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ENVIRONMENTAL MONITORING REPORT

Annual Summary - 1960

Atomics International

Canoga Park, California

The environs of Atomics International's World Headquarters and Nuclear Development Field Laboratory near Los Angeles, California are periodically surveyed to determine the radioactivity of typical surface soil, vegetation, and water samples. In addition, continuous air samples taken at the above sites provide information concerning airborne particulate radioactivity. This report summarizes the environmental monitoring results for the calendar year 1960. Annual averages for the years 1957 to 1959 are included for comparison. Average activity values for 1960 have been previously reported in the Environmental Monitoring Report for the fourth quarter of 1960. It should be noted that some deviations exist between the previously reported data and that presented herein. These deviations result from a change in the method of determining the averages. Previously, the method averaged only those samples whose activity was greater than the minimum detection limit. The present method considers all samples, upper and lower limiting values being given those samples whose activity lies below the minimum detection limit.

Soil and vegetation are sampled monthly at forty-two locations. Ten of these are within the boundaries of Atomics International sites; the remaining thirty-two are within a ten mile radius of the sites.

The average soil and vegetation activities are shown in Tables I and II.

Table I - Soil
Alpha Radioactivity

Year	On Site		Off Site	
	No. Samples	Average uuc/gram	No. Samples	Average uuc/gram
1960	115	0.34 to 0.41	362	0.27 to 0.37
1959	107	0.43	377	0.32
1958	80	0.27	309	0.26
1957	64	0.32	318	0.35

Beta-Gamma Radioactivity

Year	On Site		Off Site	
	No. Samples	Average uuc/gram	No. Samples	Average uuc/gram
1960	114	23.0	360	19.0
1959	107	14.9	379	14.0
1958	84	20.7	318	10.2
1957	72	10.6	354	10.2

Table II - Vegetation
Alpha Radioactivity

Year	On Site		Off Site	
	No.Samples	Average uuc/gram(ash)	No.Samples	Average uuc/gram(ash)
1960	115	0.31 to 0.35	362	0.21 to 0.25
1959	96	0.29	293	0.18
1958	65	0.57	250	0.39
1957	58	1.10	304	0.89

Beta-Gamma Radioactivity

Year	On Site		Off Site	
	No.Samples	Average uuc/gram(ash)	No.Samples	Average uuc/gram(ash)
1960	113	137.0	358	136.0
1959	107	212.0	380	168.0
1958	84	683.0	318	356.0
1957	70	208.0	351	200.0

Two water wells at the N.D.F.L. are sampled monthly to evaluate ground water radioactivity. The annual average water activity is shown in Table III.

Table III - Well Water

Year	Alpha		Beta-Gamma	
	No. Samples	Average uuc/liter	No. Samples	Average uuc/liter
1960	22	0.062 to 0.094	22	1.0 to 2.7
1959	18	0.077	16	1.6
1958	13	0.16	18	4.7
1957	-	-	17	13.0

Environmental air sampling is performed continuously at the Headquarters and N.D.F.L. sites. The annual average concentration of long lived airborne beta emitters is shown in Table IV.

Table IV - Air

Year	Headquarters		N.D.F.L.	
	No. Samples	Average uuc/M^3	No. Samples	Average uuc/M^3
1960	182	0.24	44	0.44
1959	215	2.50	257	0.93
1958	366	4.90	164	2.7
1957	63	1.60	141	2.7

Table I indicates that a general increase in soil beta-gamma radioactivity has occurred since 1957. Soil alpha radioactivity has remained essentially constant over the period. Table II indicates a decrease in both alpha and beta-gamma vegetation radioactivity during 1958. Table III shows that N.D.F.L. well water radioactivity has decreased considerably since 1957. Table IV shows that the 1960 annual airborne radioactivity average is less than preceeding yearly averages. The 1958 activity increase corresponds to the vegetation beta-gamma radioactivity increase in the same year.

Some of the data for 1960 given in Tables I, II, and III, is given as a range within which lies the true average. This occurs when one or more of the samples contains an "undetectable" amount of radioactivity. In these instances, two averages are determined. The lowest value assumes that the "undetectable" samples contain no radioactivity. The highest value assumes that these samples contain radioactivity equal to the appropriate minimum detection limit.

Minimum detection limits for soil, vegetation, and water are shown in Table V.

Table V - Minimum Detection Limits

Sample	Activity	Minimum Detection Limit
Soil	α	0.24 ± 0.094 uuc/gram*
	$\beta-\gamma$	6.9 ± 2.1 uuc/gram*
Vegetation	α	0.086 ± 0.089 uuc/gram**
	$\beta-\gamma$	13.8 ± 4.1 uuc/gram*
Water	α	0.052 ± 0.054 uuc/liter **
	$\beta-\gamma$	2.5 ± 1.3 uuc/liter**

* - 95 per cent error

** - Standard error

Sample preparation and analytical methods employed for the 1960 samples are discussed in Atomics International Environmental Monitoring Quarterly Reports. Procedures employed previous to 1960 differ in counting techniques which affect minimum detection values; however, sample preparation procedures are generally the same.

SUMMARY

The environs of Atomics International World Headquarters and Nuclear Development Field Laboratory near Los Angeles, California are periodically surveyed to determine the radioactivity of typical surface soil, vegetation, and water samples. In addition, continuous air samples taken at the above sites provide information concerning airborne particulate radioactivity. This report summarizes the environmental monitoring results for the second quarter of 1960.

