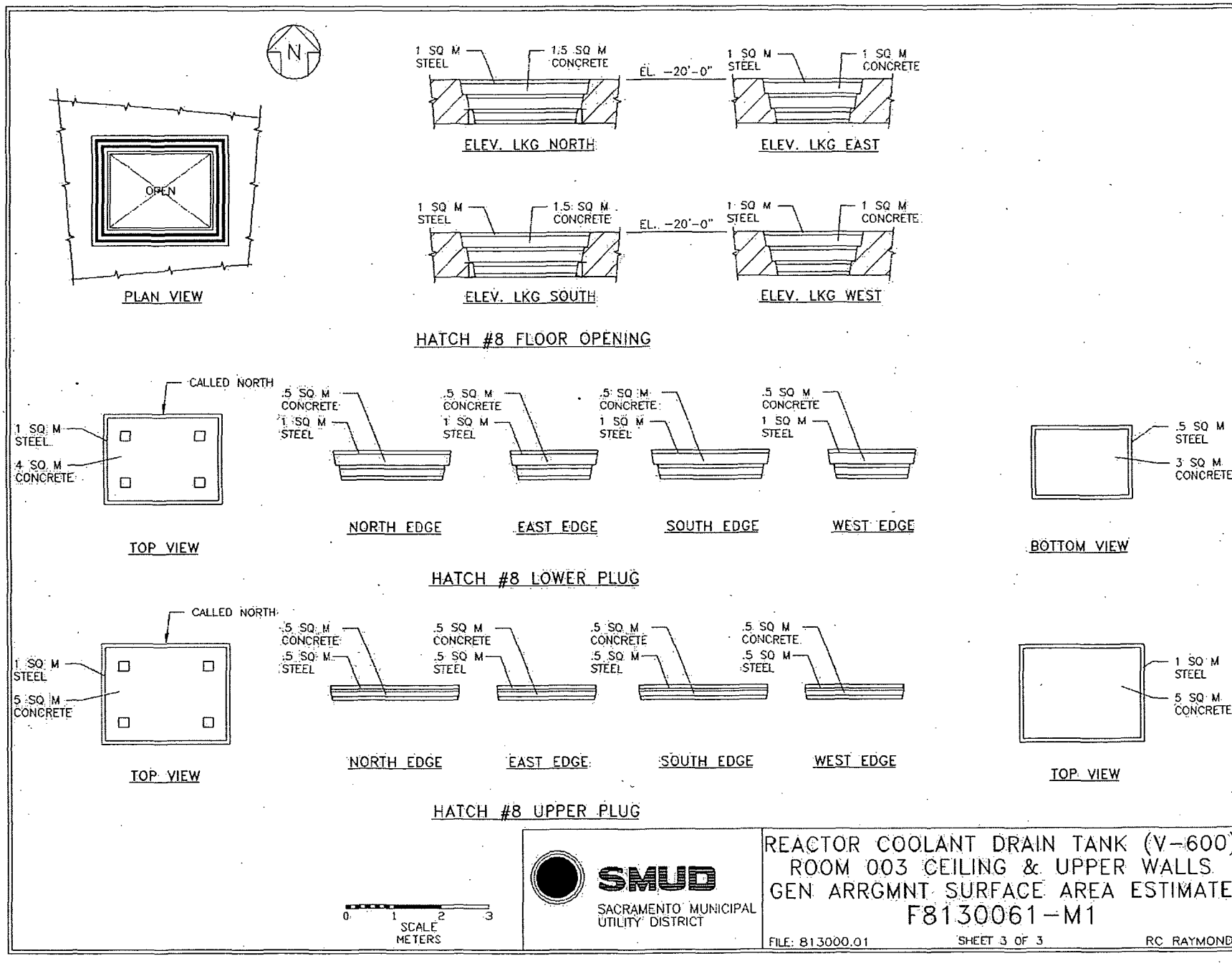
FILE: 813000.01 SHEET 1 of 3 RC RAYMOND



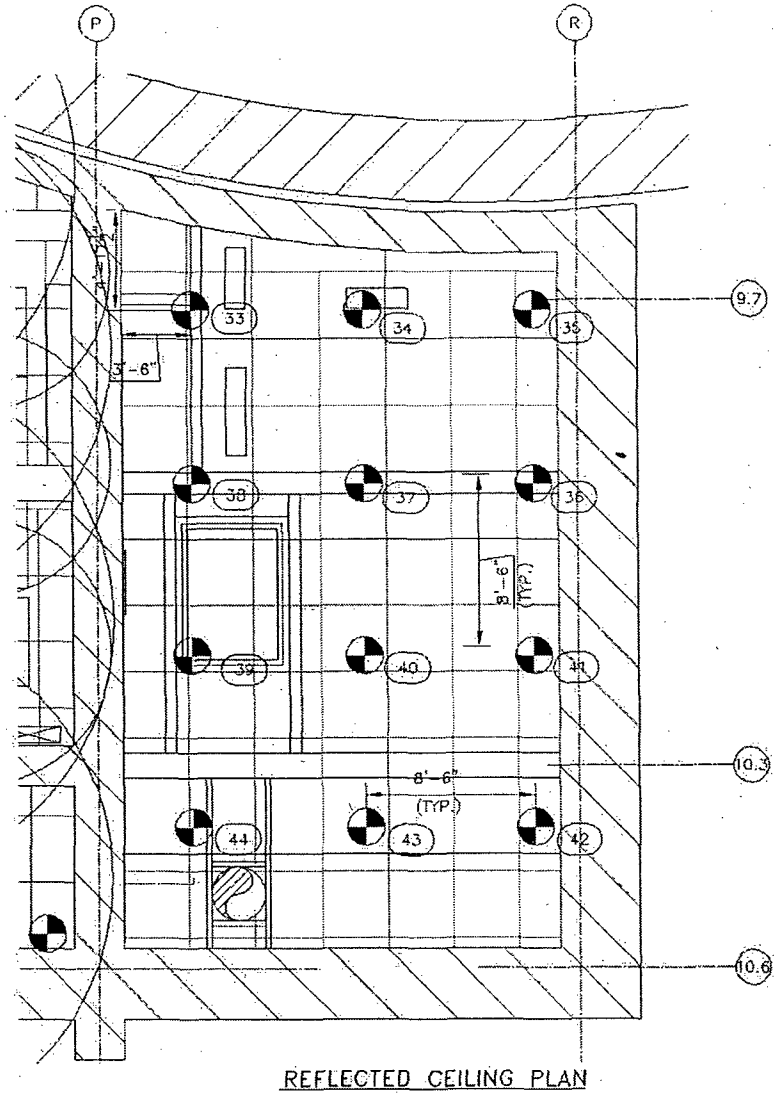
SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT

REACTOR COOLANT DRAIN TANK (V-600)
ROOM 003 CEILING & UPPER WALLS
GEN ARRGMNT SURFACE AREA ESTIMATE
F8130061-M1

FILE: 813000.01 SHEET 2 OF 3 RC RAYMOND


N
OPEN
PLAN VIEW
1 SQ M STEEL
1.5 SQ M CONCRETE
EL. -20'-0"
1 SQ M STEEL
1 SQ M CONCRETE
ELEV. LKG NORTH
ELEV. LKG EAST
1 SQ M STEEL
1.5 SQ M CONCRETE
EL. -20'-0"
1 SQ M STEEL
1 SQ M CONCRETE
ELEV. LKG SOUTH
ELEV. LKG WEST
HATCH #8 FLOOR OPENING
CALLED NORTH
1 SQ M STEEL
4 SQ M CONCRETE
TOP VIEW
.5 SQ M CONCRETE
1 SQ M STEEL
NORTH EDGE
.5 SQ M CONCRETE
1 SQ M STEEL
EAST EDGE
.5 SQ M CONCRETE
1 SQ M STEEL
SOUTH EDGE
.5 SQ M CONCRETE
1 SQ M STEEL
WEST EDGE
.5 SQ M STEEL
3 SQ M CONCRETE
BOTTOM VIEW
HATCH #8 LOWER PLUG
CALLED NORTH
1 SQ M STEEL
5 SQ M CONCRETE
TOP VIEW
.5 SQ M CONCRETE
.5 SQ M STEEL
NORTH EDGE
.5 SQ M CONCRETE
.5 SQ M STEEL
EAST EDGE
.5 SQ M CONCRETE
.5 SQ M STEEL
SOUTH EDGE
.5 SQ M CONCRETE
.5 SQ M STEEL
WEST EDGE
1 SQ M STEEL
5 SQ M CONCRETE
TOP VIEW
HATCH #8 UPPER PLUG
0 1 2 3
SCALE METERS
SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT
REACTOR COOLANT DRAIN TANK (V-600)
ROOM 003 CEILING & UPPER WALLS
GEN ARRGMNT SURFACE AREA ESTIMATE
F8130061-M1
FILE: 813000.01
SHEET 3 OF 3
RC RAYMOND

EL -40'-6¾"
NORTH WALL
SOUTH WALL
EAST WALL
WEST WALL
9.7
10.3
10.6
9.3
SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT
REACTOR COOLANT DRAIN TANK (V-600)
SURVEY LOCATION MAP
RANDOM START LOCATION
F8130061-M2
FILE: 813000.01
SHEET 1 OF 4
RC RAYMOND



