Appendix F

NFSS Vicinity Property X

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Assessment Data

Excerpt from Comprehensive Radiological Survey
Off-Site Property X
Niagara Falls Storage Site

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COMPREHENSIVE RADIOLOGICAL SURVEY

OFF-SITE PROPERTY X
NIAGARA FALLS STORAGE SITE
LEWISTON, NEW YORK

Prepared for

U.S. Department of Energy
as part of the
Formerly Utilized Sites -- Remedial Action Program

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FINAL REPORT

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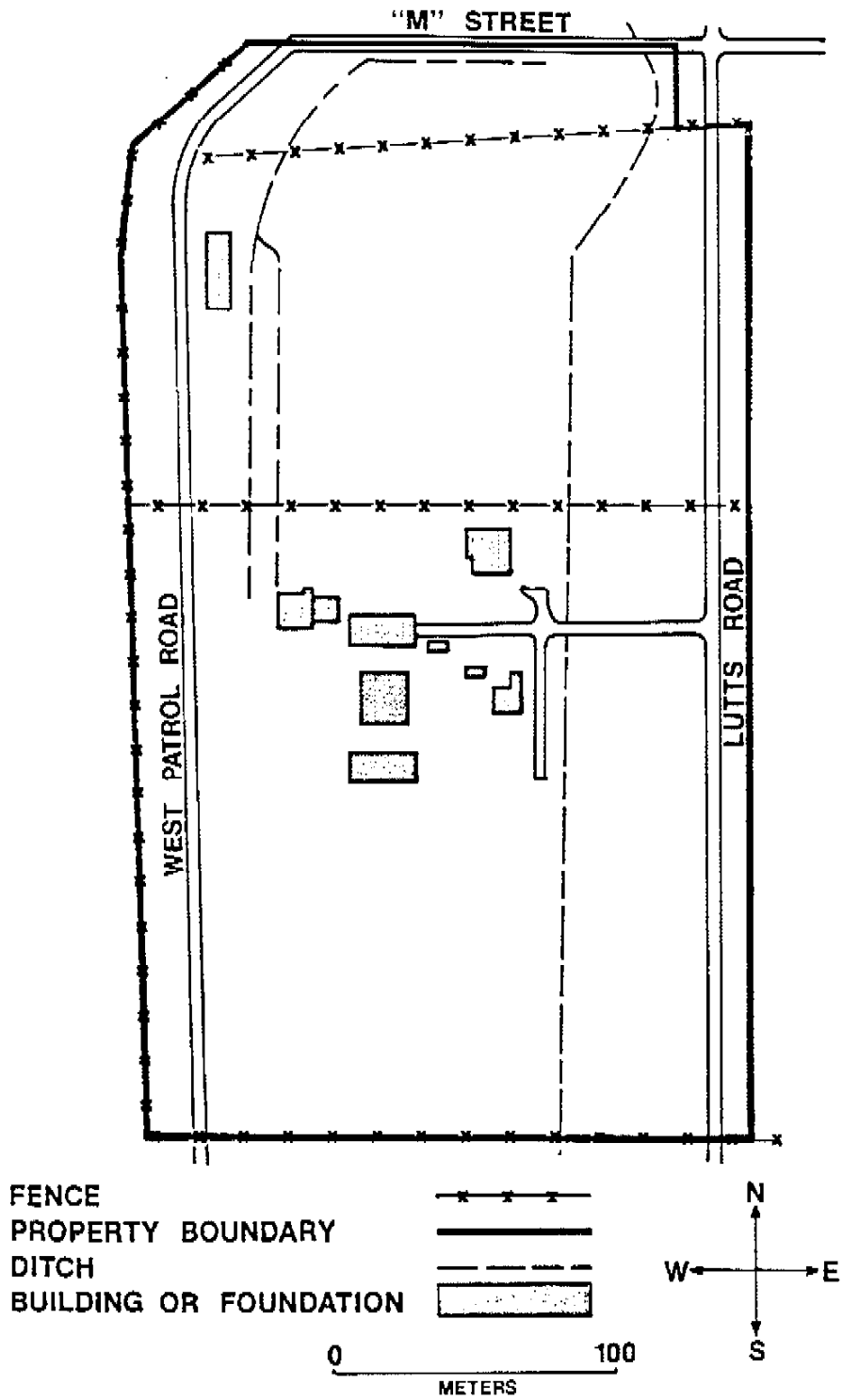

FIGURE 2. Plan View of NFSS Off-Site Property X Indicating Prominent Surface Features.

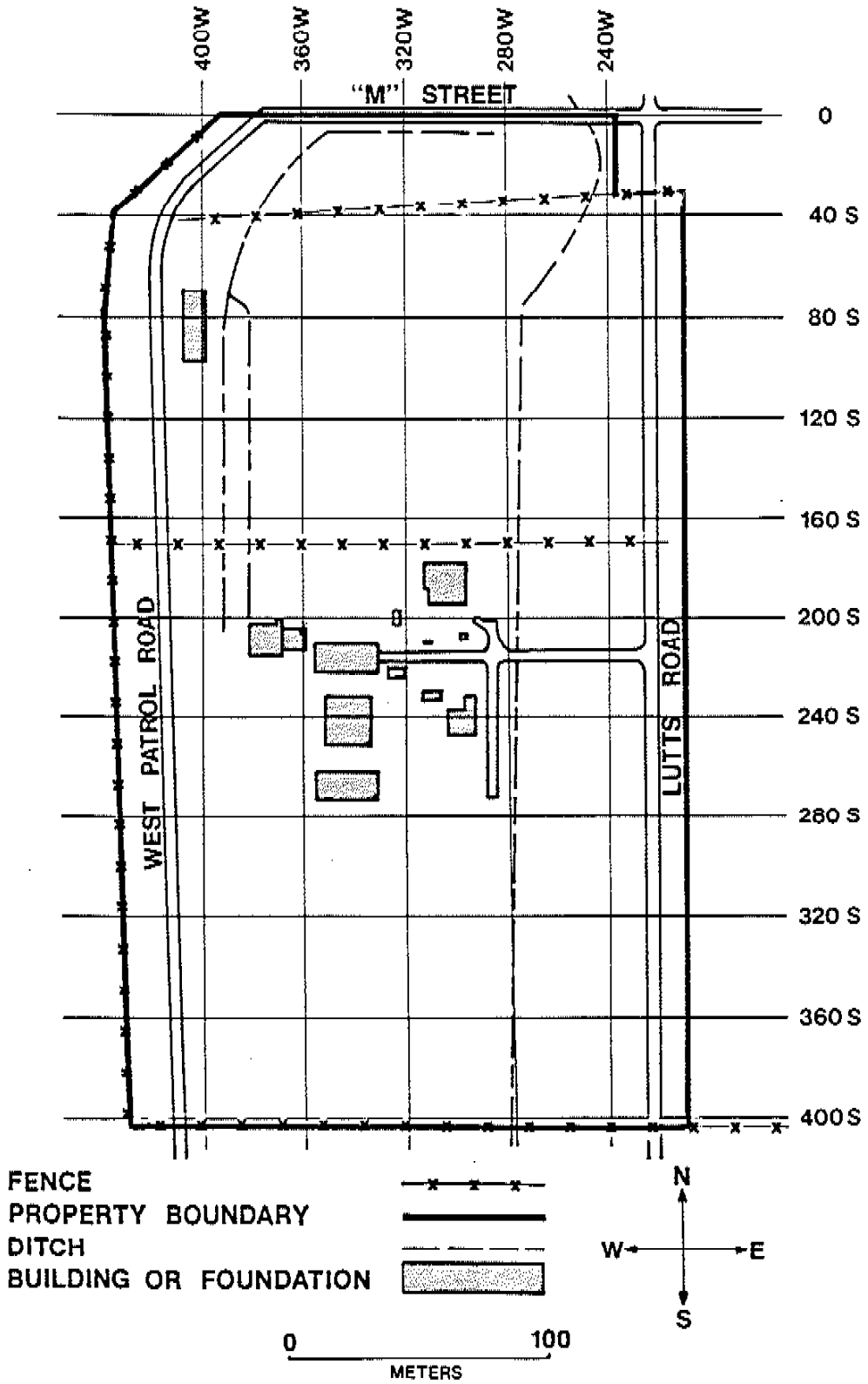

FIGURE 3. Plan View of NFSS Off-Site Property X Indicating the Grid System Established for Survey Reference.

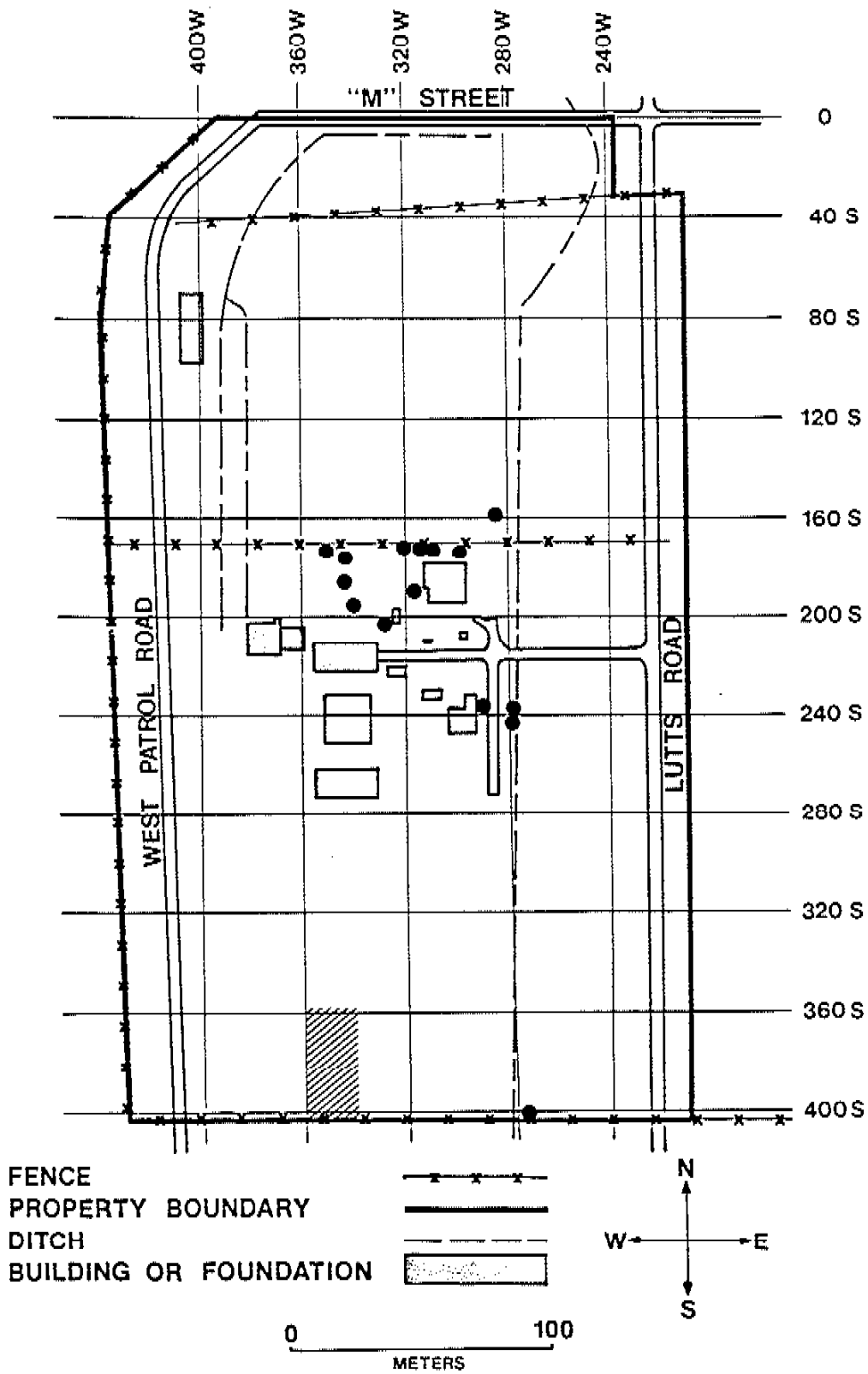

FIGURE 4. Locations of Areas of Elevated Direct Radiation. (Dots indicate small areas and cross hatching indicates a larger general area.)