Soil and vegetation are sampled monthly at forty-two locations. Ten of these are within the boundaries of Atomics International sites; the remaining thirty-two are within a ten mile radius of the sites.

The average soil and vegetation activities are shown in Tables I and II.

Table I - Soil

Location	Activity	1959		Second Quarter 1960	
		No.Samples	Average uuc/gram	No.Samples	Average uuc/gram
On Site	α	107	0.41	28	0.44
	β-γ	107	15.	28	22.
Off Site	α	377	0.31	99	0.38
	β-γ	380	14.	96	16.

Table II - Vegetation

Location	Activity	1959		Second Quarter 1960	
		No.Samples	Average uuc/gram(ash)	No.Samples	Average uuc/gram(ash)
On Site	α	96	0.24	20	.20
	β-γ	107	220.	28	150.
Off Site	α	286	0.18	78	0.18
	β-γ	380	170.	95	140.

Two water wells at the N.D.F.L. are sampled monthly. The average water activity is shown in Table III.

Table III - Well Water

Location	Activity	1959		Second Quarter - 1960	
		No.Samples	Average uuc/liter	No.Samples	Average uuc/liter
N.D.F.L.	α	18	0.076	1	0.38
	β-γ	16	2.8	5	2.8

Environmental air sampling is performed continuously at the Headquarters and N.D.F.L. sites. The average concentration of long lived airborne beta emitters is shown in Table IV.

Table IV - Air

Location	Activity	1959		Second Quarter - 1960	
		No.Samples	Average uuc/M^3	No.Samples	Average uuc/M^3
Head-quarters	β-γ	215	2.5	6	0.63
N.D.F.L.	β-γ	257	0.93	8	0.21

Table I indicates that the second quarter 1960 soil radioactivity is slightly higher than the 1959 average. The difference between on-site and off-site levels is generally within the accuracy of the measurement. Table II indicates that the second quarter 1960 vegetation alpha activity is virtually the same, whereas the beta-gamma level is lower than the 1959 average.

Since N.D.F.L. operations do not release significant levels or quantities of radioactivity to the soil, the slight variation in well water radioactivity, Table III, is attributed to natural causes.

Table IV indicates a considerable decrease in airborne beta-gamma activity from the 1959 averages for Headquarters and N.D.F.L. The higher 1959 average is believed to have been caused by fallout.

General Description of Program

Soil and vegetation sample collection and analysis, initiated in 1952 in the Downey, California area, was extended to the proposed SRE site in May 1954, and to the Canoga Park area in December 1954. The Downey area survey was stopped when Atomics International relocated to Canoga Park. The primary purpose of the environmental monitoring program is to ensure that Atomics International's operations are not contributing measurably to environmental radioactivity and, at the same time, to provide a continuing check on the integrity of engineering safeguards for the containment of radioactivity. Due to the effect of geographical location on environmental radioactivity, comparison between widely spread sampling locations is difficult. Useful information can be obtained, however, by observing the trend of individual or closely spaced groups of locations.

For this reason, samples are collected monthly in five survey areas including Canoga Park (2), Santa Susana Mountains, Simi Valley and Russell Valley. Forty-two sampling stations are currently established within the indicated areas. The maximum sampling station distance from the Nuclear Development Field Laboratory at Santa Susana is approximately ten miles. Sampling station locations are indicated on Figures 1, 2, and 3, and in Table VI.

During each calendar quarter, approximately 126 soil, 126 vegetation, 21 water and 90 environmental air samples are obtained and analyzed by the Health and Safety Laboratory for gross alpha and/or beta-gamma activity.

Methods

SOIL

Surface soil types available for sampling range from decomposed granite to clay and sandy loam. Collected samples represent the top one half inch layer of ground surface. The soil is packed in small plastic containers which are then taken to the laboratory for analysis. Sample preparation consists of transferring the soil to pyrex beakers and drying in a muffle furnace at 500° centigrade for eight hours.

After cooling the soil is screened to obtain uniform particle sizes for counting. One gram aliquots of the screened soil are then transferred to stainless steel planchets and fixed with collodion acetone solution.

The prepared samples are then counted in a thin window, gas flow proportional counter calibrated with Ra D+E (with and without alpha absorber) and K^{40}. The K^{40} in the form of crystalline KCl is used to correct for self absorption in the soil and vegetation samples. This method affords the minimum detection limits shown in Table V. While better sensitivity and accuracy are possible, the additional counting time required is not warranted for routine analysis.

Table V - Minimum Detection Limits at 95% Confidence Level.

Sample	Activity	Minimum Detection Limit
Soil	α	0.25 ± 0.076 uuc/gram
	$\beta-\gamma$	0.34 ± 0.018 uuc/gram
Vegetation	α	0.008 ± 0.005 uuc/gram (ash)
	$\beta-\gamma$	1.1 ± 0.068 uuc/gram (ash)
Water	α	0.016 ± 0.0099 uuc/liter
	$\beta-\gamma$	0.68 ± 0.042 uuc/liter

VEGETATION

Vegetation samples obtained in the field at each station are of the same plant type wherever possible, and are generally sun flower or wild tobacco plant leaves. These plant types maintain an active rate of growth during the dry season, a characteristic uncommon to most other plant types indigenous to the area. Vegetation leaves to be sampled are stripped from the plant and placed in ice cream cartons for transfer to the Health and Safety Laboratory.