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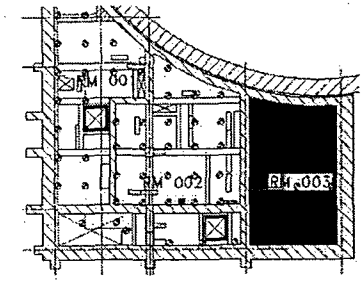


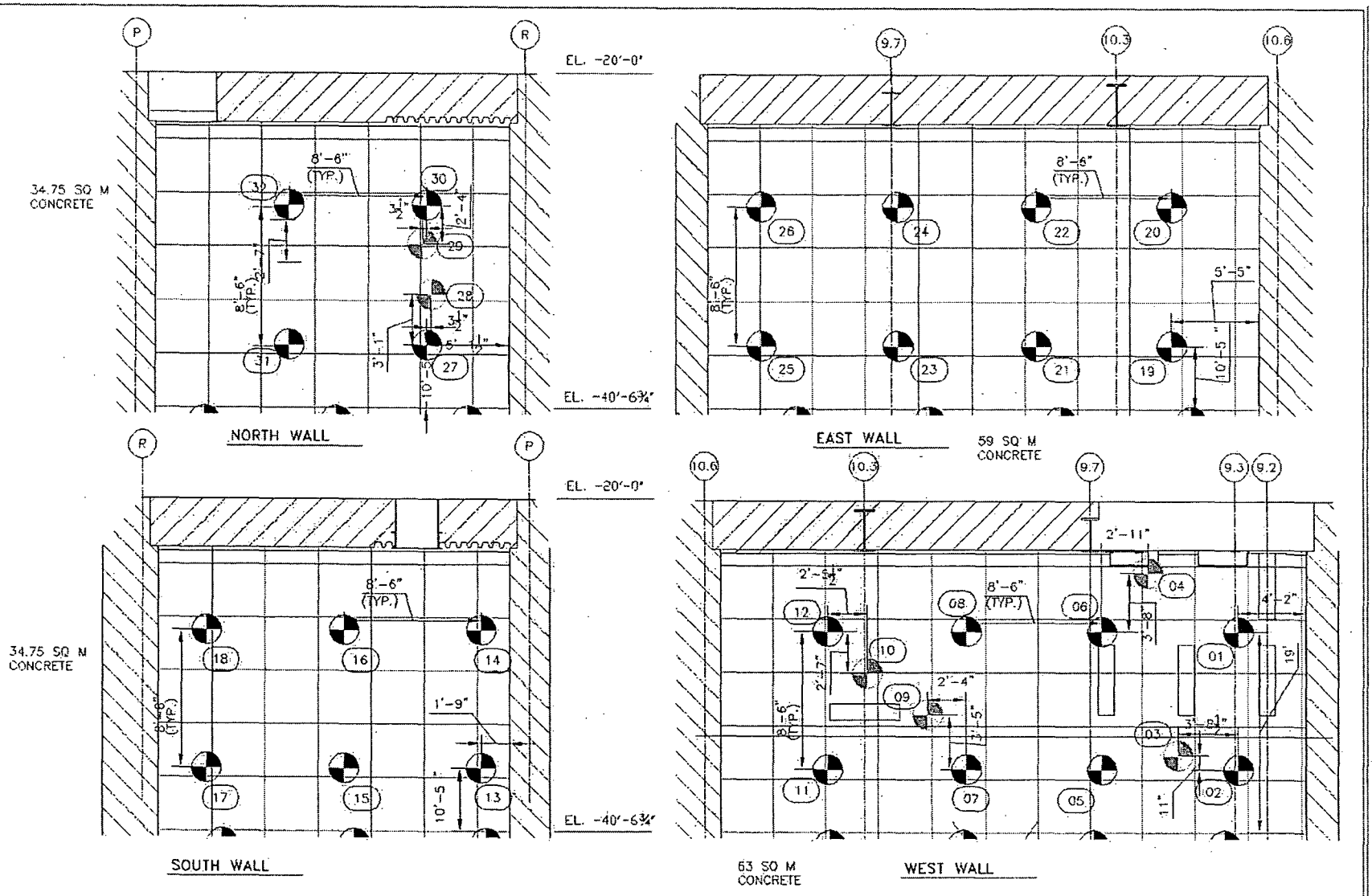
KEY PLAN

N

SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT

REACTOR COOLANT DRAIN TANK (V-600)
SURVEY LOCATION MAP
BETA DIRECT/REMOVABLE CONTAMINATION
F8130061-M2

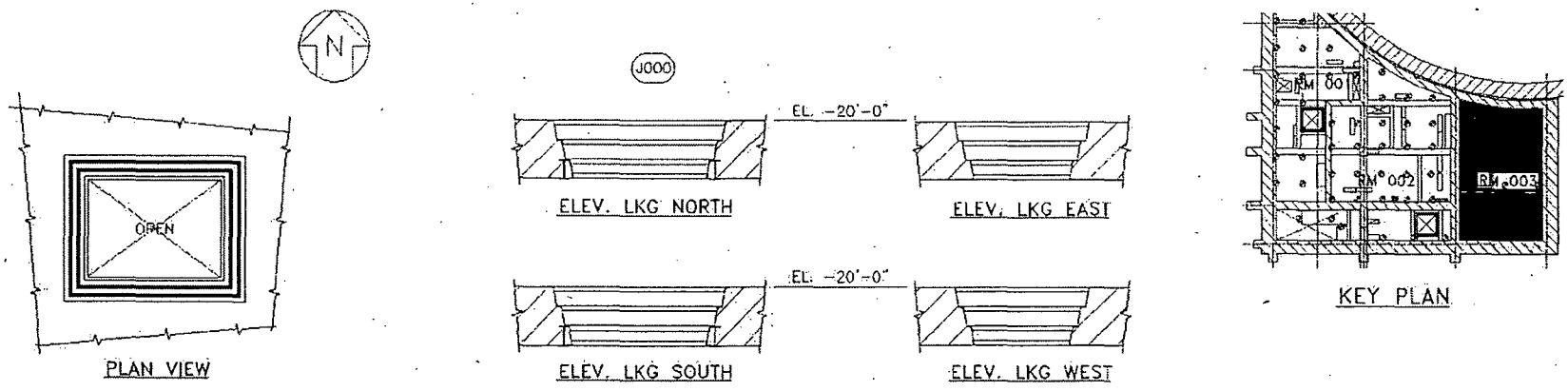
FILE: 813000.01 SHEET 2 of 4 RC RAYMOND



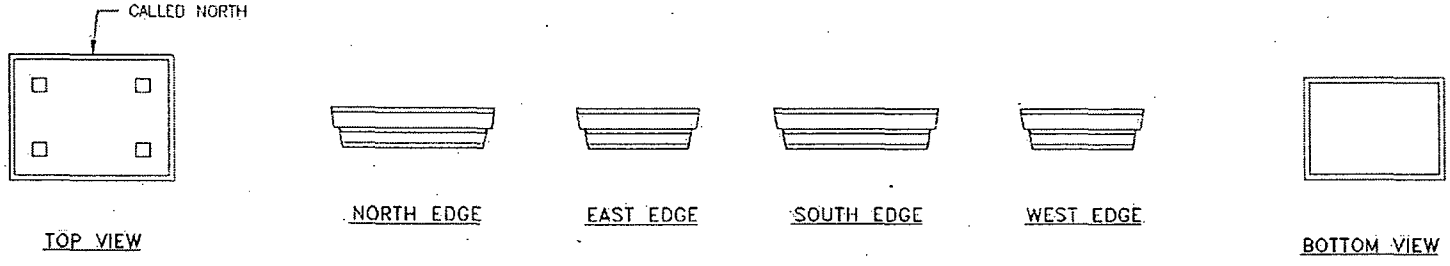
SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT

REACTOR COOLANT DRAIN TANK (V-600)
SURVEY LOCATION MAP
BETA DIRECT/REMOVABLE CONTAMINATION
F8130061-M2

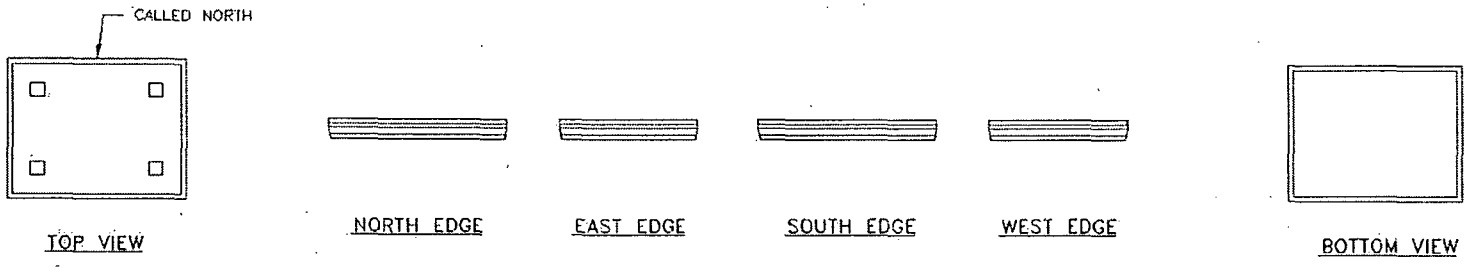
FILE: 813000.01 SHEET 3 OF 4 P/C RAYMOND