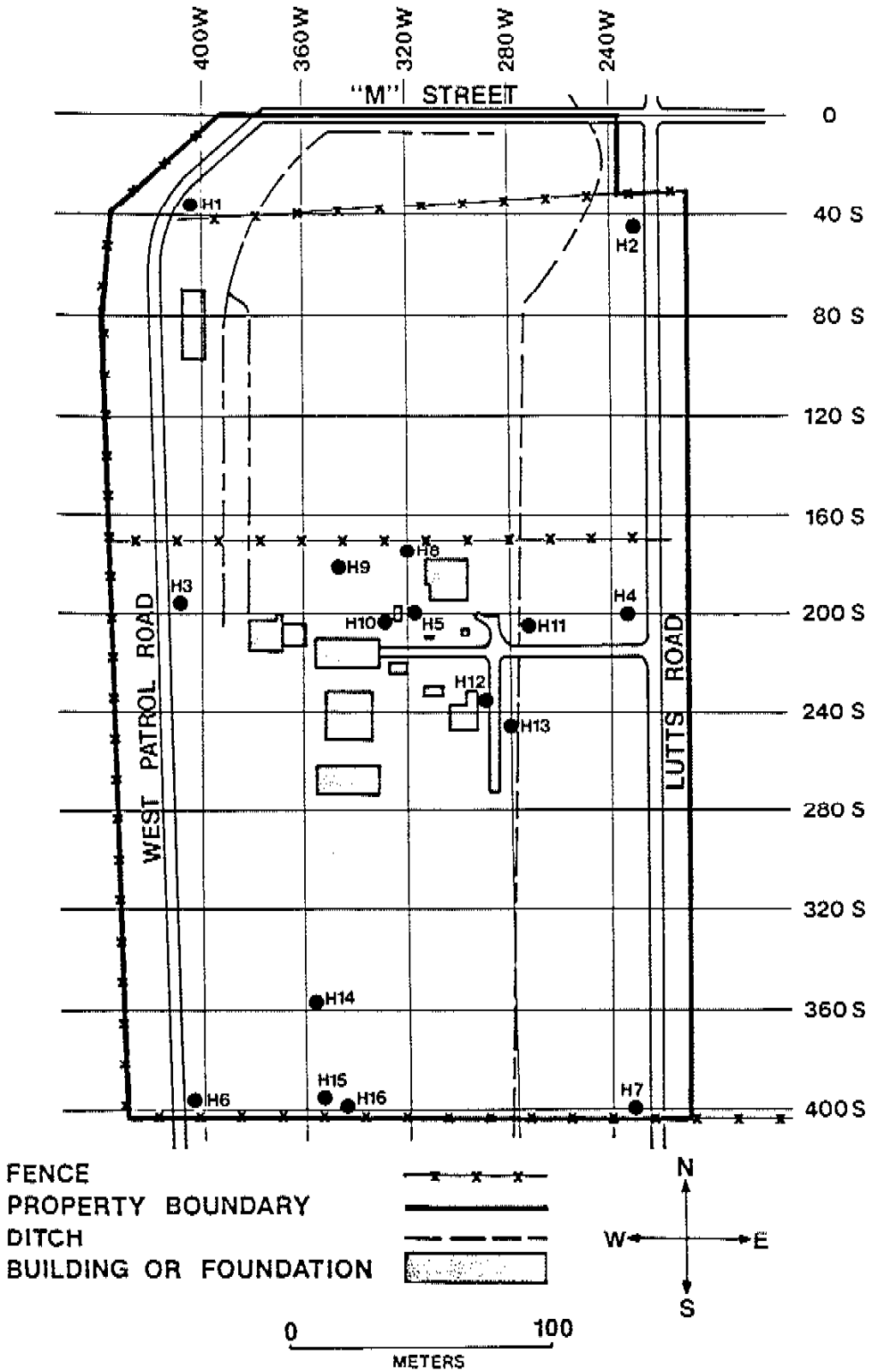

FIGURE 5. Locations of Boreholes for Subsurface Investigations.

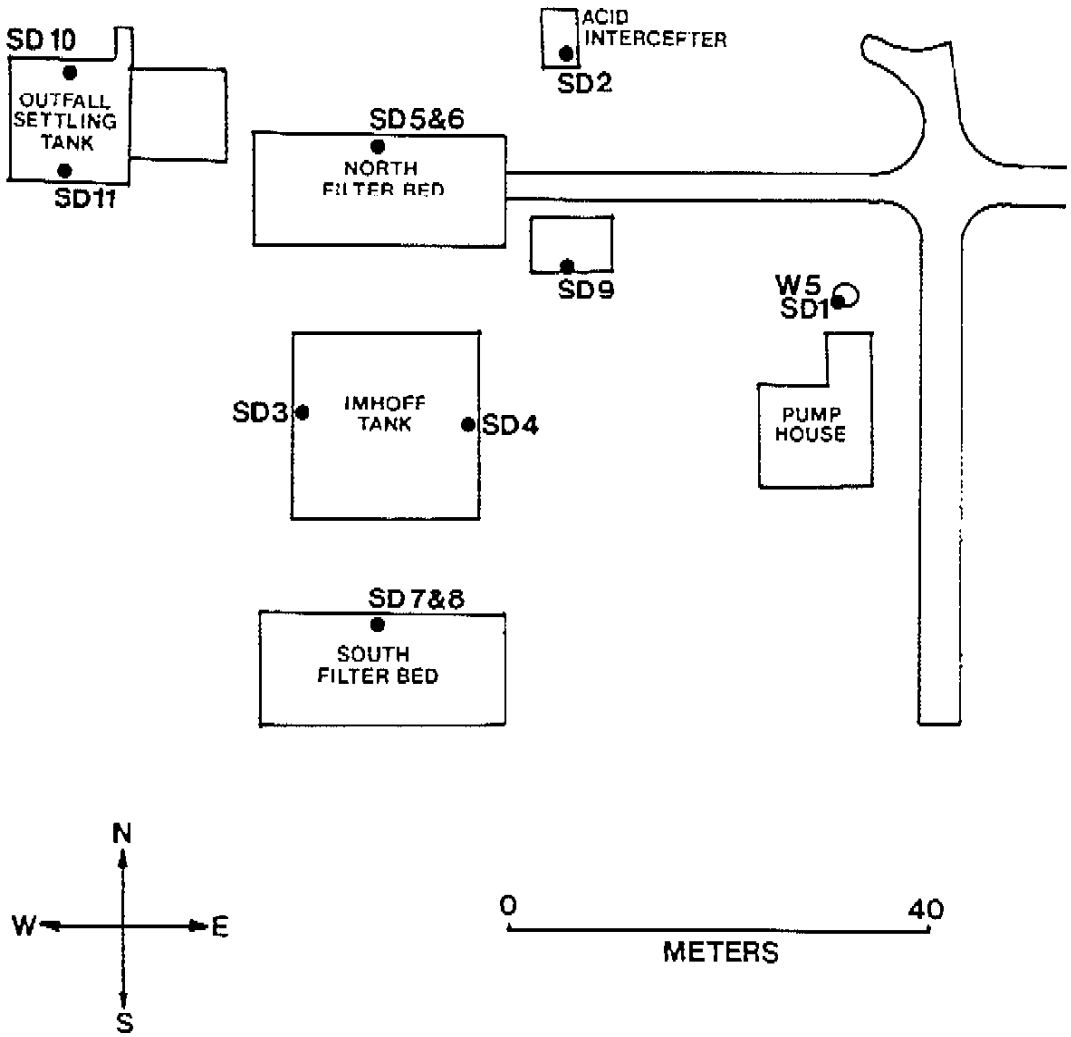

FIGURE 6. Sewage Treatment Facilities, Indicating Locations of Sediment and Water Samples.

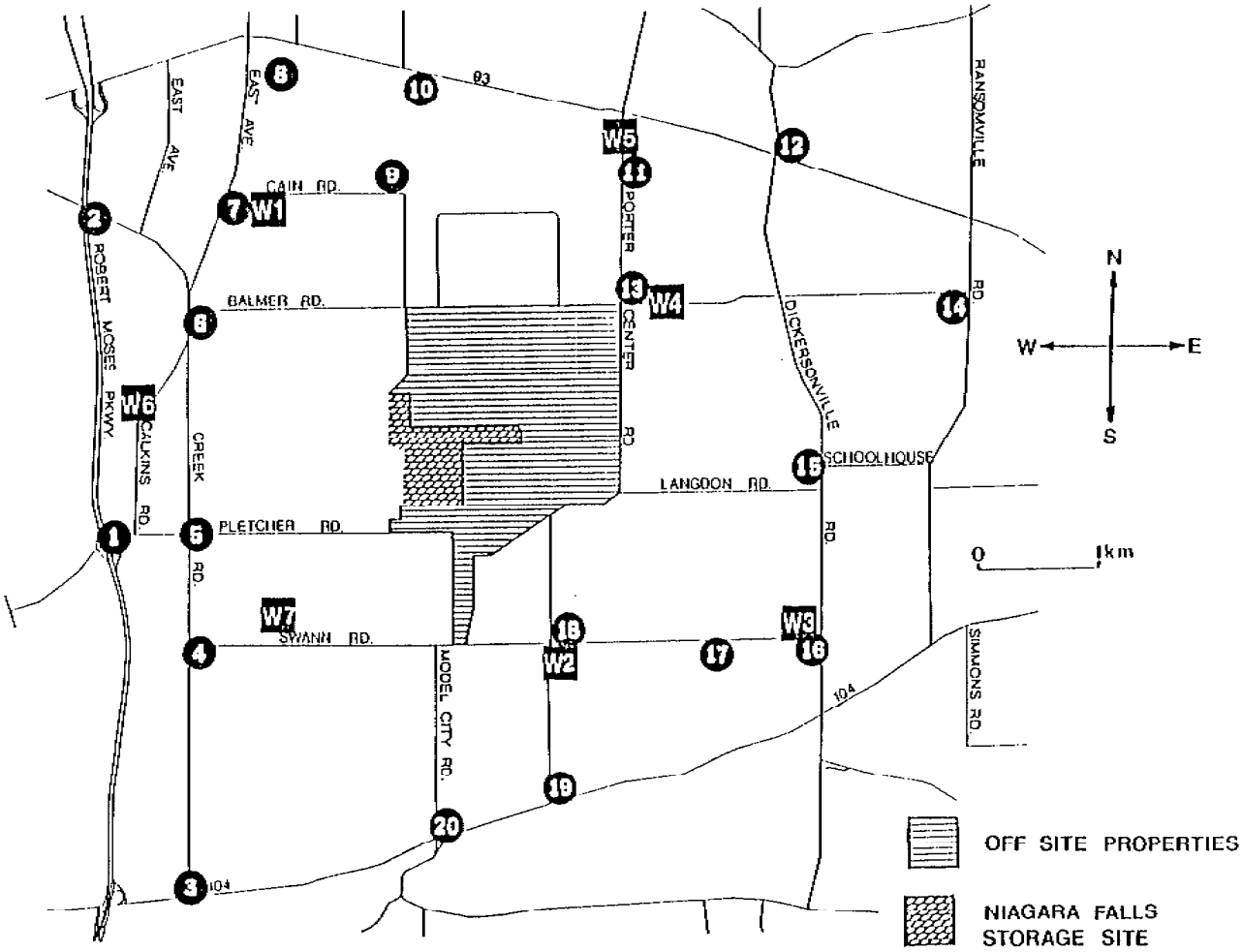

FIGURE 7. Map of Northern Niagara County, New York, Showing Locations of Background Measurements and Baseline Samples. (#1-20: soil samples and direct measurements; W1-W7: water samples)