Preparation of samples for analysis includes rinsing in distilled water to remove foreign matter and placing in porcelain crucibles for reduction to ash. The crucibles are placed in a muffle furnace at 500° centigrade for approximately eight hours. This ashing time is sufficient to produce a finely divided, completely oxidized ash

of uniform density. Three hundred milligram aliquots of ash from each crucible are then weighed and transferred to stainless steel planchets for analysis. Analytical methods are the same as for soil samples. Sensitivity and accuracy are shown in Table V.

WATER

Samples of well water are obtained at the Nuclear Development Field Laboratory. The water is drawn into one liter polyethylene bottles for transfer to the laboratory. The samples are measured into 500 milliliter volumetric flasks and then evaporated into crystallizing dishes at approximately 90° centigrade. The residue salts are transferred to stainless steel planchets, wetted to produce an even deposition in the planchet, re-dried and counted in the proportional system. Sensitivity and accuracy are shown in Table V.

AIR

Environmental air sampling is conducted continuously at the Headquarters and NDFL sites by automatic twenty four hour step cycle air monitors. Airborne particulates are collected on a fixed filter tape which is moved, after each twenty-four hour period, to place the new sample beneath a thin window G.M. detector. At pre-set intervals, usually twenty minutes, the number of counts observed by the scaler during the interval is recorded.

It has been determined that for this type of instrument twice the counting rate after 18.6 hours decay minus the counting rate after 8 hours decay closely approximates the long-lived contribution. This counting rate can be converted easily to the average long-lived airborne activity (uuc/m^3) during the sampling period. The minimum detection limit, which varies somewhat between instruments, is on the order of 0.04 uuc/m^3.

When abnormally high activities are observed, the data is plotted to determine the presence of short-lived activities other than radon and thoron daughters. If fallout is suspected, samples are removed

to the laboratory where their decay is observed for a period of several days to several weeks. If the activity decays as a function of $t^{-1.2}$, the data is extrapolated in order to find the date of origin. This date is then compared with the dates of publicized nuclear detonations in order to demonstrate that the abnormal airborne activity was not caused by Atomics International operations.