HATCH #8 FLOOR OPENING



HATCH #8 LOWER PLUG



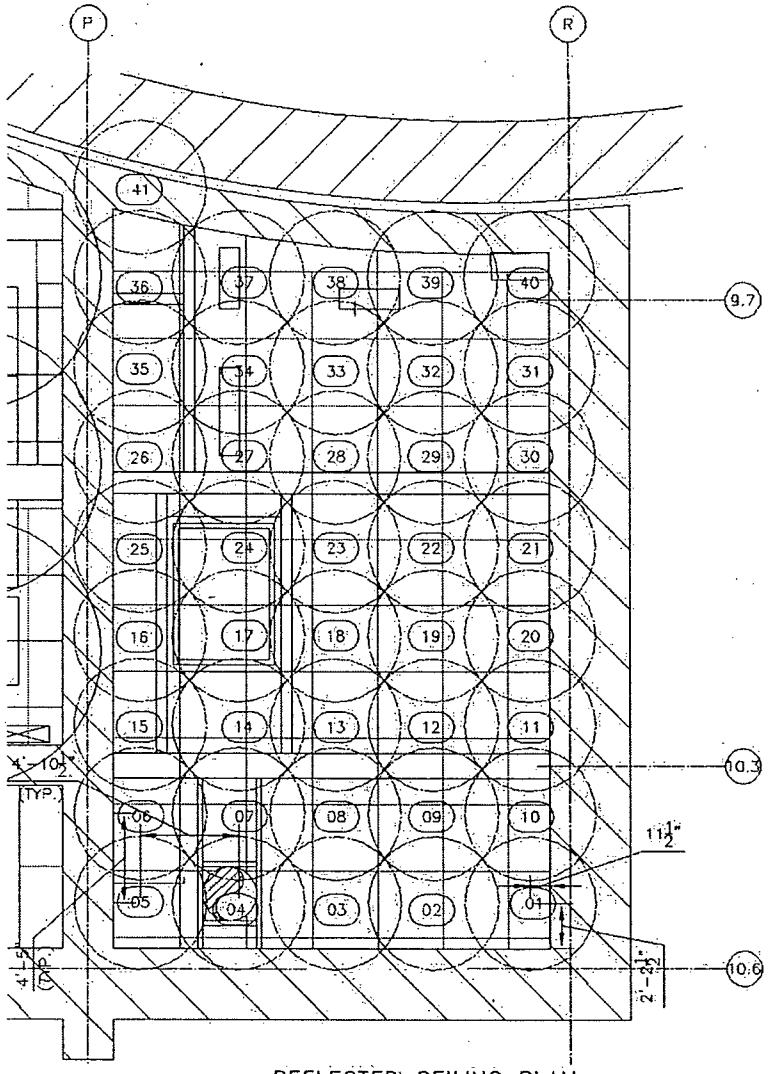
HATCH #8 UPPER PLUG

0 1 2 3
SCALE
METERS

SMUD
SACRAMENTO MUNICIPAL
UTILITY DISTRICT

REACTOR COOLANT DRAIN TANK (V-600)
SURVEY LOCATION MAP
BETA DIRECT/REMOVABLE CONTAMINATION
F8130061-M2

FILE: 813000.01 SHEET 4 OF 4 RC RAYMOND



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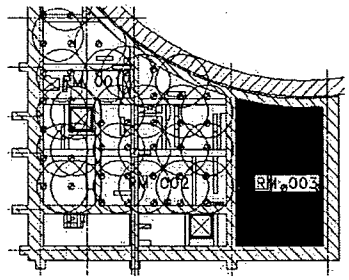

KEY PLAN

2 meters

N

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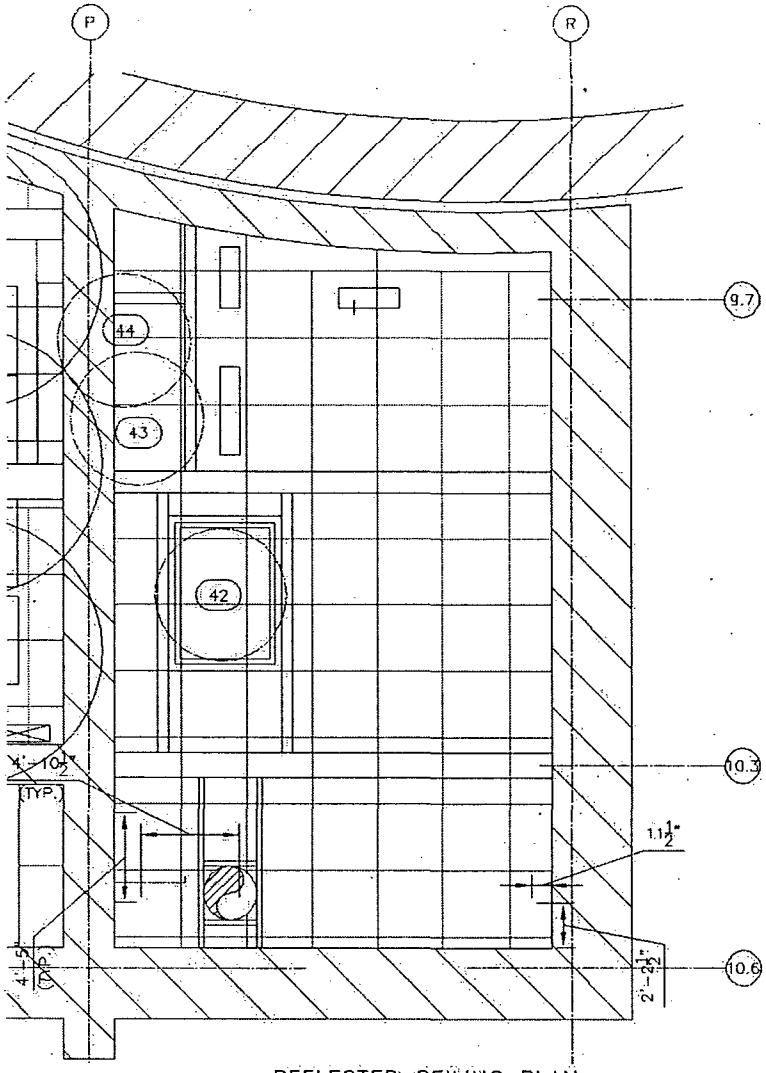
REACTOR COOLANT DRAIN TANK (V-600)
SURVEY LOCATION MAP
SCANS (GAMMA)
F8130061-M3

FILE: 813000.01 SHEET 1 of 4 RC RAYMOND



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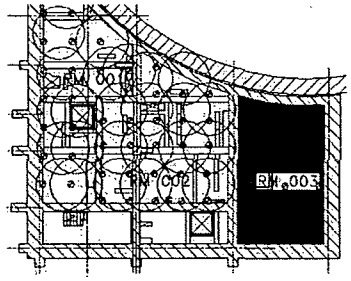