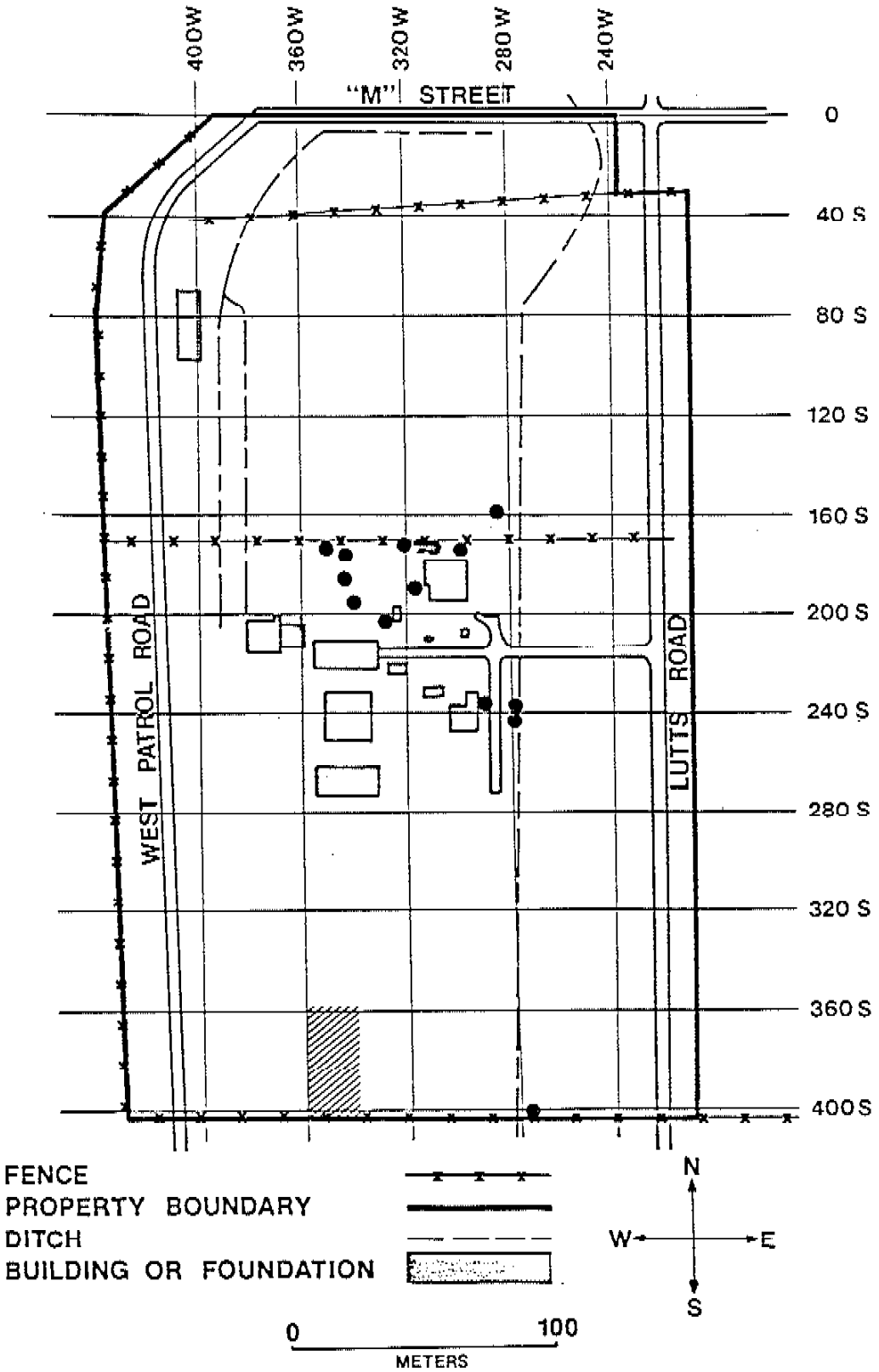

FIGURE 8. Map of NFSS Off-Site Property X Indicating Areas Where Radionuclide Concentrations in Soil Exceed Criteria. (Cross hatching indicates a large general area and dots indicate small isolated areas or "hot spots.")

TABLE 1-A

BACKGROUND EXPOSURE RATES
AND
BASELINE RADIONUCLIDE CONCENTRATIONS IN SOIL

Location[a]	Exposure Rate[b] (μR/h)	Radionuclide Concentrations (pCi/g)				
		Ra-226	U-235	U-238	Th-232	Cs-137
1	6.8	0.74 ± 0.16[c]	<0.19	<2.89	0.70 ± 0.46	0.29 ± 0.08
2	6.8	0.75 ± 0.19	<0.19	<3.35	<0.22	0.24 ± 0.08
3	8.3	0.71 ± 0.18	0.46 ± 0.41	<3.72	0.88 ± 0.33	0.34 ± 0.09
4	7.9	0.67 ± 0.18	<0.22	<4.10	1.18 ± 0.35	0.12 ± 0.07
5	7.3	0.70 ± 0.16	<0.17	<3.34	0.68 ± 0.24	0.14 ± 0.07
6	7.7	0.50 ± 0.15	<0.16	<2.33	0.52 ± 0.38	0.17 ± 0.09
7	7.7	0.63 ± 0.13	<0.17	<2.73	0.83 ± 0.24	0.35 ± 0.08
8	7.6	0.59 ± 0.12	<0.14	<2.20	0.54 ± 0.23	<0.02
9	7.1	0.63 ± 0.20	<0.23	<4.16	0.83 ± 0.38	0.69 ± 0.11
10	7.1	0.70 ± 0.16	<0.19	<2.98	<0.18	0.69 ± 0.10
11	6.7	<0.09	<0.19	<2.83	0.49 ± 0.31	0.48 ± 0.14
12	7.1	0.48 ± 0.13	<0.16	<2.84	0.65 ± 0.26	0.68 ± 0.10
13	6.7	0.57 ± 0.14	<0.17	<2.36	0.49 ± 0.26	0.41 ± 0.08
14	6.8	0.68 ± 0.17	<0.19	<3.24	0.67 ± 0.25	0.70 ± 0.10
15	8.2	0.65 ± 0.14	<0.17	<3.20	0.72 ± 0.35	0.23 ± 0.08
16	7.4	0.91 ± 0.17	<0.21	<3.58	0.83 ± 0.28	0.61 ± 0.09
17	7.0	0.48 ± 0.14	<0.16	<2.73	0.32 ± 0.22	0.38 ± 0.08
18	7.7	0.73 ± 0.16	<0.18	6.26 ± 9.23	<0.23	0.32 ± 0.12
19	8.8	1.22 ± 0.22	<0.23	<3.79	1.08 ± 0.49	1.05 ± 0.13
20	8.6	0.83 ± 0.17	<0.21	<3.59	0.84 ± 0.29	0.08 ± 0.07
Range	6.8 to 8.8	<0.09 to 1.22	<0.14 to 0.46	<2.20 to 6.26	<0.18 to 1.18	<0.02 to 1.05

[a] Refer to Figure 7.
[b] Measured at 1 m above the surface.
[c] Errors is 2σ based on counting statistics only.

TABLE 1-B

RADIONUCLIDE CONCENTRATIONS IN BASELINE WATER SAMPLES

Location[a]	Radionuclide Concentrations (pCi/l)	
	Gross Alpha	Gross Beta
W1	0.95 ± 0.93 [b]	4.79 ± 1.15
W2	0.95 ± 0.94	9.17 ± 1.31
W3	0.55 ± 0.78	2.73 ± 1.05
W4	0.63 ± 0.89	5.37 ± 1.17
W5	0.73 ± 0.68	<0.64
W6	1.87 ± 1.84	14.3 ± 2.4
W7	1.16 ± 0.66	<0.63
Range	0.55 to 1.87	<0.63 to 14.3

[a] Refer to Figure 7.
[b] Errors are 2σ based on counting statistics.

TABLE 2

DIRECT RADIATION LEVELS SYSTEMATICALLY MEASURED
AT 40 M GRID INTERVALS

Grid Location S	Grid Location W	Gamma Exposure Rates at 1 m Above the Surface (μR/h)	Gamma Exposure Rates at the Surface (μR/h)	Beta-Gamma Dose Rates at 1 cm Above the Surface (μrad/h)
0	240	6	6	7
0	280	6	6	6
0	320	6	6	6
0	360	6	6	6
0	380	7	7	30
40	212	8	9	19
40	240	9	9	24
40	280	9	10	37
40	320	7	7	30
40	360	8	8	38
40	400	8	9	12
40	435	8	8	21
80	212	8	9	25
80	240	8	8	32
80	280	10	11	29
80	320	8	8	21
80	360	8	8	9
80	400	8	8	9
80	435	7	8	14
120	212	8	8	8
120	240	7	8	17
120	280	9	9	13
120	320	8	9	12
120	360	8	8	8
120	400	8	8	21
120	438	7	8	19
160	212	8	8	10
160	240	7	8	8
160	280	9	9	17
160	320	8	9	28
160	360	8	9	24
160	400	8	8	19
160	436	8	8	16
200	212	7	8	16
200	240	8	9	13
200	280	8	8	8

TABLE 2, cont.

DIRECT RADIATION LEVELS SYSTEMATICALLY MEASURED
AT 40 M GRID INTERVALS

Grid Location		Gamma Exposure Rates at 1 m Above the Surface (μR/h)	Gamma Exposure Rates at the Surface (μR/h)	Beta-Gamma Dose Rates at 1 cm Above the Surface (μrad/h)
S	W			
200	320	7	7	7
200	360	9	9	28
200	400	7	7	11
200	440	7	8	9
240	212	8	8	8
240	240	8	9	9
240	280	10	10	47
240	320	6	6	6
240	360	8	9	9
240	400	7	8	26
240	438	8	8	21
280	212	8	8	21
280	240	8	8	24
280	280	9	8	24
280	320	7	7	13
280	360	7	7	11
280	400	8	7	32
280	432	8	8	12
320	212	8	9	9
320	240	8	8	23
320	280	10	10	23
320	320	8	8	8
320	360	8	8	27
320	400	9	9	22
320	432	7	7	13
360	212	8	8	16
360	240	8	8	22
360	280	12	12	24
360	320	10	10	24
360	360	12	13	29
360	400	9	9	29
360	428	8	8	8
400	212	8	9	9
400	240	8	9	23
400	280	11	11	24
400	320	8	9	9

TABLE 2, cont.

DIRECT RADIATION LEVELS SYSTEMATICALLY MEASURED
AT 40 M GRID INTERVALS

Grid Location		Gamma Exposure Rates at 1 m Above the Surface (μR/h)	Gamma Exposure Rates at the Surface (μR/h)	Beta-Gamma Dose Rates at 1 cm Above the Surface (μrad/h)
S	W			
400	360	12	10	17
400	400	10	10	40
400	428	8	8	21
404	212	8	8	16
404	240	8	8	8
404	280	10	11	21
404	320	9	9	19
404	360	12	12	29
404	400	9	10	16
404	428	8	9	15

TABLE 3

DIRECT RADIATION LEVELS AT LOCATIONS IDENTIFIED BY THE WALKOVER SURFACE SCAN

Grid Location S	Grid Location W	Exposure Rate (μR/h) Contact	Exposure Rate (μR/h) 1 m Above Surface	Surface Dose Rate (μrad/h)	Sample Identification[b]	Contact Exposure Rate After Sample Removal (μR/h)
160	290	18	10	20	B1	18
170	310	22	--[c]	--	--	--
170	315	25	--	--	--	--
170	320	68	20	240	B2	54
172	350	68	17	280	B3	59
175	305	53	--	--	--	--
175	345	40	--	--	--	--
181	345	46	25	100	B4	43
185	315	25	12	45	B5	25
194	342	35	--	--	--	--
203	330	34	17	41	B6	35
230-235	288-293	25-43	--	--	--	--
230	290	43	16	100	B7	40
234	291	39	--	--	--	--
239	280	22	--	--	--	--
242	280	27	13	--	B8	40
355-404	340-360	14-84	--	--	--	--
359	359	20	13	58	B9	18
380	350	16	--	--	--	--
392	352	84	26	220	B10	56
396	352	29	--	--	--	--
400	344	31	16	100	b11	29
404	276	25	14	46	B12	20

[a] Refer to Figure 4.
[b] Radionuclide concentrations are presented in Table 5.
[c] Dash indicates measurement or sampling not performed.