Table VI

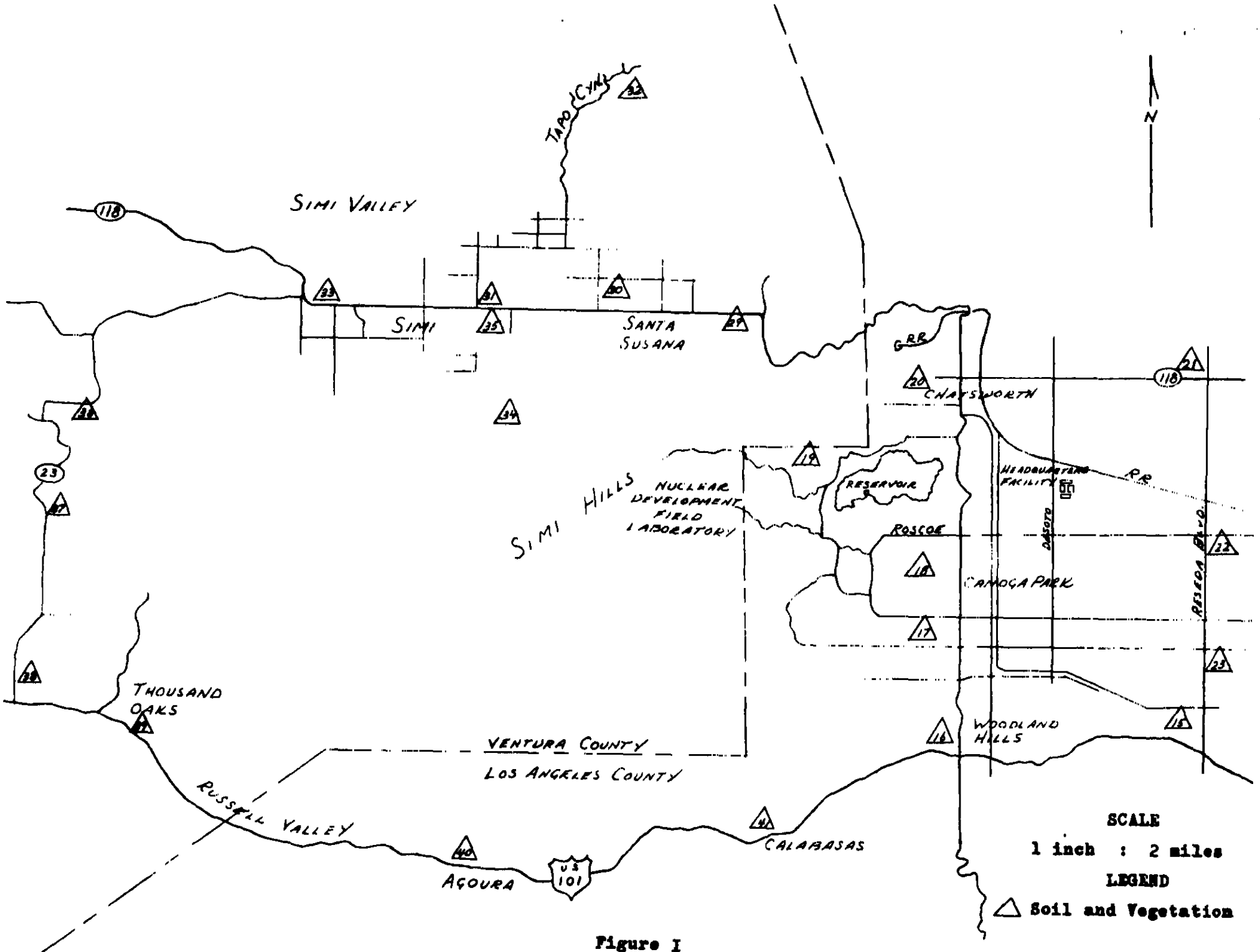
Sample Station Locations

Station	Location
SV-1	SRE Reactor
SV-2	SRE Perimeter Drainage Ditch
SV-3	Building 064 Parking Lot
SV-4	West of Building 020
SV-5	Building 363
SV-6	Rocketdyne Retention Reservoir, PFL
SV-7	Rocketdyne PFL
SV-8	Rocketdyne PFL
SV-9	Rocketdyne PFL
SV-10	Santa Susana Site Access Road
SV-11	Santa Susana Site Access Road
SV-12	KEWB Reactor
SV-13	Sodium Burning Pad
SV-14	Canyon below Building 022
SV-15	Reseda Blvd. and Ventura Blvd.
SV-16	Topanga Canyon Blvd. and Ventura Blvd.
SV-17	Topanga Canyon Blvd. and Vanowen St.
SV-18	Topanga Canyon Blvd. and Saticoy St.
SV-19	Santa Susana Facility Entrance
SV-20	Topanga Canyon Blvd. and Devonshire St.
SV-21	Reseda Blvd. and Devonshire St.
SV-22	Reseda Blvd. and Nordhoff St.
SV-23	Reseda Blvd. and Sherman Way
SV-24	Headquarters
SV-25	DeSoto Ave. and Plummer St.
SV-26	Nordhoff St. and Mason Ave.
SV-27	DeSoto Ave. and Parthenia St.
SV-28	Canoga Ave. and Nordhoff St.
SV-29	Santa Susana Knolls
SV-30	Los Angeles Ave. at Bridge
SV-31	Los Angeles Ave. and Sycamore Road
SV-32	Tapo Canyon
SV-33	Los Angeles Ave. and Sinaloa Road

Station Con't	Location Con't
SV-34	Meier Canyon
SV-35	Brandeis Camp Entrance
SV-36	Moorpark Road and Camarillo Road
SV-37	Moorpark Road at Oil Pumping Station
SV-38	Moorpark Road and Ventura Blvd.
SV-39	Ventura Blvd. at Potrero Road
SV-40	Ventura Blvd. at Cornell Corners (Agoura)
SV-41	Ventura Blvd. at Calabasas
SV-42	Non Radioactive Materials Disposal Area, Nuclear Development Field Laboratory
W 2	SRE Perimeter Drainage Ditch
W 6	Rocketdyne Retention Reservoir, PFL
W 7	Well Water from Engineering Test Building
W 11	Well Water from Building 363
W R.O.	Run Off Collection Sump
W C.T.	Edison Cooling Tower
W R.D.	SRE Retention Dam