KEY PLAN

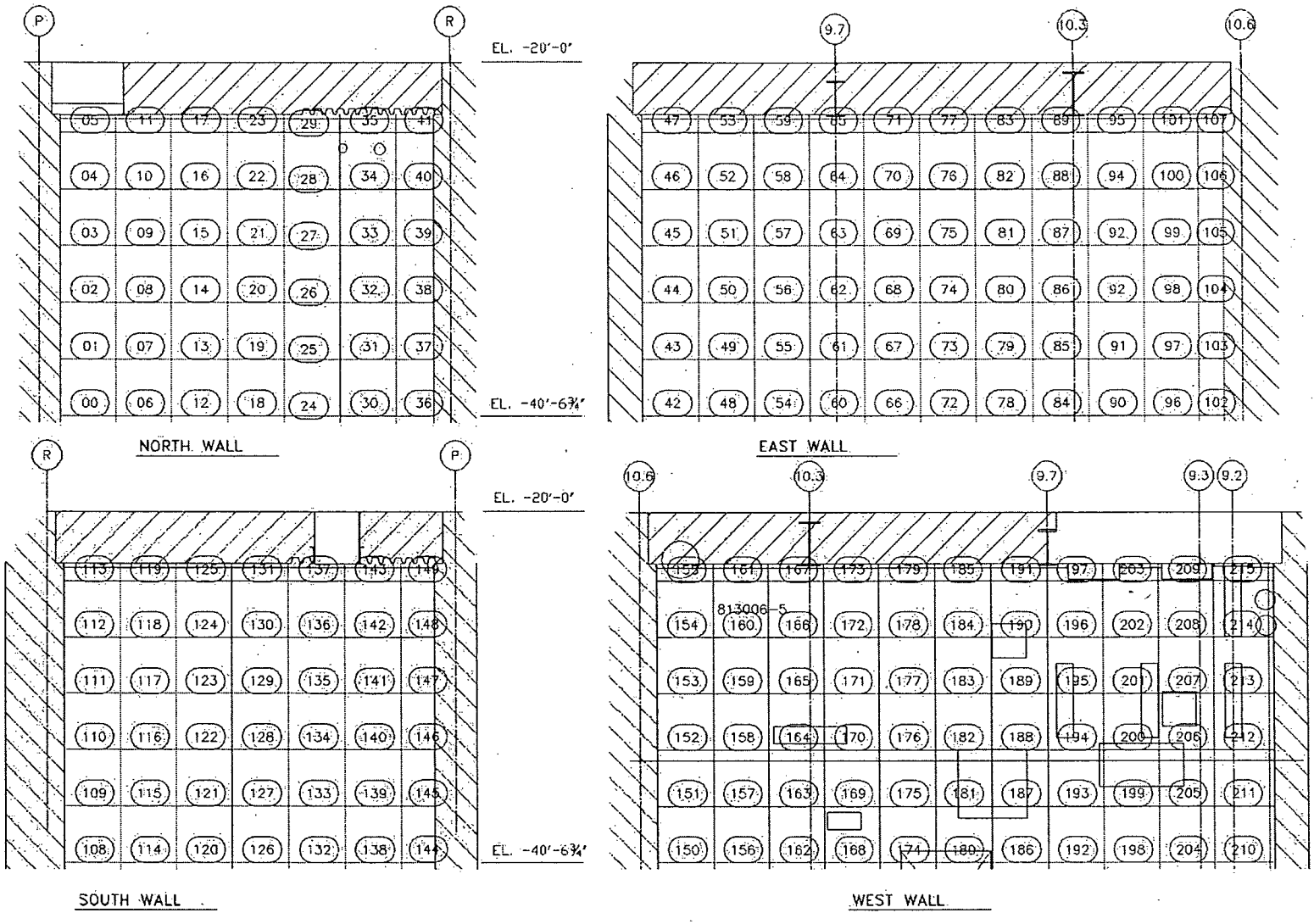
2 meters

N

SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT

REACTOR COOLANT DRAIN TANK (V-600)
SURVEY LOCATION MAP
SCANS (GAMMA)
F8130061-M3

FILE: 813000.01 SHEET 2 of 4 RC RAYMOND



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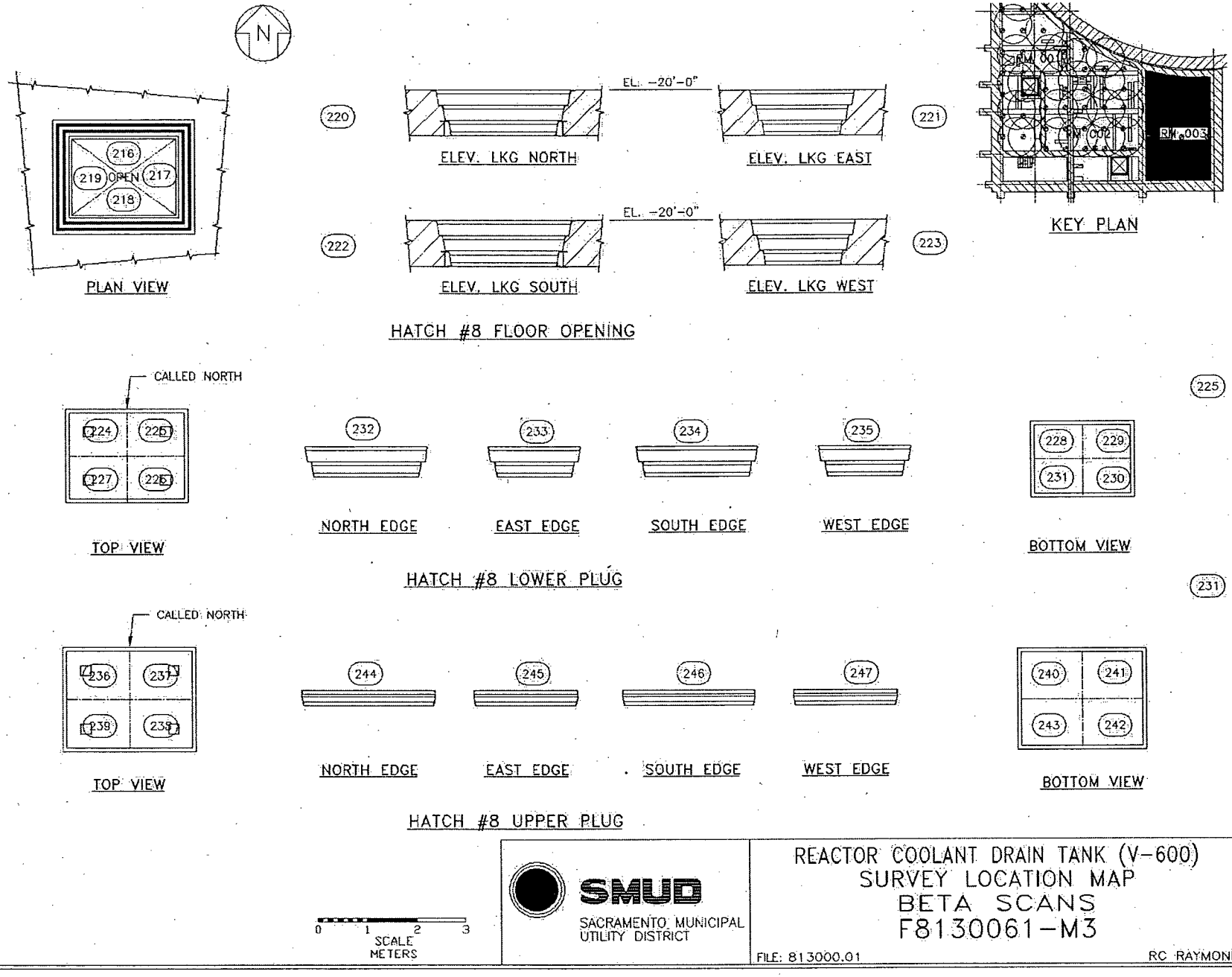
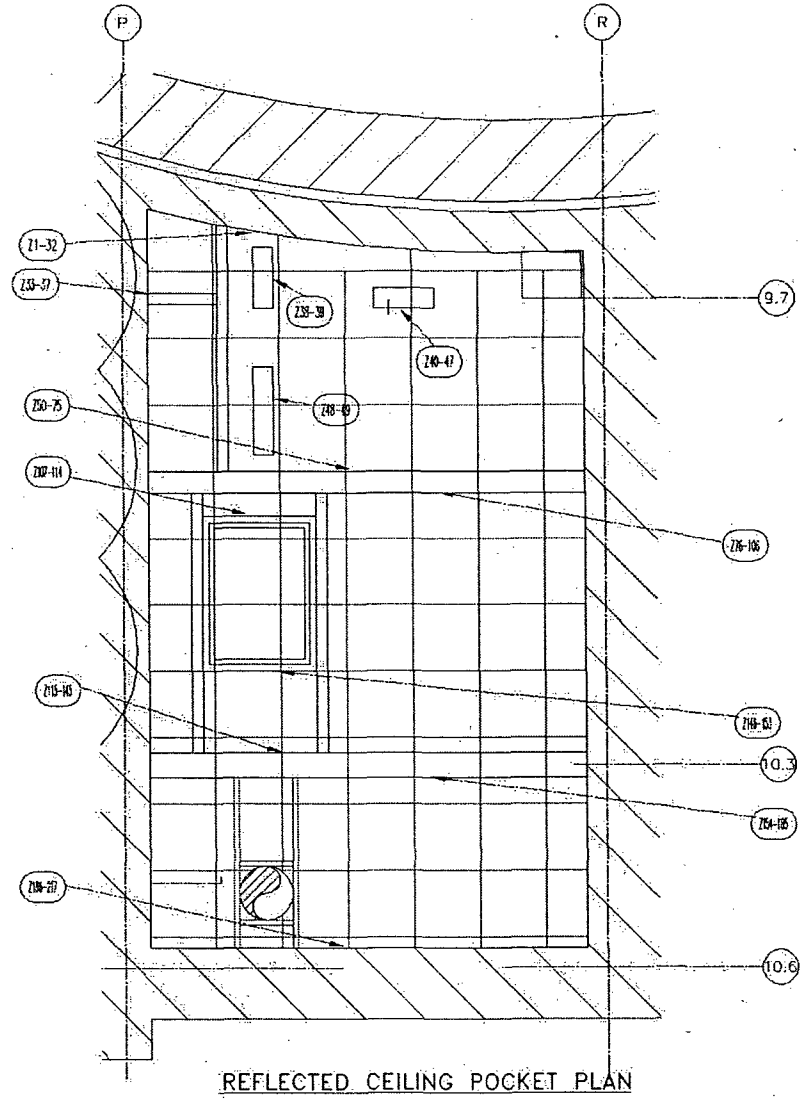
SACRAMENTO MUNICIPAL UTILITY DISTRICT