TABLE 4

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL SAMPLES
FROM 40 M GRID INTERVALS

Grid Location S	Grid Location W	Radionuclide Concentrations (pCi/g) Ra-226	U-235	U-238	Cs-137	Th-232
0	240	1.23 ± 0.28a	<0.22	<0.79	0.83 ± 0.14	0.41 ± 0.27
0	280	1.03 ± 0.23	<0.29	<0.86	1.33 ± 0.16	0.62 ± 0.24
0	320	0.88 ± 0.19	<0.29	<4.92	0.65 ± 0.14	0.71 ± 0.38
0	360	0.54 ± 0.19	0.33 ± 0.40	<0.63	0.81 ± 0.11	<0.22
0	380	1.00 ± 0.20	0.59 ± 0.47	<0.74	0.33 ± 0.10	0.71 ± 0.37
40	210	1.56 ± 0.31	<0.19	1.59 ± 0.88	0.65 ± 0.15	0.83 ± 0.42
40	240	0.95 ± 0.30	<0.25	<0.86	0.37 ± 0.11	0.92 ± 0.38
40	280	2.69 ± 0.41	<0.22	1.51 ± 0.73	1.00 ± 0.17	0.96 ± 0.34
40	320	0.68 ± 0.25	<0.32	<0.96	0.94 ± 0.15	0.93 ± 0.40
40	360	0.89 ± 0.20	<0.27	1.32 ± 1.19	<0.04	1.15 ± 0.35
40	400	0.98 ± 0.25	<0.29	<0.88	0.75 ± 0.16	0.90 ± 0.42
40	440	0.89 ± 0.26	<0.26	0.87 ± 1.59	0.68 ± 0.15	0.77 ± 0.50
80	210	0.89 ± 0.26	<0.16	1.63 ± 0.91	0.49 ± 0.13	0.86 ± 0.46
80	240	0.83 ± 0.19	<0.28	<0.89	0.26 ± 0.08	1.15 ± 0.28
80	280	2.33 ± 0.39	<0.39	1.69 ± 1.66	0.57 ± 0.15	1.20 ± 0.46
80	320	0.90 ± 0.21	<0.17	0.64 ± 0.97	0.13 ± 0.09	0.87 ± 0.27
80	360	0.83 ± 0.23	<0.19	2.00 ± 1.64	<0.04	0.87 ± 0.36
80	400	0.88 ± 0.38	<0.30	2.03 ± 3.28	0.10 ± 0.09	1.04 ± 0.39
80	440	0.80 ± 0.24	<0.19	<0.71	0.48 ± 0.12	0.85 ± 0.30
120	210	0.98 ± 0.33	<0.32	<1.02	0.71 ± 0.14	0.68 ± 0.50
120	240	0.73 ± 0.26	<0.30	<0.99	<0.04	0.79 ± 0.58
120	280	1.33 ± 0.35	<0.35	<1.02	0.56 ± 0.14	1.09 ± 0.33
120	320	0.73 ± 0.26	<0.22	1.04 ± 1.73	0.27 ± 0.08	1.35 ± 0.44
120	360	0.78 ± 0.19	<0.15	1.16 ± 0.77	0.35 ± 0.08	1.35 ± 0.44
120	400	0.98 ± 0.21	<0.16	1.07 ± 0.75	<0.04	0.78 ± 0.28
120	440	0.88 ± 0.35	<0.32	1.84 ± 1.15	0.16 ± 0.12	<0.30
160	210	0.93 ± 0.29	<0.33	<1.00	0.40 ± 0.12	0.83 ± 0.48
160	240	0.49 ± 0.19	<0.14	0.50 ± 0.70	<0.03	0.44 ± 0.25
160	280	0.89 ± 0.25	0.60 ± 0.62	1.13 ± 1.84	0.22 ± 0.15	0.58 ± 0.48
160	320	0.76 ± 0.28	<0.21	1.80 ± 1.86	0.64 ± 0.13	0.85 ± 0.36
160	360	1.34 ± 0.34	<0.37	<1.14	0.63 ± 0.14	1.68 ± 0.71
160	400	0.84 ± 0.24	<0.25	<0.80	0.47 ± 0.09	0.85 ± 0.30
160	440	1.16 ± 0.26	0.38 ± 0.23	0.86 ± 0.64	0.60 ± 0.11	0.94 ± 0.41
200	210	0.83 ± 0.41	<0.19	0.65 ± 1.87	0.56 ± 0.13	0.98 ± 0.36
200	240	0.81 ± 0.31	0.22 ± 0.46	1.33 ± 0.85	0.17 ± 0.08	1.24 ± 0.34

TABLE 4, cont.

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL SAMPLES
FROM 40 M GRID INTERVALS

Grid Location S	Grid Location W	Radionuclide Concentrations (pCi/g) Ra-226	U-235	U-238	Cs-137	Th-232
200	280	0.56 ± 0.16	<0.14	0.65 ± 0.74	0.10 ± 0.07	0.41 ± 0.35
200	320	0.54 ± 0.18	0.24 ± 0.26	<0.49	0.08 ± 0.04	0.25 ± 0.30
200	*360*	*1.28 ± 0.31*	*<0.32*	*1.93 ± 1.50*	*0.78 ± 0.14*	*1.13 ± 0.42*
200	400	0.96 ± 0.25	<0.24	0.75 ± 1.73	0.98 ± 0.15	0.58 ± 0.32
200	440	0.81 ± 0.20	<0.21	1.22 ± 1.84	0.42 ± 0.11	0.98 ± 0.37
240	212	0.84 ± 0.23	<0.20	<0.78	0.39 ± 0.11	0.68 ± 0.31
240	240	0.69 ± 0.23	0.50 ± 0.58	<0.86	0.43 ± 0.11	0.78 ± 0.47
240	280	1.53 ± 0.25	<0.13	0.61 ± 0.56	0.07 ± 0.08	0.39 ± 0.22
240	320	1.88 ± 0.29	<0.23	2.28 ± 0.91	0.37 ± 0.09	1.25 ± 0.34
240	360	0.90 ± 0.30	<0.21	<0.75	0.39 ± 0.10	0.91 ± 0.48
240	400	0.48 ± 0.14	<0.23	2.20 ± 0.92	<0.04	1.14 ± 0.52
240	435	0.90 ± 0.21	<0.31	2.09 ± 1.27	0.65 ± 0.13	1.06 ± 0.43
280	210	0.73 ± 0.30	<0.34	1.99 ± 2.01	0.42 ± 0.14	1.14 ± 0.37
280	240	0.56 ± 0.28	<0.19	0.61 ± 0.49	0.11 ± 0.08	0.86 ± 0.36
280	280	0.68 ± 0.26	<0.33	1.64 ± 2.08	0.19 ± 0.11	0.93 ± 0.45
280	320	0.75 ± 0.30	<0.25	<0.83	0.76 ± 0.17	0.55 ± 0.30
280	360	0.43 ± 0.18	<0.13	0.55 ± 0.64	0.26 ± 0.08	0.41 ± 0.24
280	400	0.61 ± 0.26	<0.23	1.84 ± 1.49	<0.04	1.07 ± 0.47
280	436	0.76 ± 0.20	<0.14	0.50 ± 0.98	0.16 ± 0.09	0.85 ± 0.26
320	212	3.36 ± 0.40	<0.35	<1.19	0.60 ± 0.13	0.77 ± 0.93
320	240	0.89 ± 0.24	<0.15	0.70 ± 0.41	0.47 ± 0.08	0.94 ± 0.28
320	280	1.13 ± 0.28	<0.31	<1.08	<0.06	1.29 ± 0.45
320	320	0.79 ± 0.31	<0.33	1.39 ± 1.46	0.37 ± 0.13	0.98 ± 0.30
320	360	0.56 ± 0.30	<0.20	1.80 ± 1.06	0.87 ± 0.13	0.75 ± 0.35
320	400	0.78 ± 0.21	<0.21	1.38 ± 1.59	0.15 ± 0.07	0.93 ± 0.30
320	436	0.88 ± 0.29	<0.21	6.99 ± 1.44	0.56 ± 0.12	0.93 ± 0.35
360	212	0.55 ± 0.25	<0.17	1.52 ± 0.78	0.64 ± 0.15	0.76 ± 0.38
360	240	0.85 ± 0.28	<0.21	1.88 ± 1.82	0.48 ± 0.11	0.65 ± 0.46
360	280	1.20 ± 0.26	<0.20	<0.74	<0.04	0.88 ± 0.29
360	320	1.75 ± 0.31	<0.81	1.57 ± 1.03	0.56 ± 0.15	0.61 ± 0.34
360	360	3.06 ± 0.36	<0.38	4.97 ± 1.37	0.59 ± 0.11	1.10 ± 0.37
360	400	1.33 ± 0.28	<0.22	<0.72	0.84 ± 0.13	0.90 ± 0.40
360	435	0.69 ± 0.26	<0.29	1.48 ± 2.55	0.39 ± 0.10	1.00 ± 0.41
400	212	4.21 ± 0.61	<0.45	<1.25	0.62 ± 0.22	1.01 ± 0.49
400	240	0.59 ± 0.23	<0.22	1.26 ± 1.83	0.51 ± 0.15	1.04 ± 0.51

TABLE 4, cont.

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL SAMPLES
FROM 40 M GRID INTERVALS

Grid Location S	Grid Location W	Radionuclide Concentrations (pCi/g) Ra-226	U-235	U-238	Cs-137	Th-232
400	280	0.76 ± 0.25	<0.18	1.26 ± 1.16	0.15 ± 0.09	0.73 ± 0.49
400	320	0.41 ± 0.20	<0.20	0.58 ± 2.16	0.54 ± 0.13	0.65 ± 0.38
400	360	0.93 ± 0.19	<0.25	2.62 ± 1.33	0.18 ± 0.08	0.94 ± 0.29
400	400	1.01 ± 0.31	<0.24	6.92 ± 2.25	0.18 ± 0.12	1.11 ± 0.35
400	428	0.68 ± 0.21	0.36 ± 0.44	1.25 ± 1.05	1.13 ± 0.21	0.57 ± 0.57
404	212	1.04 ± 0.30	<0.24	1.26 ± 1.77	0.68 ± 0.16	1.15 ± 0.68
404	240	0.88 ± 0.21	<0.29	<0.89	0.55 ± 0.12	1.00 ± 0.32
404	280	0.88 ± 0.40	<0.18	0.70 ± 0.73	0.14 ± 0.11	0.72 ± 0.39
404	320	0.61 ± 0.23	<0.15	<0.37	1.36 ± 0.20	0.49 ± 0.36
404	360	2.29 ± 0.36	<0.22	1.79 ± 1.83	0.74 ± 0.15	0.47 ± 0.28
404	400	0.74 ± 0.43	<0.32	1.86 ± 2.11	0.36 ± 0.18	0.85 ± 0.46
404	428	0.76 ± 0.26	<0.30	1.48 ± 1.53	0.58 ± 0.12	0.88 ± 0.46

[a] Errors are 2σ based on counting statistics.