SV - Soil and Vegetation

W - Water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GRR
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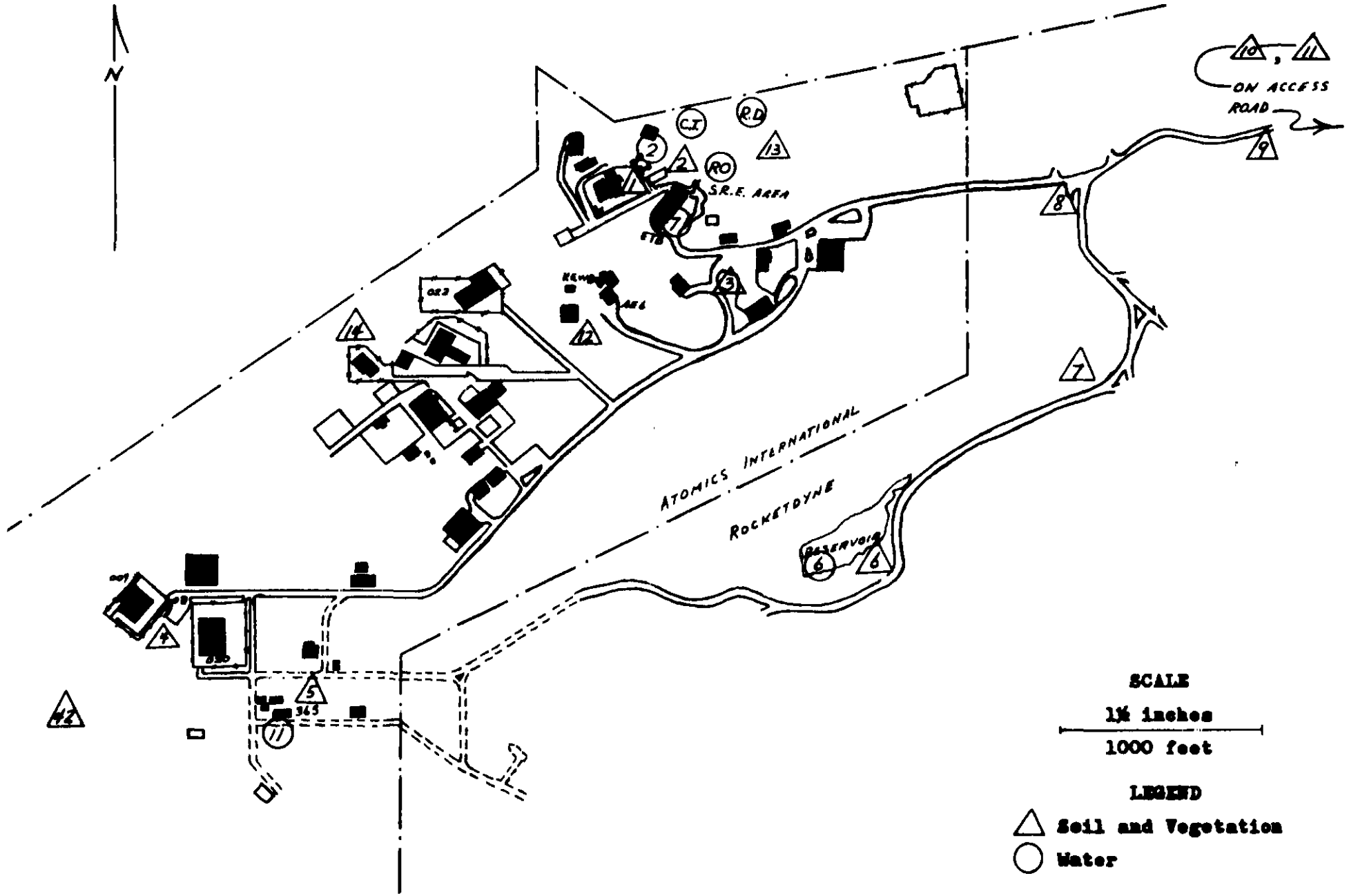
RESERVOIR
HEADQUARTERS FACILITY
P.P.
ROSCOE
CANOGA PARK
DESOTO
RESEDA BLVD.
THOUSAND OAKS
VENTURA COUNTY
LOS ANGELES COUNTY
WOODLAND HILLS
RUSSELL VALLEY
AGOURA
U.S. 101
CALABASAS
N
SCALE
1 inch : 2 miles
LEGEND
Soil and Vegetation

Figure I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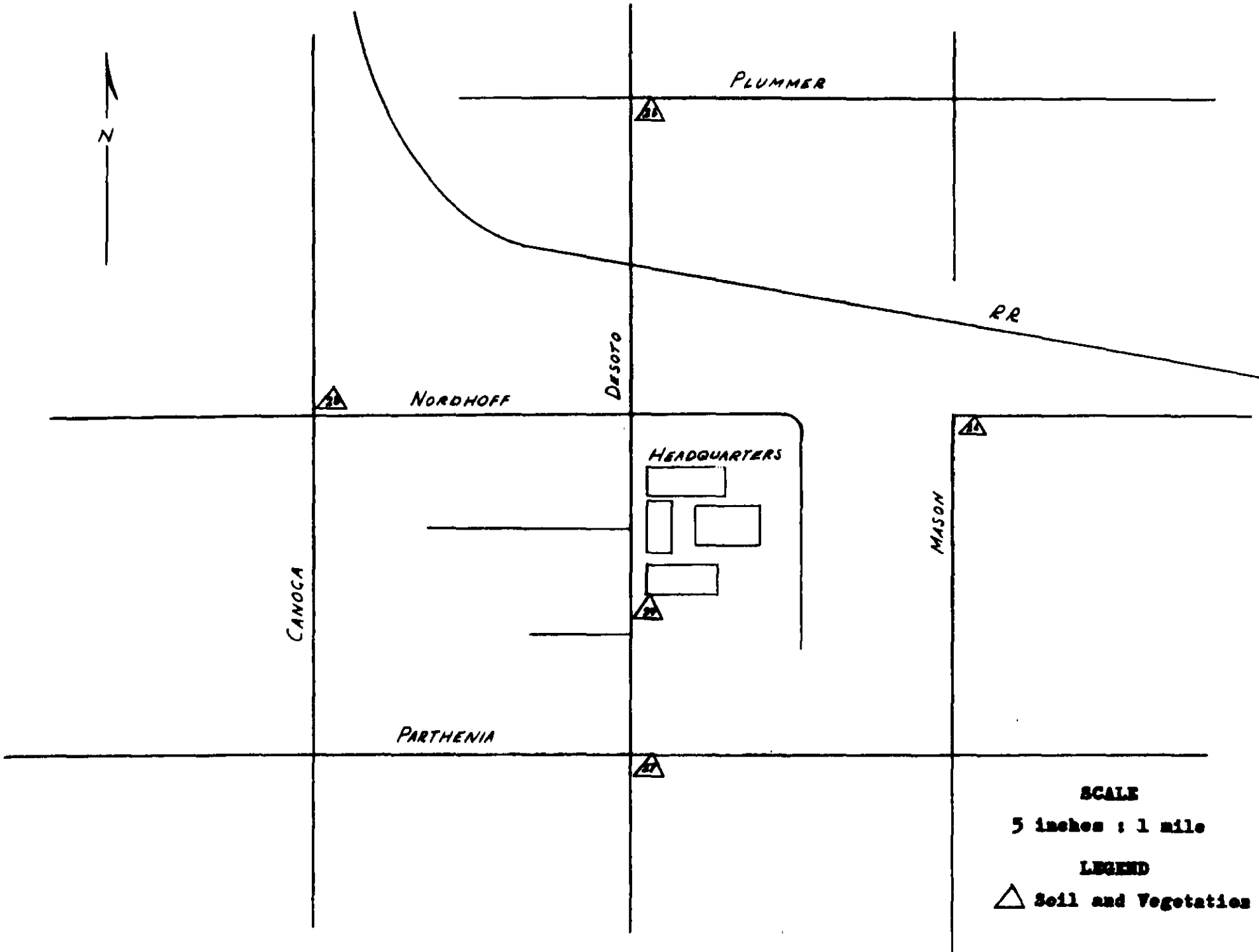
ON ACCESS ROAD
S.R.E. AREA
ATOMICS INTERNATIONAL
ROCKETDYNE
RESERVOIR
SCALE
1¼ inches
1000 feet
LEGEND
Soil and Vegetation
Water