REACTOR COOLANT DRAIN TANK (V-600) SURVEY LOCATION MAP SCANS (BETA) F8130061-M3

FILE: 813000.01 SHEET 3 OF 4 RC RAYMOND


N
216
219
OPEN
217
218
PLAN VIEW
220
EL. -20'-0"
ELEV. LKG NORTH
221
ELEV. LKG EAST
222
EL. -20'-0"
ELEV. LKG SOUTH
223
ELEV. LKG WEST
RM 001
RM 002
RM 003
KEY PLAN
HATCH #8 FLOOR OPENING
CALLED NORTH
224
225
227
226
TOP VIEW
232
233
234
235
NORTH EDGE
EAST EDGE
SOUTH EDGE
WEST EDGE
225
228
229
231
230
BOTTOM VIEW
HATCH #8 LOWER PLUG
CALLED NORTH
236
237
239
238
TOP VIEW
244
245
246
247
NORTH EDGE
EAST EDGE
SOUTH EDGE
WEST EDGE
231
240
241
243
242
BOTTOM VIEW
HATCH #8 UPPER PLUG
0 1 2 3
SCALE
METERS
SMUD
SACRAMENTO MUNICIPAL
UTILITY DISTRICT
REACTOR COOLANT DRAIN TANK (V-600)
SURVEY LOCATION MAP
BETA SCANS
F8130061-M3
FILE: 813000.01
RC RAYMOND

CEILING PANEL POCKETS <Z> SEE ATTACHED PHOTOS FOR INDIVIDUAL ID NUMBERS



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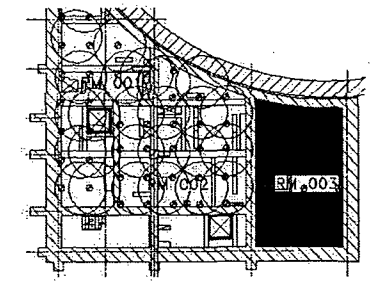


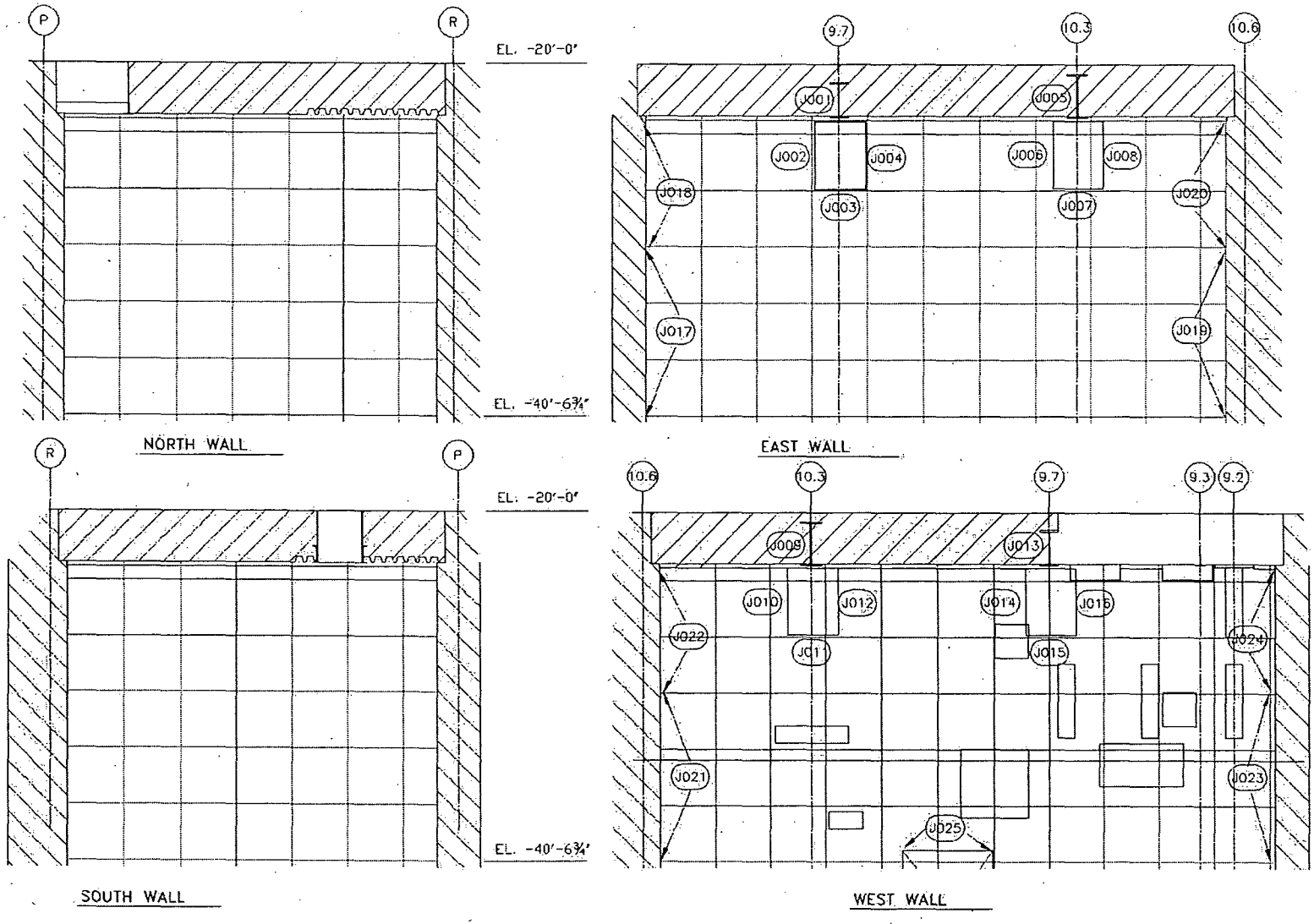
KEY PLAN

N

SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT

REACTOR COOLANT DRAIN TANK (V-600)
SURVEY LOCATION MAP
JUNCTURE SCANS
F8130061-M4

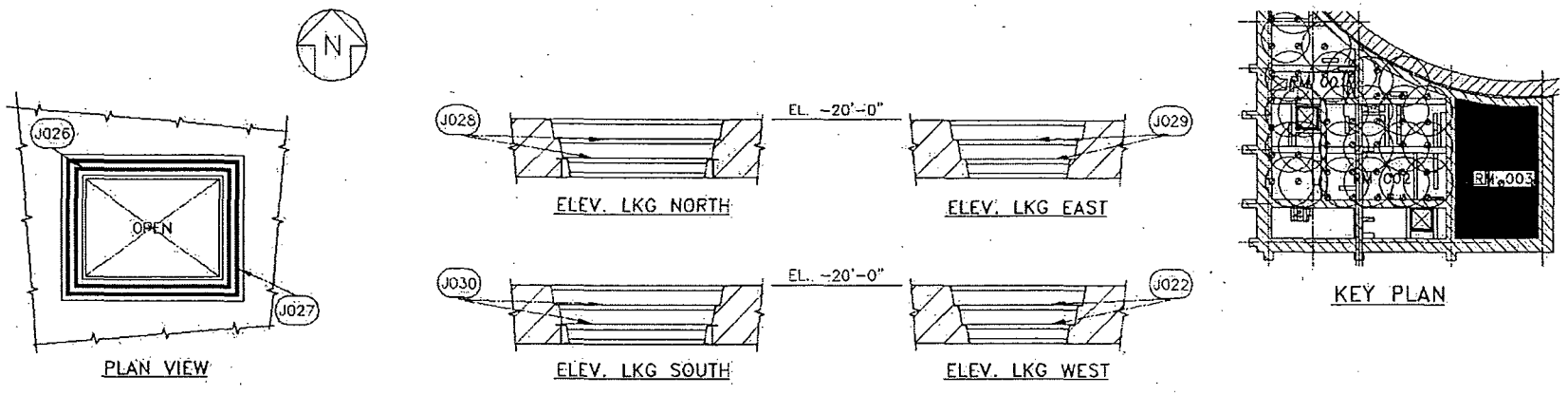
FILE: 813000.01 SHEET 1 of 3 RC RAYMOND



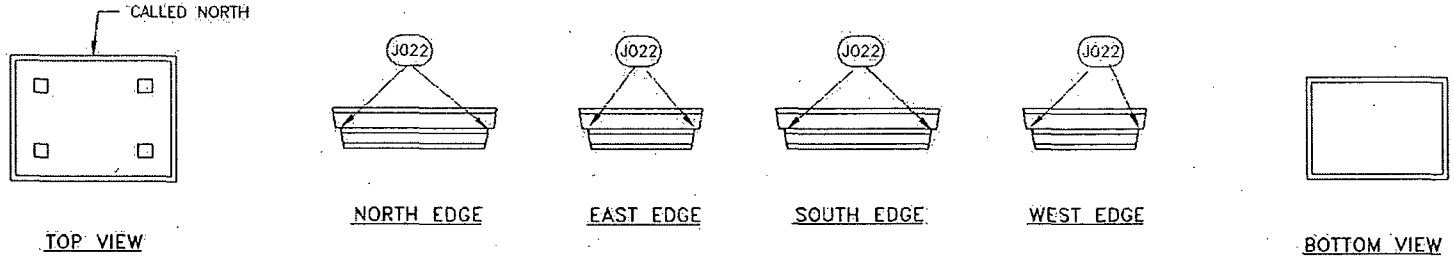
SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT

REACTOR COOLANT DRAIN TANK (V-600)
SURVEY LOCATION MAP
JUNCTURE SCANS
F8130061-M4

FILE: 813000.01 SHEET 2 OF 3 RC RAYMOND



HATCH #8 FLOOR OPENING



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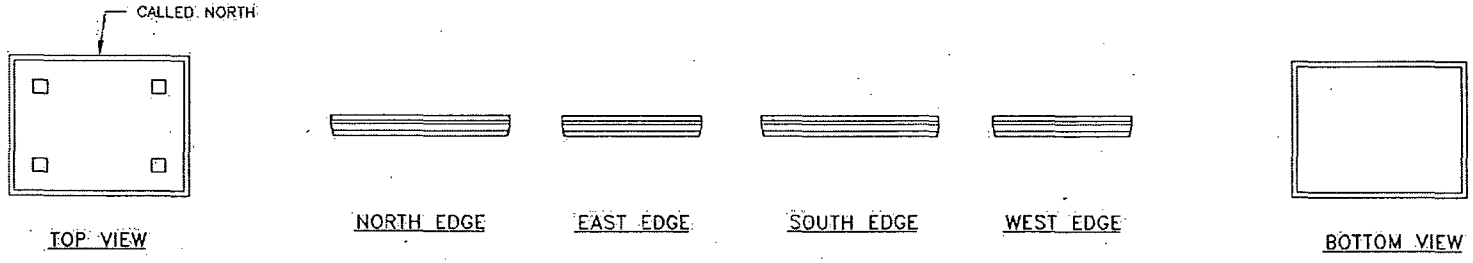