TABLE 5

RADIONUCLIDE CONCENTRATIONS IN SURFACE SOIL SAMPLES
FROM SELECTED LOCATIONS IDENTIFIED BY THE WALKOVER SCAN

Sample Identification	Grid Location S	Grid Location W	Radionuclide Concentrations (pCi/g)[a] Ra-226	U-235	U-238	Cs-137	Th-232
B1	160	290	18.5 ± 0.9[b]	<0.77	1.14 ± 1.57	1.48 ± 0.20	<0.38
B2	170	320	73.6 ± 2.3	2.54 ± 2.58	9.15 ± 6.96	0.76 ± 0.22	<0.60
B3	172	350	349 ± 5	17.4 ± 5.0	23.9 ± 14.3	<0.40	<1.50
B4	181	345	43.4 ± 1.3	3.31 ± 1.38	29.7 ± 2.0	0.25 ± 0.10	<0.36
B5 (rocks)	185	315	9.29 ± 0.56	0.68 ± 1.08	9.45 ± 2.05	2.37 ± 0.21	<0.32
B6 (rocks)	203	330	7.55 ± 0.55	<0.34	4.15 ± 1.85	0.49 ± 0.11	0.64 ± 0.57
B7	230	290	83.6 ± 2.1	2.96 ± 2.40	19.9 ± 6.9	<0.16	<0.65
B8	242	280	67.1 ± 1.6	2.49 ± 2.21	<3.73	0.83 ± 0.18	<0.63
B9	359	359	14.8 ± 0.9	3.17 ± 1.34	4.13 ± 2.11	0.64 ± 0.13	0.88 ± 0.72
B10	392	352	84.0 ± 1.6	5.92 ± 2.22	13.2 ± 5.8	<0.16	1.67 ± 0.96
B11	400	344	22.2 ± 1.0	12.4 ± 1.8	26.0 ± 6.6	0.31 ± 0.11	0.27 ± 0.95
B12	404	276	9.99 ± 0.75	<0.66	4.57 ± 2.36	<0.09	1.03 ± 0.52

[a] Refer to Table 3 for direct radiation levels.
[b] Errors are 2σ based on counting statistics.

TABLE 6

RADIONUCLIDE CONCENTRATIONS IN BOREHOLE SOIL SAMPLES

Borehole No.[a]	Grid Location S	Grid Location W	Depth (m)	Radionuclide Concentrations (pCi/g) Ra-226	U-235	U-238	Cs-137	Th-232
H1	34	403	Surface	1.16 ± 0.25[b]	<0.27	1.85 ± 1.59	0.60 ± 0.16	0.79 ± 0.52
			0.5	0.48 ± 0.34	<0.22	2.51 ± 1.53	<0.04	0.99 ± 0.43
			1.0	0.96 ± 0.30	<0.19	1.22 ± 0.94	<0.04	0.98 ± 0.58
			2.0	1.70 ± 0.45	<0.32	1.92 ± 1.17	<0.05	0.88 ± 0.43
H2	45	230	Surface	1.04 ± 0.29	<0.16	1.49 ± 0.58	0.55 ± 0.12	0.98 ± 0.28
			0.5	0.83 ± 0.23	<0.15	0.46 ± 1.16	<0.04	0.95 ± 0.33
			1.0	0.89 ± 0.20	<0.18	1.03 ± 1.40	<0.04	0.79 ± 0.43
H3	198	416	Surface	0.76 ± 0.28	<0.21	0.75 ± 1.12	0.56 + 0.10	0.65 + 0.29
			0.5	0.61 ± 0.21	<0.26	<0.76	<0.03	1.17 ± 0.35
			1.0	1.69 ± 0.30	<0.27	1.16 ± 1.55	0.09 ± 0.08	0.71 ± 0.39
			2.0	0.96 ± 0.20	<0.20	1.15 + 0.93	<0.03	0.95 ± 0.41
H4	200	230	Surface	1.16 ± 0.31	<0.22	<0.69	0.15 ± 0.07	0.99 ± 0.29
			0.5	0.85 ± 0.21	<0.30	1.66 ± 1.84	<0.04	1.16 ± 0.35
			1.0	0.90 ± 0.25	<0.15	1.52 ± 0.57	<0.02	1.10 ± 0.34
			2.0	0.85 ± 0.30	<0.18	0.89 ± 1.41	<0.02	0.80 ± 0.39
H5	200	320	Surface	0.56 ± 0.18	<0.17	1.54 ± 0.95	0.69 ± 0.38	<0.09
			0.5	0.81 ± 0.20	<0.19	1.43 ± 1.48	<0.03	0.73 ± 0.39
			1.0	1.18 ± 0.33	<0.30	<1.01	<0.04	0.82 ± 0.39
			2.0	0.76 ± 0.31	<0.18	1.05 ± 0.83	<0.03	0.99 ± 0.32
H6	396	412	Surface	0.68 ± 0.29	<0.21	0.89 ± 1.95	0.86 ± 0.17	0.63 ± 0.37
			0.5	0.55 ± 0.33	<0.18	1.49 ± 1.39	<0.03	0.99 ± 0.30
			1.0	0.83 ± 0.19	<0.25	<0.78	<0.03	0.96 ± 0.35
			2.0	0.71 ± 0.30	<0.19	<0.68	<0.03	1.05 ± 0.32
H7	400	230	Surface	0.76 ± 0.18	<0.30	<0.94	0.29 ± 0.09	1.04 ± 0.42
			0.5	1.08 ± 0.29	<0.24	<0.73	<0.04	1.05 ± 0.43
			1.0	0.81 ± 0.18	<0.27	0.97 ± 1.53	<0.04	1.04 ± 0.46
			2.0	0.98 ± 0.33	<0.22	1.23 ± 0.96	<0.04	1.15 ± 0.37
H8	170	320	Surface	73.6 ± 2.3	2.54 ± 2.58	9.15 ± 6.96	0.76 ± 0.22	<0.06
			0.15	0.93 ± 0.28	<0.22	<0.74	0.28 ± 0.09	1.21 ± 0.38
H9	181	345	Surface	43.4 ± 1.3	3.31 ± 1.38	29.7 ± 2.0	0.25 ± 0.10	<0.36
			0.15	5.53 ± 0.45	0.58 ± 0.62	4.37 ± 2.26	<0.05	0.80 ± 0.29
			0.3	0.65 ± 0.25	<0.26	<0.04	<0.03	1.09 ± 0.32

TABLE 6, cont.

RADIONUCLIDE CONCENTRATIONS IN BOREHOLE SOIL SAMPLES

Borehole No	Grid Location S	Grid Location W	Depth (m)	Radionuclide Concentrations (pCi/g) Ra-226	U 235	U-238	Cs-137	Th-232
H10	203	310	Surface	7.55 ± 0.55	<0.34	4.13 ± 1.65	0.49 ± 0.11	0.64 ± 0.32
			0.15	6.69 ± 0.58	<0.50	3.90 ± 2.28	0.36 ± 0.17	0.65 ± 0.41
			0.3	5.81 ± 0.45	<0.33	4.45 ± 1.51	0.16 ± 0.07	0.57 ± 0.28
H11	210	270	Surface	0.83 ± 0.21	<0.18	0.84 ± 0.79	0.30 ± 0.07	0.41 ± 0.41
			0.6	0.91 ± 0.26	<0.29	1.11 ± 1.53	<0.04	1.09 ± 0.59
H12	230	290	Surface	83.6 ± 2.1	2.90 ± 2.40	19.9 ± 6.9	<0.16	<0.65
			0.15	3.48 ± 0.40	<0.38	6.17 ± 1.82	<0.04	0.95 ± 0.53
			0.3	2.65 ± 0.34	<0.27	1.75 ± 1.76	<0.04	0.93 ± 0.50
H13	242	280	Surface	67.1 ± 1.6	2.49 ± 2.21	<3.73	0.83 ± 0.18	<0.63
			0.15	5.36 ± 0.46	<0.44	<1.27	0.22 ± 0.07	0.78 ± 0.49
H14	359	359	Surface	14.8 ± 0.9	3.17 ± 1.34	4.13 ± 2.11	0.64 ± 0.13	0.88 ± 0.72
			0.5	1.10 ± 0.21	<0.20	0.81 ± 1.39	0.05 ± 0.11	0.94 ± 0.34
H15	392	352	Surface	84.0 ± 1.6	5.92 ± 2.22	13.2 ± 5.8	<0.16	1.67 ± 0.96
			0.15	17.9 ± 0.9	1.09 ± 1.05	1.60 ± 3.23	<0.07	0.73 ± 0.53
			0.3	12.8 ± 0.8	1.39 ± 0.89	2.76 ± 3.17	<0.07	0.92 ± 0.69
H16	400	344	Surface	22.2 ± 1.0	12.4 ± 1.0	26.0 ± 6.6	0.31 ± 0.11	0.27 ± 0.95
			0.15	3.06 ± 0.31	1.38 ± 0.72	16.7 ± 2.7	<0.05	1.09 ± 0.42

[a] Refer to Figure 5.
[b] Errors are 2σ based on counting statistics.

TABLE 7

RADIONUCLIDE CONCENTRATIONS IN WATER SAMPLES

Sample No.	Sample Type	Grid Location S	Grid Location W	Radionuclide Concentrations (pCi/l) Gross Alpha	Gross Beta	Ra-226
W1	Subsurface (Borehole H2)	45	230	1.21 ± 0.77[a]	1.98 ± 0.81	---
W2	Subsurface (Borehole H4)	200	230	1.43 ± 1.92	6.23 ± 2.11	---
W3	Subsurface (Borehole H6)	396	412	0.55 ± 0.74	1.25 ± 0.78	---
W4	Subsurface (Borehole H7)	400	230	4.54 ± 2.10	4.51 ± 2.17	---
W5	Manhole on sewer system	230	295	7.04 ± 1.33	16.0 ± 1.3	0.26 ± 0.26

[a] Errors are 2σ based on counting statistics.

TABLE 8

RADIONUCLIDE CONCENTRATIONS IN SAMPLES FROM SEWAGE TREATMENT FACILITIES

Sample ID[a]	Sample Location	Radionuclide Concentrations (pCi/g)				
		Ra-226	U-235	U-238	Cs-137	Th-232
SD1	Manhole (230S,295W)	1.56 ± 0.15	0.16 ± 0.23	3.11 ± 0.34	<0.02	0.37 ± 0.11
SD2	Acid Interceptor Tank	0.64 ± 0.21[b]	0.28 ± 0.58	6.51 ± 1.40	0.19 ± 0.09	0.66 ± 0.31
SD3	Imhoff Tank (West side)	0.71 ± 0.20	<0.26	4.72 ± 2.06	1.04 ± 0.14	<0.10
SD4	Imhoff Tank (East side)	1.24 ± 0.69	<0.37	7.05 ± 2.09	3.12 ± 0.20	<0.25
SD5	North Filter Bed (surf.)	0.39 ± 0.16	<0.12	0.63 ± 0.56	0.04 ± 0.05	0.65 ± 0.25
SD6	North Filter Bed (20 cm)	0.61 ± 0.14	<0.19	<0.58	<0.02	0.80 ± 0.25
SD7	South Filter Bed (surf.)	0.58 ± 0.18	<0.13	0.61 ± 0.92	0.06 ± 0.04	0.42 ± 0.27
SD8	South Filter Bed (20 cm)	1.10 ± 0.20	<0.12	0.87 ± 0.62	0.04 ± 0.06	0.33 ± 0.28
SD9	Chlorination Pit	3.44 ± 0.94	1.14 ± 1.25	8.09 ± 6.10	0.21 ± 0.13	<0.57
SD10	Outfall Settling Tank	3.70 ± 1.03	8.09 ± 2.38	75.3 ± 10.7	4.93 ± 0.68	1.73 ± 0.74
SD11	Outfall Settling Tank	2.25 ± 0.30	1.83 ± 0.50	32.5 ± 1.6	2.97 ± 0.19	1.49 ± 0.42

[a] Refer to Figure 6.
[b] Errors are 2σ based on counting statistics.