Figure II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PLUMMER
RR
DESOTO
NORDHOFF
HEADQUARTERS
MASON
CANOGA
PARTHENIA
SCALE
5 inches : 1 mile
LEGEND
Soil and Vegetation

Figure III

ENVIRONMENTAL MONITORING REPORT
JULY 1, 1960, to SEPTEMBER 30, 1960

ATOMICS INTERNATIONAL
CANOGA PARK, CALIFORNIA

SUMMARY

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The average soil and vegetation activities are shown in Tables I and II:

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Location	Activity	1959		Third Quarter 1960	
		No.Samples	Average uuc/gram	No.Samples	Average uuc/gram
On Site	α	107	0.41	30	0.42
	β-γ	107	15.	30	29.
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		No.Samples	Average uuc/m^3	No.Samples	Average uuc/m^3
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* Sampling equipment being modified. No data available.

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SV-11	Santa Susana Site Access Road
SV-12	KEWB Reactor
SV-13	Sodium Burning Pad
SV-14	Canyon below Building 022
SV-15	Reseda Blvd. and Ventura Blvd.
SV-16	Topanga Canyon Blvd. and Ventura Blvd.
SV-17	Topanga Canyon Blvd. and Vanowen St.
SV-18	Topanga Canyon Blvd. and Saticoy St.
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SV-22	Reseda Blvd. and Nordhoff St.
SV-23	Reseda Blvd. and Sherman Way
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SV-33	Los Angeles Ave. and Sinaloa Road

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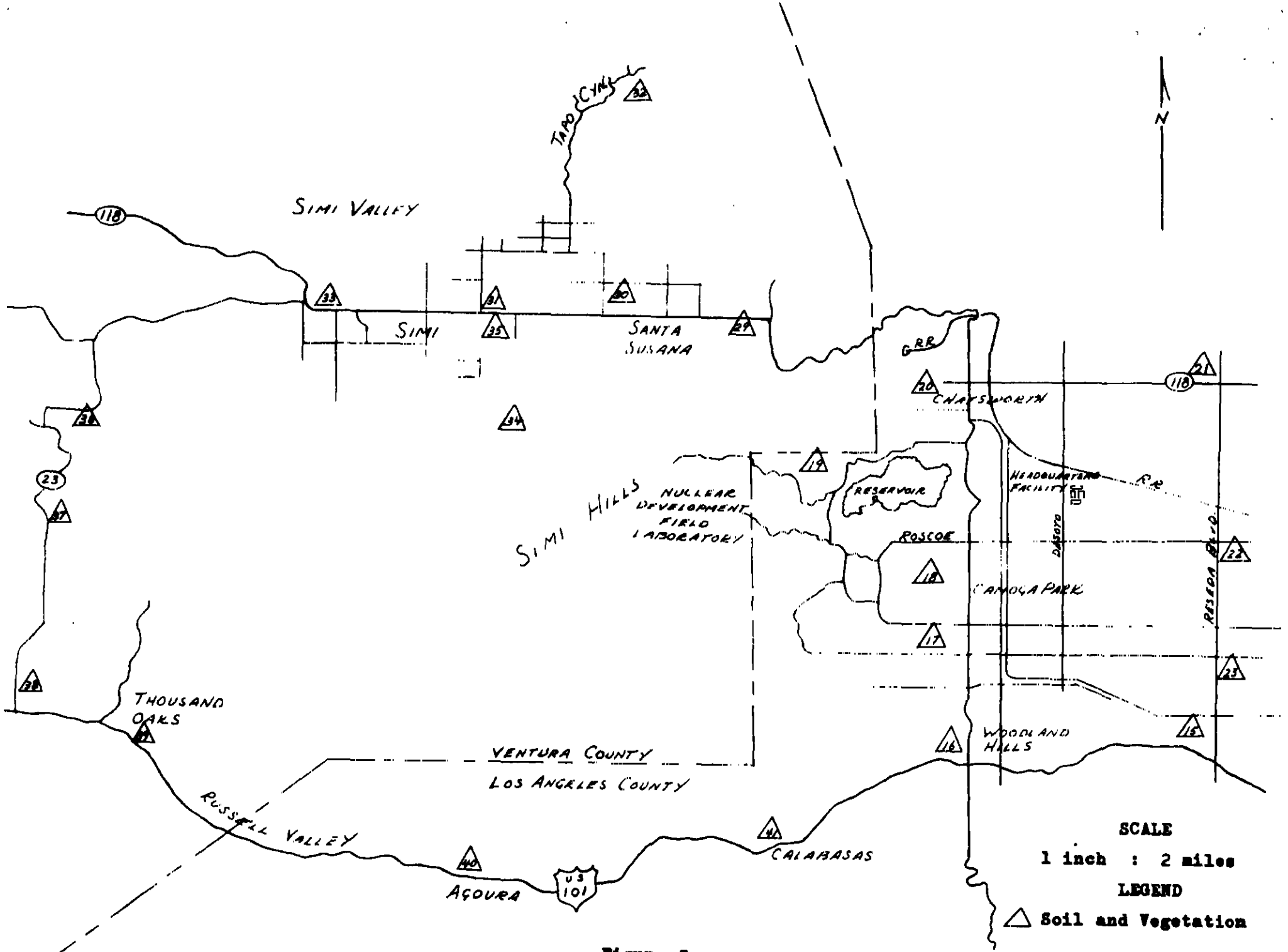
SV-35	Brandeis Camp Entrance
SV-36	Moorpark Road and Camarillo Road
SV-37	Moorpark Road at Oil Pumping Station
SV-38	Moorpark Road and Ventura Blvd.
SV-39	Ventura Blvd. at Potrero Road
SV-40	Ventura Blvd. at Cornell Corners (Agoura)
SV-41	Ventura Blvd. at Calabasas
SV-42	Non Radioactive Materials Disposal Area, Nuclear Development Field Laboratory
W 2	SRE Perimeter Drainage Ditch
W 6	Rocketdyne Retention Reservoir, PFL
W 7	Well Water from Engineering Test Building
W 11	Well Water from Building 363
W R.O.	Run Off Collection Sump
W C.T.	Edison Cooling Tower
W R.D.	SRE Retention Dam