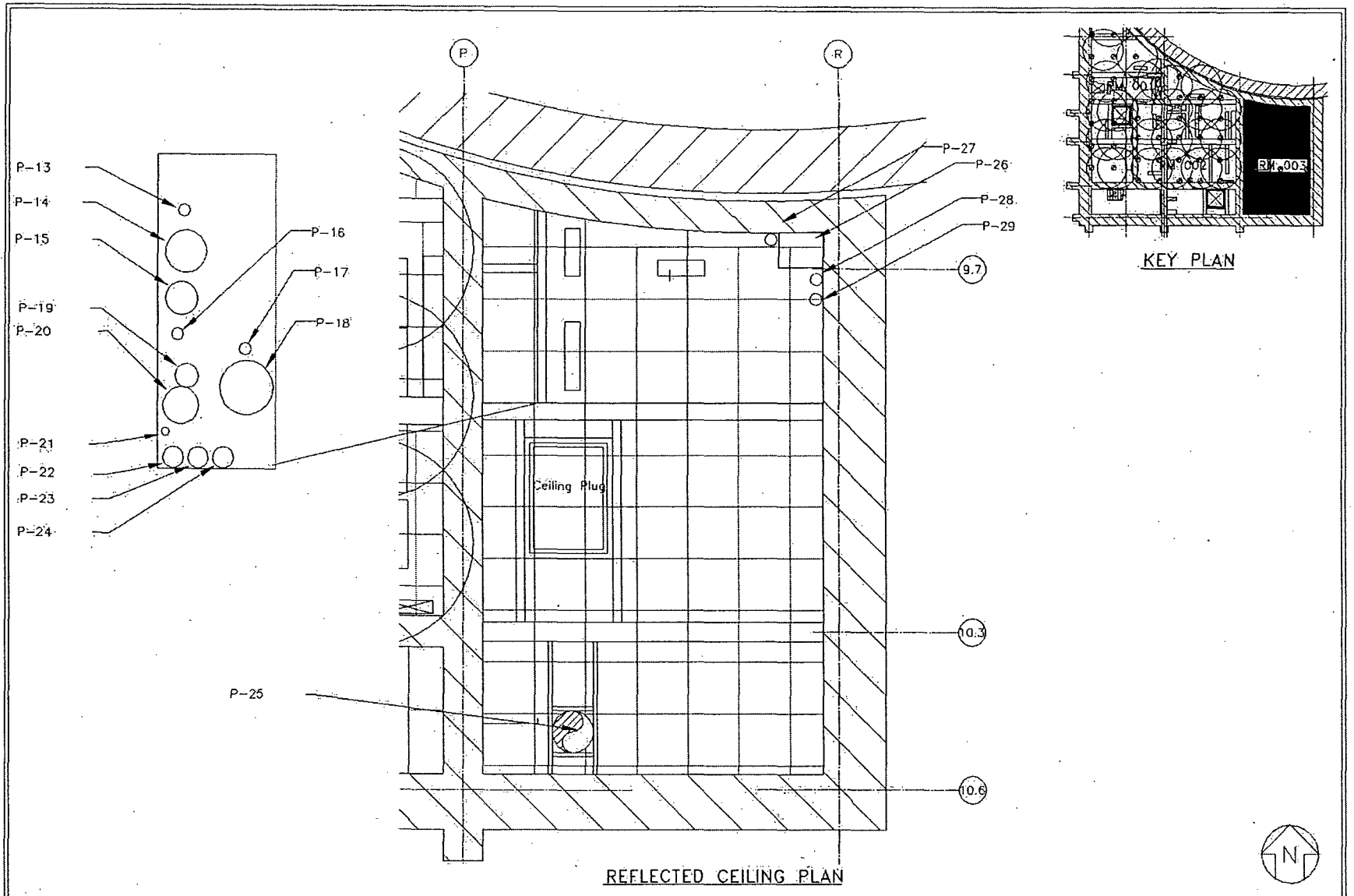
HATCH #8 UPPER PLUG

0 1 2 3
SCALE
METERS

SMUD
SACRAMENTO MUNICIPAL
UTILITY DISTRICT

REACTOR COOLANT DRAIN TANK (V-600)
SURVEY LOCATION MAP
JUNCTURE SCANS
F8130061-M4

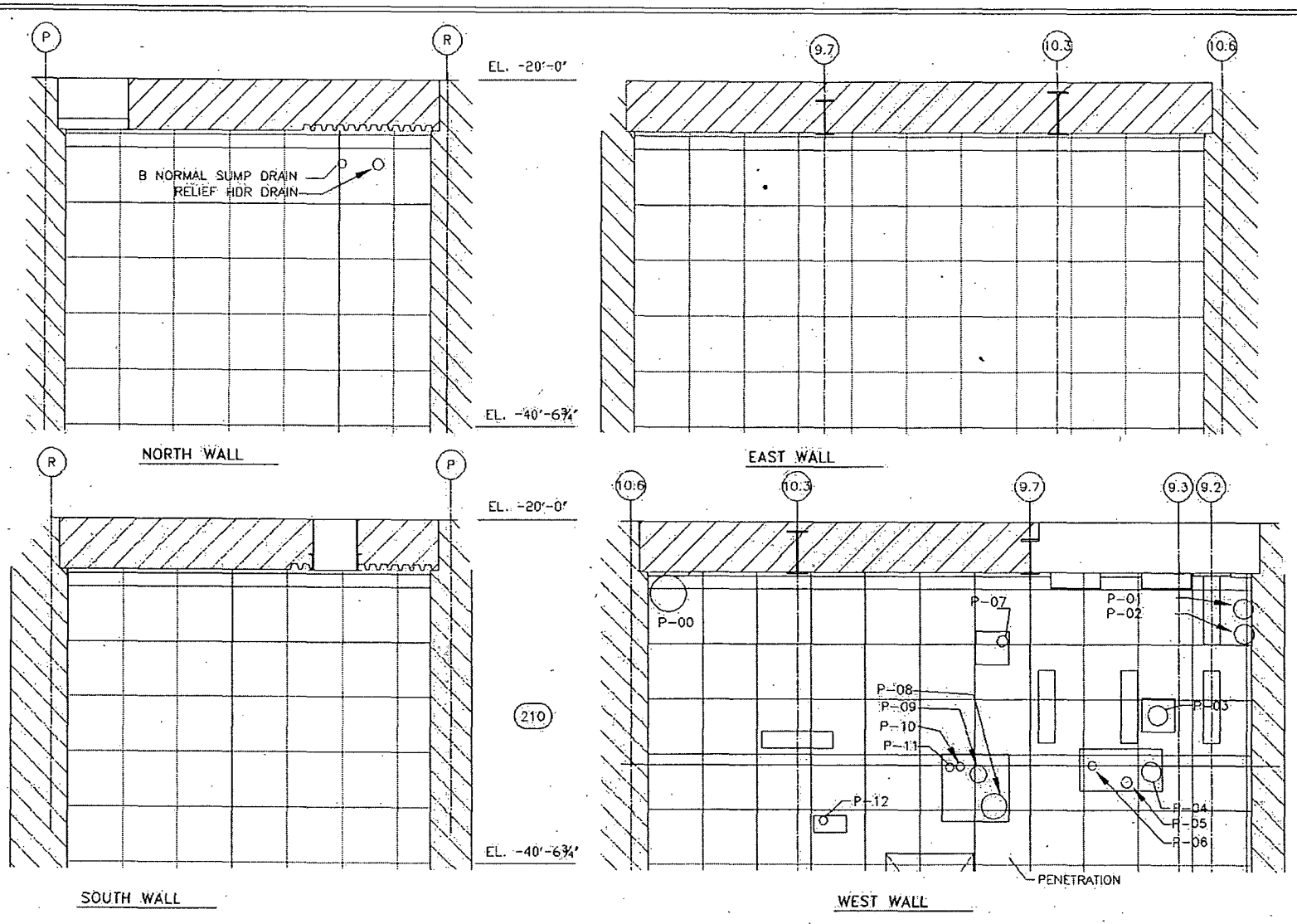
FILE: 813000.01 SHEET 3 OF 3 RC RAYMOND



SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT

REACTOR COOLANT DRAIN TANK (V-600)
SURVEY LOCATION MAP
PENETRATION SCANS
F8130061-M5

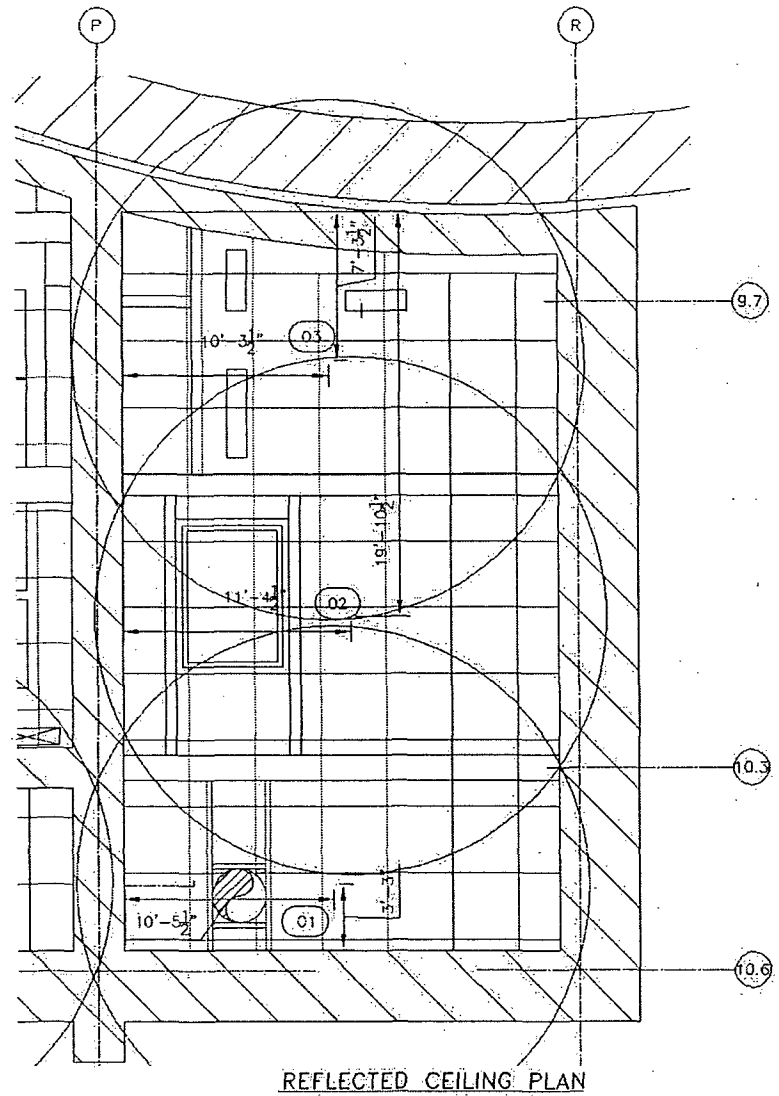
FILE: 813000.01 SHEET 1 of 2 RC RAYMOND



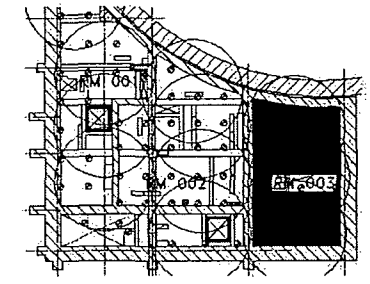
SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT

REACTOR COOLANT DRAIN TANK (V-600)
SURVEY LOCATION MAP
PENETRATION SCANS
F8130061-M5

FILE: 813000.01 SHEET 2 of 2 RC RAYMOND



REFLECTED CEILING PLAN



KEY PLAN

N

SMUD
SACRAMENTO MUNICIPAL UTILITY DISTRICT

REACTOR COOLANT DRAIN TANK (V-600) SURVEY LOCATION MAP SCANS (GAMMA) F8130061-M3

FILE: 813000.01 SHEET 1 of 4 RC RAYMOND

Attachment 2

Instrumentation

March 3, 2008

Survey Unit F8130061

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	630[2,3]
M2350; 180733	43-98B; 148638	N/A	990[2,4]
M2350; 180733	43-98B; 148638	N/A	1490[2,5]
M2350; 180733	43-98B; 148638	N/A	2520[1,5]
M2350; 180733	43-94; 148620	N/A	1030[1,3]
M2350; 203486 M2350; 203482 M2350; 203486	43-68B; 190476 43-68B; 178511 43-68B; 161400	433[1] 257[2]	1033[1] 612[2]
M2350; 142507 M2350; 142515	43-68B; 160781 43-68B; 148453	433[1]	1033[1]
M2350; 142515 M2350; 203486	43-116-1B; 256007 43-116-1B; 190173	796[1] 491[1,6]	3258[1] 739[1,6]
M2350; 149789 M2350; 203486	43-116-1B; 256006 43-116-1B; 190173	472[2] 291[2,6]	1930[2] 437[2,6]
Tennelec; 0401171	N/A	5.88 dpm α, 11.7 dpm β	N/A

[1] Concrete
[2] Metal
[3] 2" penetration
[4] 3" penetration
[5] 4" penetration
[6] Juncture

Table 2-2. Investigation Criteria and DCGL

Parameter	Value (dpm/100 cm²)
Investigation Criteria - Direct	154227
Investigation Criteria – Scan	43000[1]
$DCGL_W$	43000
$DCGL_{EMC}$	154227

[1] Investigation level set at $DCGL_W$ within the survey instruction

Attachment 3

Investigation

March 3, 2008

Survey Unit F8130061

Table 3-1 Survey Unit Investigation

Grid	*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*
0222	5840[1]	7066	7066	2.3	7.75	333256	51835	0.149
P029	1990[1]	4981	4981	0.30	45.38	1950092	107627	0.054
Survey Unit Remainder						DCGL = 43,000	SU Mean = 2076	0.048
							EMC Unity Sum	0.251

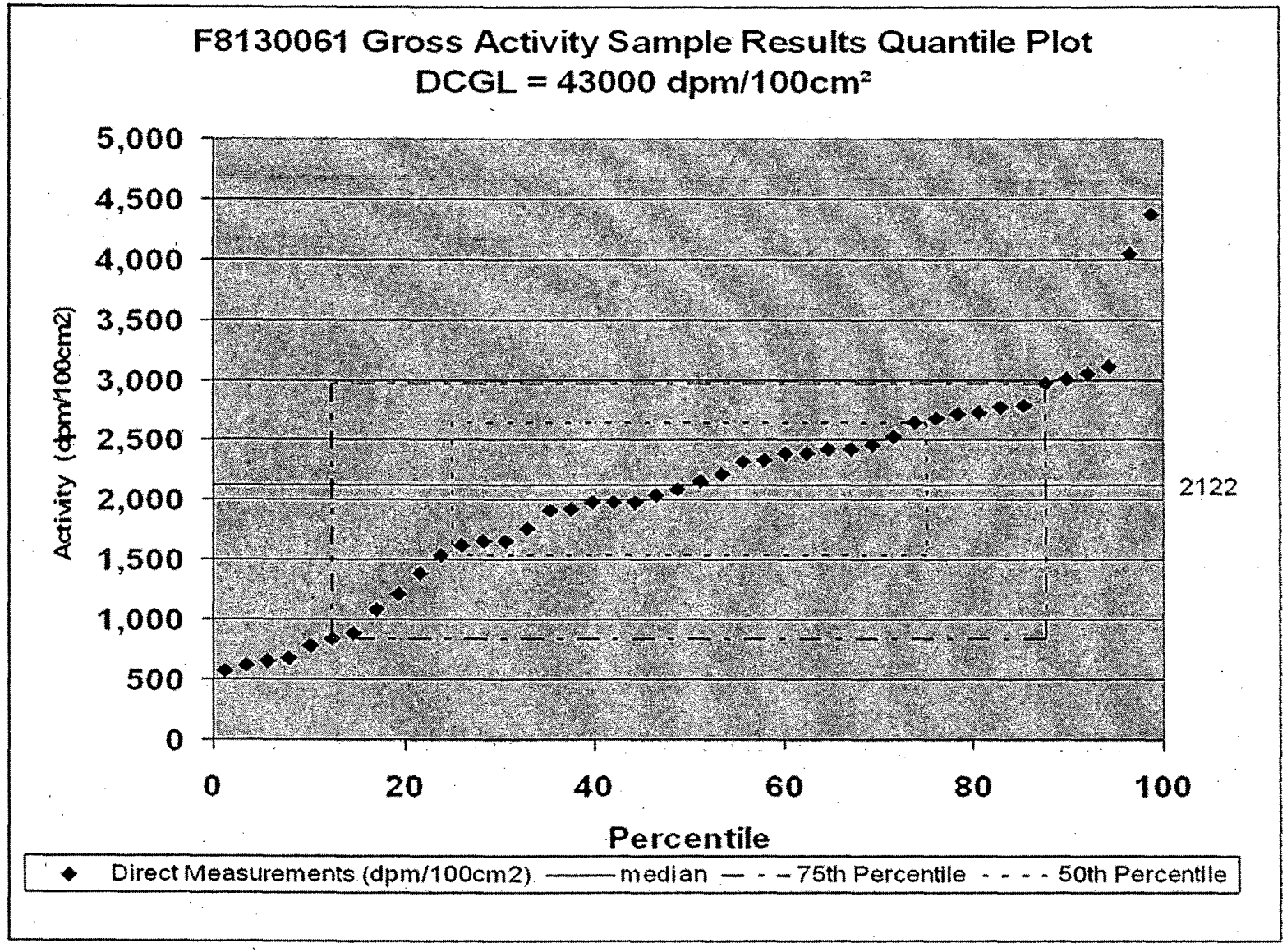
[1] Investigation level conservatively set at $DCGL_W$