TABLE 9

LISTING OF AREAS ON PROPERTY X WHERE RADIONUCLIDE CONCENTRATIONS EXCEED GUIDELINES FOR FORMERLY USED MED/AEC SITES

Grid Location[a] S	Grid Location[a] W	Principal Radionuclide(s)[b]	Estimated Quantities of Material Exceeding Guidelines: Area (m^2)	Avg. Depth (m)	Volume (m^3)	Remarks
355-404	340-360	Ra-226	980	0.15	147	
230-235	288-293	Ra-226	25	0.15	3.8	
160	290	Ra-226	---[c]	---	---	Small isolated surface or near surface "hot spot." Each of these locations involves less than 1 m^3 in volume.
170	310	Ra-226	---	---	---	
170	315	Ra-226	---	---	---	
170	320	Ra-226	---	---	---	
172	350	Ra-226	---	---	---	
175	305	Ra-226	---	---	---	
175	345	Ra-226	---	---	---	
181	345	Ra-226	---	---	---	
185	315	Ra-226, U-238[d]	---	---	---	
194	342	Ra-226	---	---	---	
203	330	Ra-226, U-238[d]	---	---	---	
239	280	Ra-226	---	---	---	
242	280	Ra-226	---	---	---	
404	276	Ra-226	---	---	---	

[a] Refer to Figure 8.
[b] Based on locations, physical appearance, direct radiation levels, and laboratory analyses.
[c] Dash indicates determination was not made.
[d] Naturally occurring material in rock fill.

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Excavated Area

Excerpt from Post-Remedial Action Report for the Niagara Falls Storage Site Vicinity Properties 1983 and 1984

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DOE/OR/20722-84

Formerly Utilized Sites Remedial Action Program (FUSRAP)
Contract No. DE-ACO5-810R20722

POST-REMEDIAL ACTION REPORT FOR THE NIAGARA FALLS STORAGE SITE VICINITY PROPERTIES - 1983 AND 1984

Lewiston, New York

December 1986

Bechtel National, Inc.