SV - Soil and Vegetation

W - Water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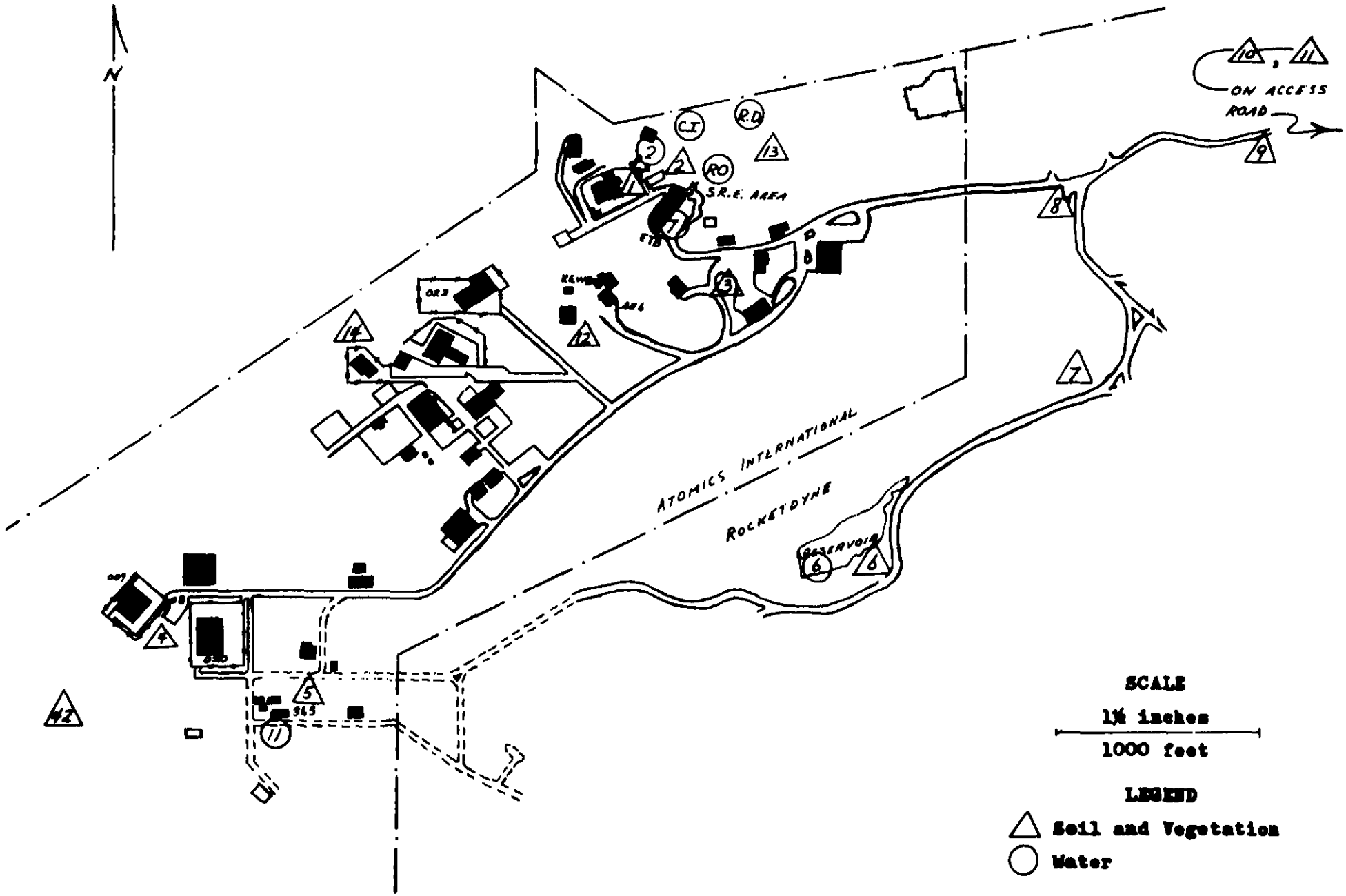
CANOGA PARK
WOODLAND HILLS
THOUSAND OAKS
VENTURA COUNTY
LOS ANGELES COUNTY
RUSSELL VALLEY
AGOURA
CALABASAS
U.S. 101
SCALE
1 inch : 2 miles
LEGEND
△ Soil and Vegetation