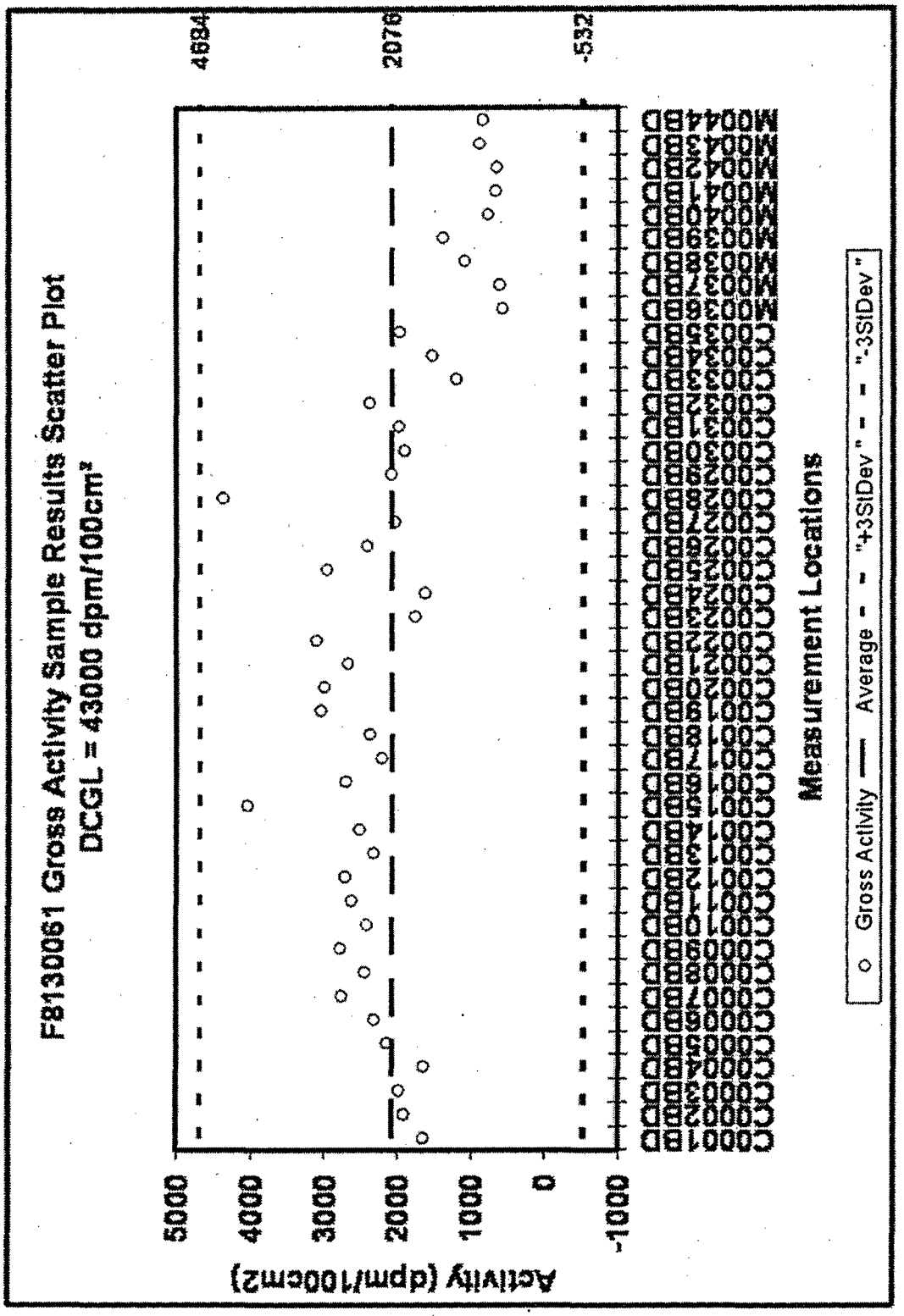
Attachment 4

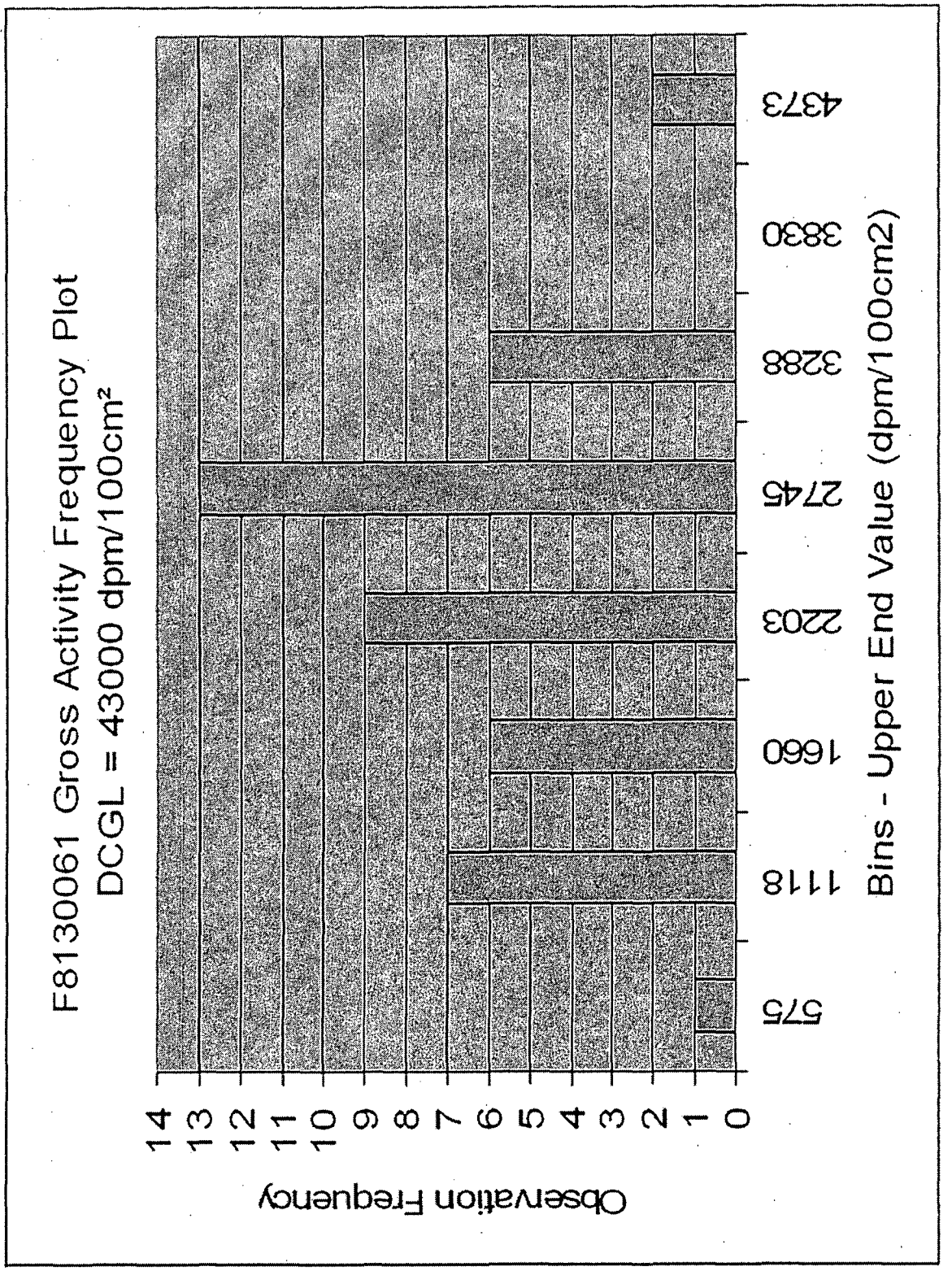
Data Assessment

March 3, 2008

Survey Unit F8130061


F8130061 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
0
20
40
60
80
100
Percentile
2122
Direct Measurements (dpm/100cm2)
median
75th Percentile
50th Percentile


F8130061 Gross Activity Sample Results Scatter Plot
DCGL = 43000 dpm/100cm²
4684
2076
-532
5000
4000
3000
2000
1000
0
-1000
Activity (dpm/100cm2)
Measurement Locations
Gross Activity
Average
"+3StDev"
"-3StDev"


F8130061 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
575
1118
1660
2203
2745
3288
3830
4373
Bins - Upper End Value (dpm/100cm2)