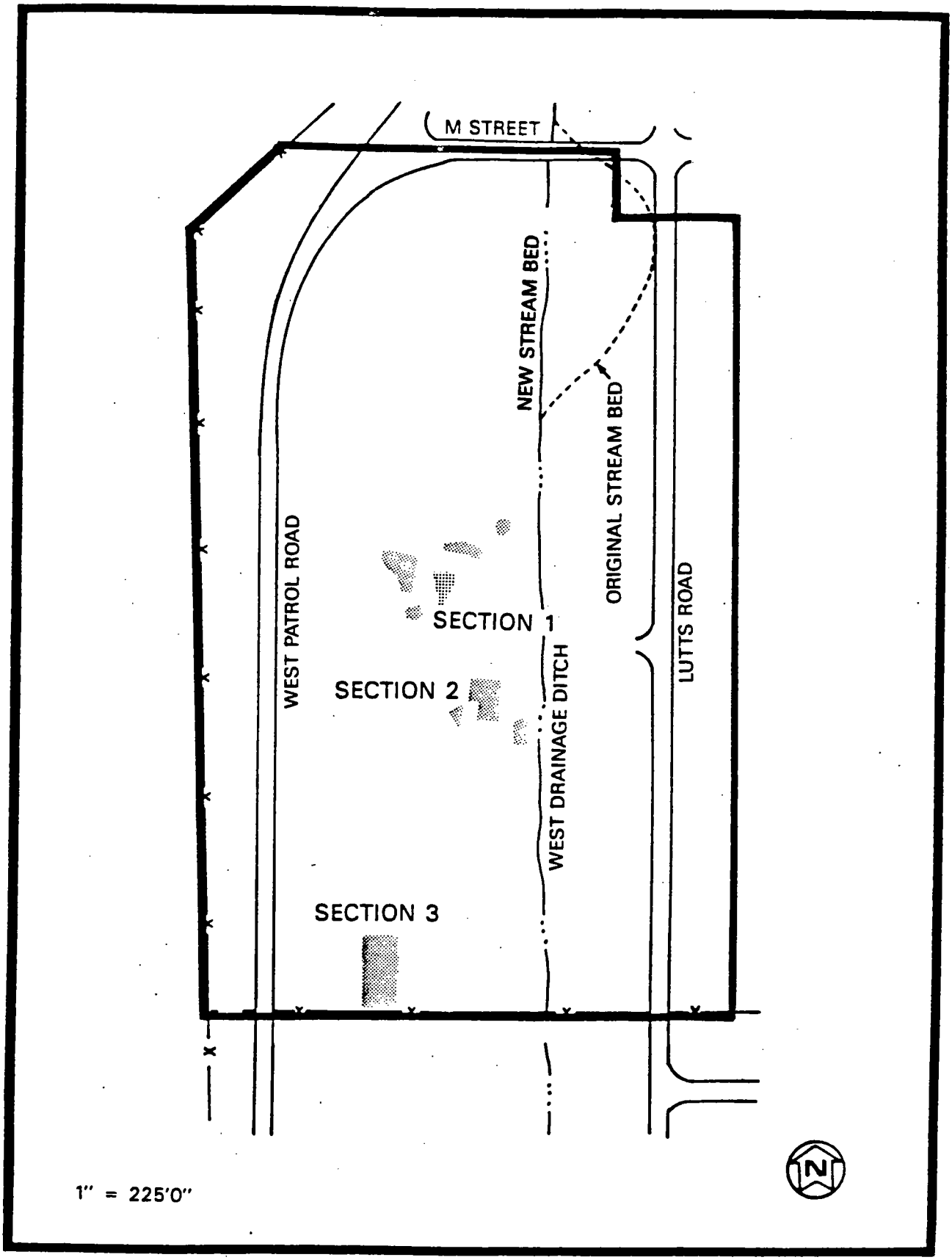

FIGURE 31 EXCAVATED AREAS ON PROPERTY X

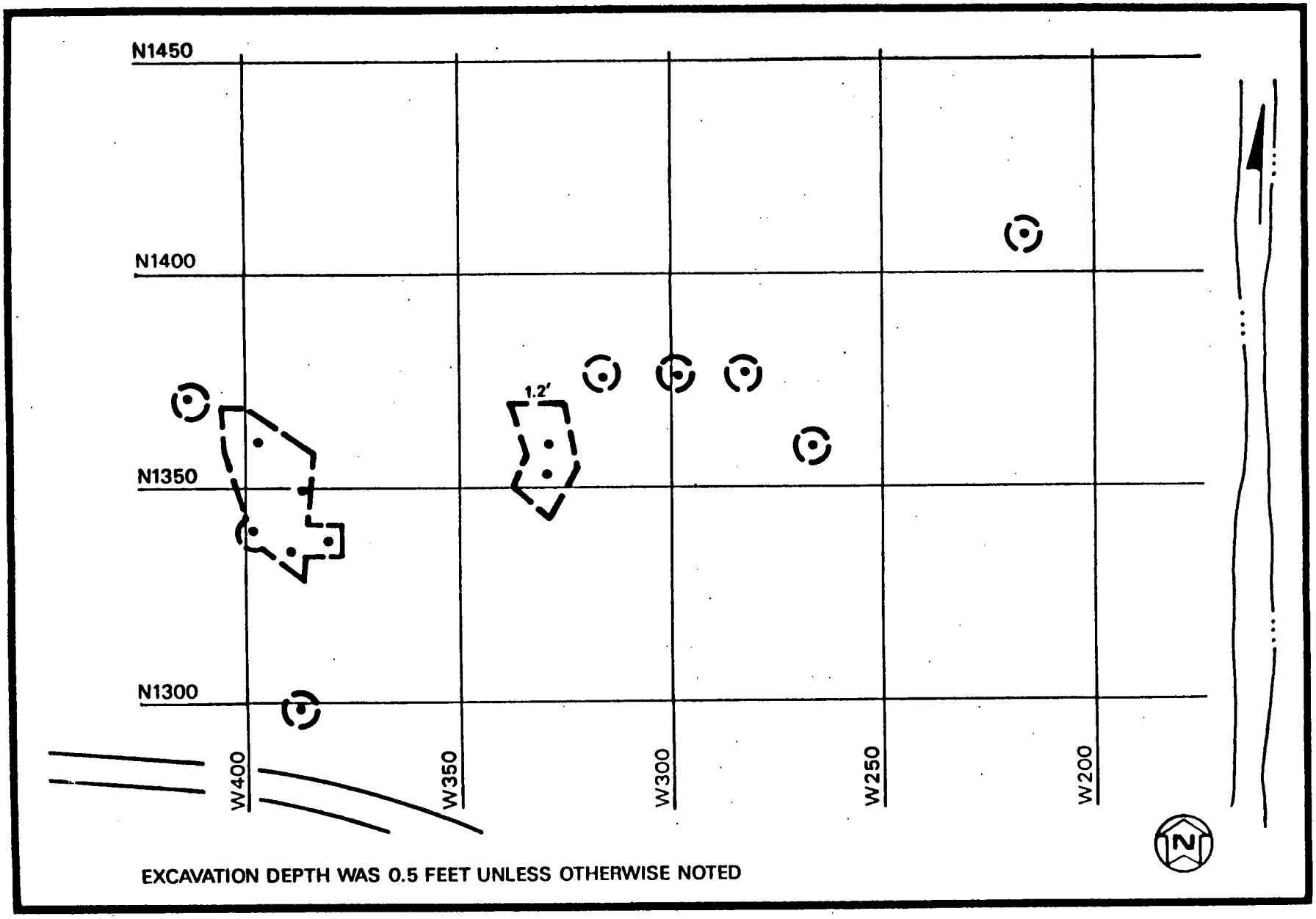

FIGURE 32 POST-REMEDIAL ACTION SAMPLING LOCATIONS ON PROPERTY X - SECTION 1

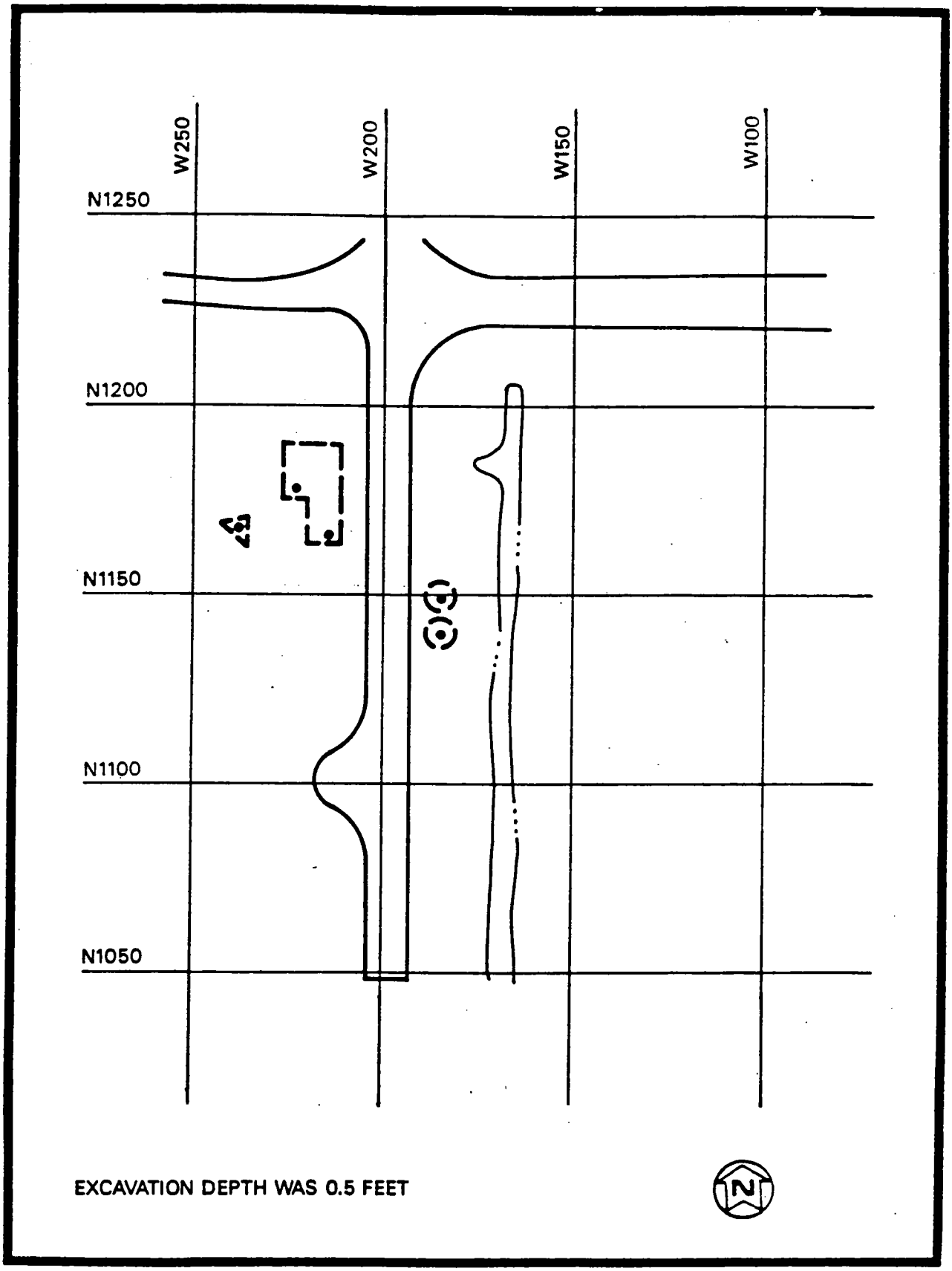

FIGURE 33 POST-REMEDIAL ACTION SAMPLING LOCATIONS ON PROPERTY X - SECTION 2

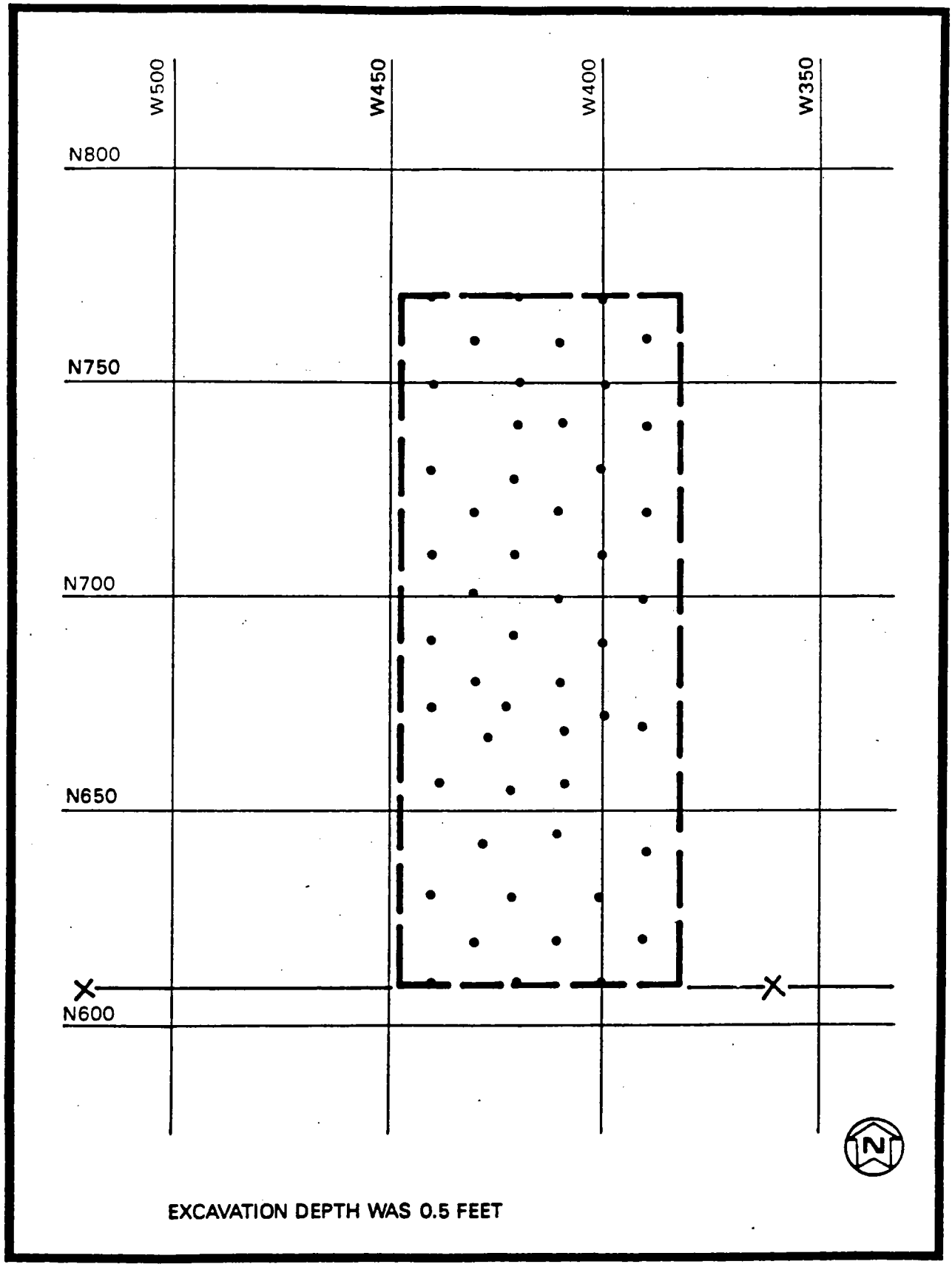

FIGURE 34 POST-REMEDIAL ACTION SAMPLING LOCATIONS ON PROPERTY X - SECTION 3

TABLE 11

POST-REMEDIAL ACTION SAMPLING RESULTS

FOR PROPERTY X

Grid Coordinates		Concentrations (pCi/g ±/- 1 sigma)		
E, W	N, S	Uranium-238	Radium-226	Thorium-232
W0185	N1140	A	1.1 ± 0.1	0.7 ± 0.2
W0185	N1150	A	1.0 ± 0.1	1.3 ± 0.2
W0215	N1165	A	1.6 ± 0.1	0.9±0.2
W0217	N1409	A	5.1 ± 0.2	1.0 ± 0.2
W0225	N1175	A	1.2 ± 0.1	1.0 ± 0.2
W0240	N1160	A	2.6 ± 0.2	0.8 ± 0.2
W0267	N1360	A	0.9 ± 0.1	1.1 ± 0.2
W0283	N1377	A	1.3 ± 0.1	0.9 ± 0.2
W0299	N1377	A	0.8 ± 0.1	1.1 ± 0.2
W0316	N1377	A	1.3 ± 0.1	0.7 ± 0.2
W0328	N1360	A	1.3 ± 0.4	1.4 ± 0.2
W0335	N1355	A	0.6 ± 0.4	1.0 ± 0.2
W0382	N1300	A	2.1 ± 0.1	1.0 ± 0.2
W0388	N1330	1.7 ± 1.3	1.1 ± 0.1	0.8 ± 0.2
W0388	N1350	A	0.8 ± 0.1	0.7 ± 0.2
W0390	N0620	A	1.1 ± 0.1	1.0 ± 0.2
W0390	N0640	A	0.7 ± 0.1	0.8±0.1
W0390	N0660	A	1.1 ± 0.1	0.5 ± 0.2
W0390	N0700	A	0.8 ± 0.1	A
W0390	N0720	A	1.2 ± 0.1	1.1 ± 0.2
W0390	N0740	A	0.7 ± 0.1	0.8 ± 0.2
W0390	N0760	A	0.8 ± 0.1	1.0 ± 0.1
W0398	N1340	A	1.0 ± 0.1	1.2±0.2
W0398	N1360	A	1.5 ± 0.1	0.9±0.2
W0400	N0610	A	1.2 ± 0.1	0.9 ± 0.2
W0400	N0630	2.1 ± 1.4	0.9 ± 0.1	1.1 ± 0.2
W0400	N0670	A	0.9 ± 0.1	1.3 ± 0.2
W0400	N0690	0.8 ± 1.1	0.6 ±0.1	0.9 0.2
W0400	N0710	A	1.1 ± 0.1	1.3 ± 0.2
W0400	N0730	A	1.3 ± 0.1	1.5 ± 0.2
W0400	N0750	A	0.8 ± 0.1	0.8 ± 0.2
W0400	N0770	A	1.0 ± 0.1	1.0 ± 0.2
W0410	N0620	4.0 ± 1.0	0.5 ± 0.1	0.6±0.1
W0410	N0640	1.3 ± 1.8	1.2 ± 0.1	0.8 ± 0.2
W0410	N0650	A	1.0 ± 0.1	0.5 ± 0.2
W0410	N0660	8.3 ± 1.6	1.1 ± 0.1	0.4 ± 0.2
W0410	N0680	A	2.7 ± 0.2	0.8 ± 0.2
W0410	N0700	3.3 ± 1.5	0.8 ± 0.1	0.7 ± 0.2
W0410	N0720	A	0.5 ± 0.1	0.8 ± 0.1
W0410	N0740	2.9 ± 1.1	1.1 ± 0.1	0.8 ± 0.2
W0410	N0760	A	1.2 ± 0.1	0.8 0.2
W0414	N1370	A	0.8 ± 0.1	0.9 ± 0.1
W0420	N0610	5.4 ± 1.4	0.8 ± 0.1	A

TABLE 11 (continued)

Grid Coordinates		Concentrations (pCi/g ±/- 1 sigma)		
E, W	N, S	Uranium-238	Radium-226	Thorium-232
W0420	N0630	4.5±1.3	0.6 ± 0.1	0.7 ± 0.1
W0420	N0650	3.2 ± 1.2	0.9 ± 0.1	0.7 ± 0.1
W0420	N0670	A	0.6 ± 0.1	0.7 ± 0.1
W0420	N0690	A	1.0 ± 0.1	0.7 ± 0.1
W0420	N0710	A	0.5 ± 0.1	0.7 ± 0.2
W0420	N0730	A	0.7 ± 0.1	0.8 ± 0.2
W0420	N0740	A	0.7 ± 0.1	1.0 ± 0.2
W0420	N0750	A	0.6 ± 0.1	0.7 ± 0.1
W0420	N0770	A	0.8 ± 0.1	0.9 ± 0.2
W0430	N0620	9.2 ± 1.7	0.5 ± 0.1	0.9 ± 0.1
W0430	N0640	0.9 ± 2.0	0.8 ± 0.1	A
W0430	N0660	A	0.9 ± 0.1	0.7 ± 0.1
W0430	N0680	2.9 ± 1.4	0.8 ± 0.1	A
W0430	N0700	2.7 ± 1.6	0.7±0.1	0.7 ± 0.1
W0430	N0720	2.0 ± 1.1	0.6 ± 0.1	0.6 ± 0.1
W0430	N0760	7.0 ± 1.5	1.5 ± 0.1	1.2 ± 0.2
W0440	N0610	3.7 ± 1.2	0.9 ± 0.1	0.8 ± 0.1
W0440	N0630	A	0.5 ± 0.1	0.7 ± 0.1
W0440	N0670	1.4 ± 1.0	0.6 ± 0.1	0.7 ± 0.1
W0440	N0690	2.7 ± 1.2	0.6 ± 0.1	0.4 ± 0.1
W0440	N0710	A	0.7 ± 0.1	1.0 ± 0.2
W0440	N0730	2.4 ± 1.1	0.5 ± 0.1	0.6 ± 0.1
W0440	N0750	A	0.6 ± 0.1	0.7 ± 0.1
W0440	N0770	3.0 ± 1.4	0.6 ± 0.2	1.1 ± 0.2
W0490	N0650	A	0.6 ± 0.1	0.7 ± 0.1

'A' denotes less than detectable activity

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Verification Data

Excerpt from Verification of 1983 and 1984 Remedial Actions Niagara Falls Storage Site Vicinity Properties, Lewiston, New York, December 1989

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VERIFICATION
OF
1983 AND 1984 REMEDIAL ACTIONS
NIAGARA FALLS STORAGE SITE
VICINITY PROPERTIES
LEWISTON, NEW YORK

Prepared by

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Prepared for

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as part of the
Formerly Utilized Sites - Remedial Action Program

FINAL REPORT

December 1989

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

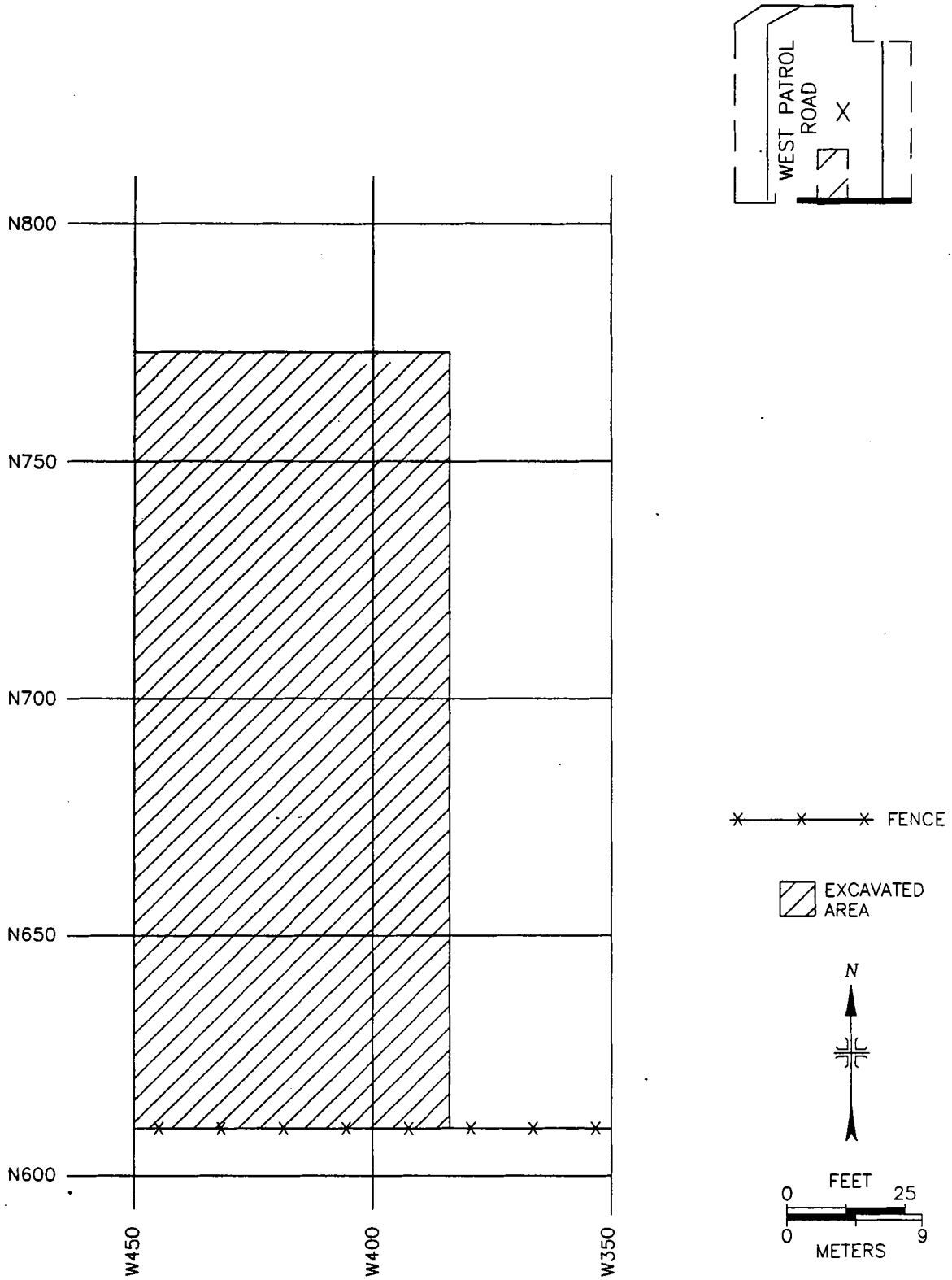

FIGURE 17: Plot Plan of Remediated Section of Vicinity Property X

TABLE 1 (continued)

RESULTS OF CONFIRMATORY ANALYSES ON SOIL SAMPLES
NIAGARA FALLS STORAGE SITE VICINITY PROPERTIES
LEWISTON, NEW YORK

Property	Sample ID[a]	Grid Location	Analysis By	Radionuclide Concentration(pCi/g)[b] Ra-226	U-238	Th-232
	63	S2320, E3660	BNI	0.6 ± 0.2	<MDA	0.7 ± 0.2
			ORAU	0.6 ± 0.2	1.1 ± 0.6	0.7 ± 0.4
	69	S2330, E3690	BNI	0.6 ± 0.2	<MDA	0.7 ± 0.2
			ORAU	0.6 ± 0.2	1.1 ± 0.6	0.7 ± 0.4
R	2	S3140, W 607	BNI	4.0 ± 0.4	<MDA	1.1 ± 0.6
			ORAU	3.8 ± 0.5	<0.8	0.5 ± 0.3
	6	S3140, W 527	BNI	1.3 ± 0.2	<MDA	<MDA
			ORAU	1.2 ± 0.3	<0.7	1.6 ± 0.5
S	3	N1305, E 885	BNI	2.8 ± 0.6	<MDA	0.9 ± 0.4
			ORAU	2.1 ± 0.3	1.5 ± 0.9	1.0 ± 0.4
V	2	N3709, E1138	BNI	0.8 ± 0.2	<MDA	1.1 ± 0.4
			ORAU	0.9 ± 0.3	6.9 ± 1.3	1.0 ± 0.5
X	312	N 640, W 410	BNI	1.2 ± 0.2	1.3 ± 3.6	0.8 ± 0.4
			ORAU	1.0 ± 0.3	4.3 ± 2.0	1.4 ± 0.4
	4	N 690, W 420	BNI	1.0 ± 0.2	<MDA	0.7 ± 0.2
			ORAU	0.9 ± 0.3	2.9 ± 1.4	0.7 ± 0.3
	9	N 710, W 400	BNI	1.1 ± 0.2	<MDA	1.3 ± 0.4
			ORAU	0.8 ± 0.2	2.1 ± 2.2	1.3 ± 0.3
West Ditch	67	N 820, W 170.5	BNI	0.9 ± 0.2	<MDA	1.2 ± 0.6
			ORAU	1.0 ± 0.2	0.3 ± 1.1	0.9 ± 0.4
	125	N1560, W 170	BNI	1.3 ± 0.4	<MDA	1.2 ± 0.6
			ORAU	1.5 ± 0.3	1.5 ± 1.3	1.0 ± 0.3
	128	N1600, W 160	BNI	<MDA	<MDA	0.9 ± 1.2
			ORAU	78.7 ± 1.8	9.3 ± 12.5	0.9 ± 1.1
	200	N2220, W 110	BNI	1.3 ± 0.4	<MDA	0.6 ± 0.4
			ORAU	1.4 ± 0.3	1.3 ± 1.1	1.1 ± 0.4
	252	W2500, E 090	BNI	1.0 ± 0.2	<MDA	0.8 ± 0.4
			ORAU	1.0 ± 0.3	2.2 ± 1.4	1.2 ± 0.4

TABLE 1 (continued)

RESULTS OF CONFIRMATORY ANALYSES ON SOIL SAMPLES
NIAGARA FALLS STORAGE SITE VICINITY PROPERTIES
LEWISTON, NEW YORK

Property	Sample ID[a]	Grid Location	Analysis By	Radionuclide Concentration(pCi/g)[b] Ra-226	U-238	Th-232
Central Ditch	142	N 660, E 480	BNI	1.3 ± 0.6	<15	1.2 ± 0.6
			ORAU	1.4 ± 0.3	<0.9	0.4 ± 0.2
	248	N1020, E 490	BNI	1.1 ± 0.2	0.8 ± 0.4	0.6 ± 0.2
			ORAU	1.1 ± 0.2	2.2 ± 0.8	0.8 ± 0.3
	469	N2160, E 461	BNI	1.0 ± 0.2	<MDA	1.0 ± 0.4
			ORAU	1.0 ± 0.2	0.7 ± 0.9	1.0 ± 0.3
	33	N5330, E 415	BNI	1.0 ± 0.2	<MDA	0.6 ± 0.2
			ORAU	0.9 ± 0.2	< 0.5	0.8 ± 0.4
	1302	N7590, E 410	BNI	0.9 ± 0.2	<MDA	1.0 ± 0.4
			ORAU	0.8 ± 0.2	2.1 ± 1.2	1.1 ± 0.3
	1761	N10190, W 650	BNI	0.8 ± 0.2	<MDA	0.9 ± 0.4
			ORAU	3.8 ± 0.5	1.8 ± 1.9	1.7 ± 0.8

[a]Sample Identification as presented in the BNI post-remedial action report.[14]
[b]Reported data includes background contributions from naturally occurring materials in soil.
[c]Uncertainties represent the 95% confidence levels, based only on counting statistics: systematic ORAU laboratory uncertainties, estimated at ± 6 to 10%, are not included in the reported values for the ORAU analyses.
[d]Reported as less than the minimum detectable activity (no values given).

TABLE 16

RADIONUCLIDE CONCENTRATIONS IN SOIL SAMPLES
FROM PROPERTY X
NIAGARA FALLS STORAGE SITE VICINITY PROPERTIES
LEWISTON, NEW YORK

Location[a] N	Location[a] W	Depth (m)	Radionuclide Concentrations (pCi/g) Ra-226	U-238	Th-232
610	432	Surface	1.5 ± 0.3[b]	1.0 ± 2.6	0.8 ± 0.9
631	344	Surface	0.9 ± 0.2	0.9 ± 1.4	1.0 ± 0.5
658	409	Surface	1.0 ± 0.3	1.7 ± 1.3	0.9 ± 0.3
		0.2 - 0.4	0.7 ± 0.2	3.8 ± 0.8	1.0 ± 0.3
699	375	Surface	0.6 ± 0.3	1.5 ± 2.1	1.0 ± 0.4
729	459	Surface	0.6 ± 0.2	2.1 ± 1.0	0.7 ± 0.3
735	395	Surface	1.3 ± 0.3	4.1 ± 2.1	1.2 ± 0.4
		0.2 - 0.4	0.9 ± 0.2	1.4 ± 0.5	0.9 ± 0.5
759	368	Surface	1.4 ± 0.5	2.6 ± 1.8	0.7 ± 0.3

[a]Refer to Figure 17.
[b]Uncertainties represent the 95% confidence levels, based only on counting statistics; additional laboratory uncertainties of ± 6 to 10% have not been propagated into these data.

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