Figure I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ON ACCESS ROAD
S.R.E. AREA
ATOMICS INTERNATIONAL
ROCKETDYNE
RESERVOIR
SCALE
1¼ inches
1000 feet
LEGEND
Soil and Vegetation
Water

Figure II

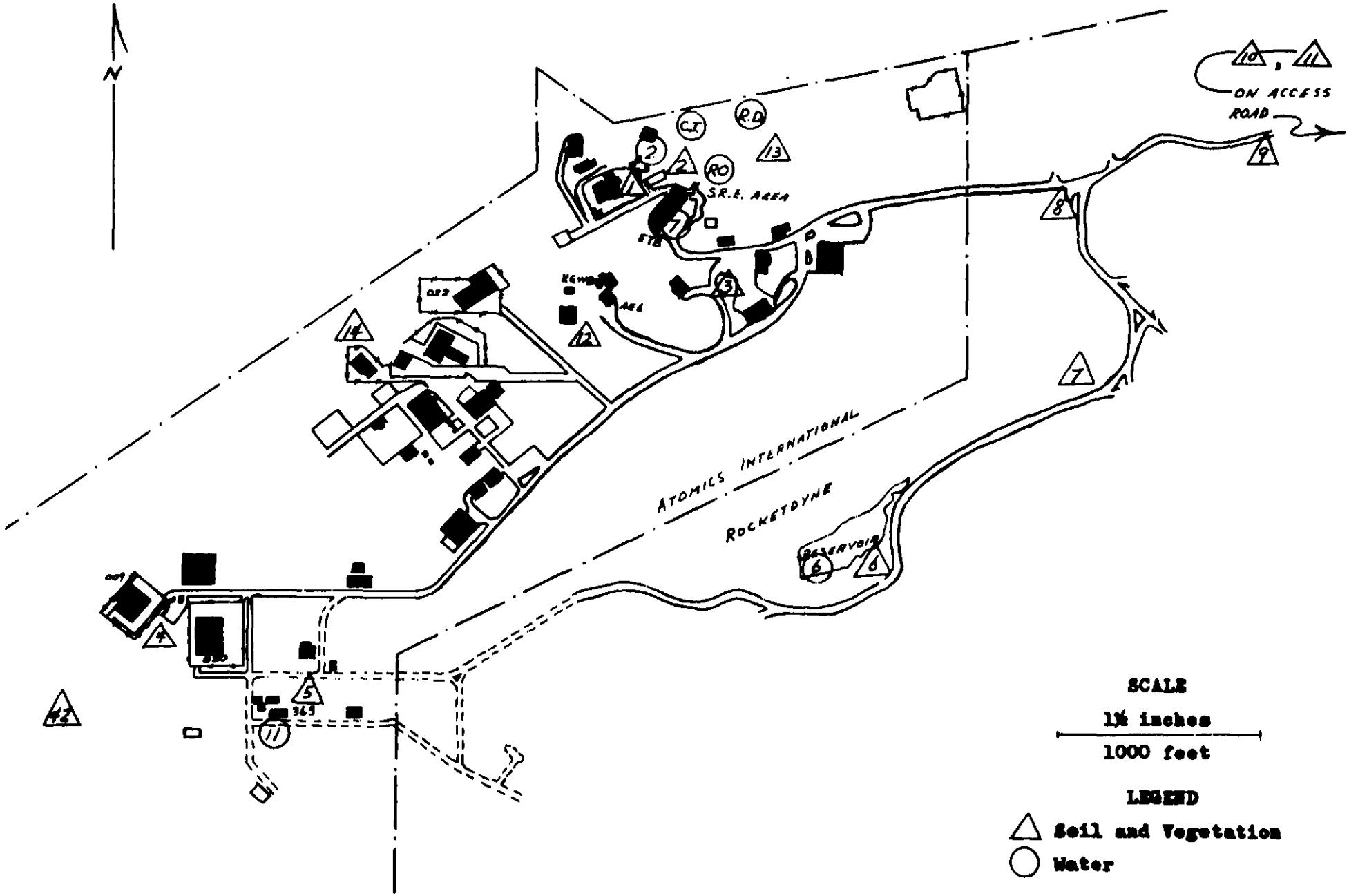
N
ON ACCESS ROAD
S.R.E. AREA
ATOMICS INTERNATIONAL
ROCKETDYNE
RESERVOIR
SCALE
1½ inches
1000 feet
LEGEND
Soil and Vegetation
Water

Figure II

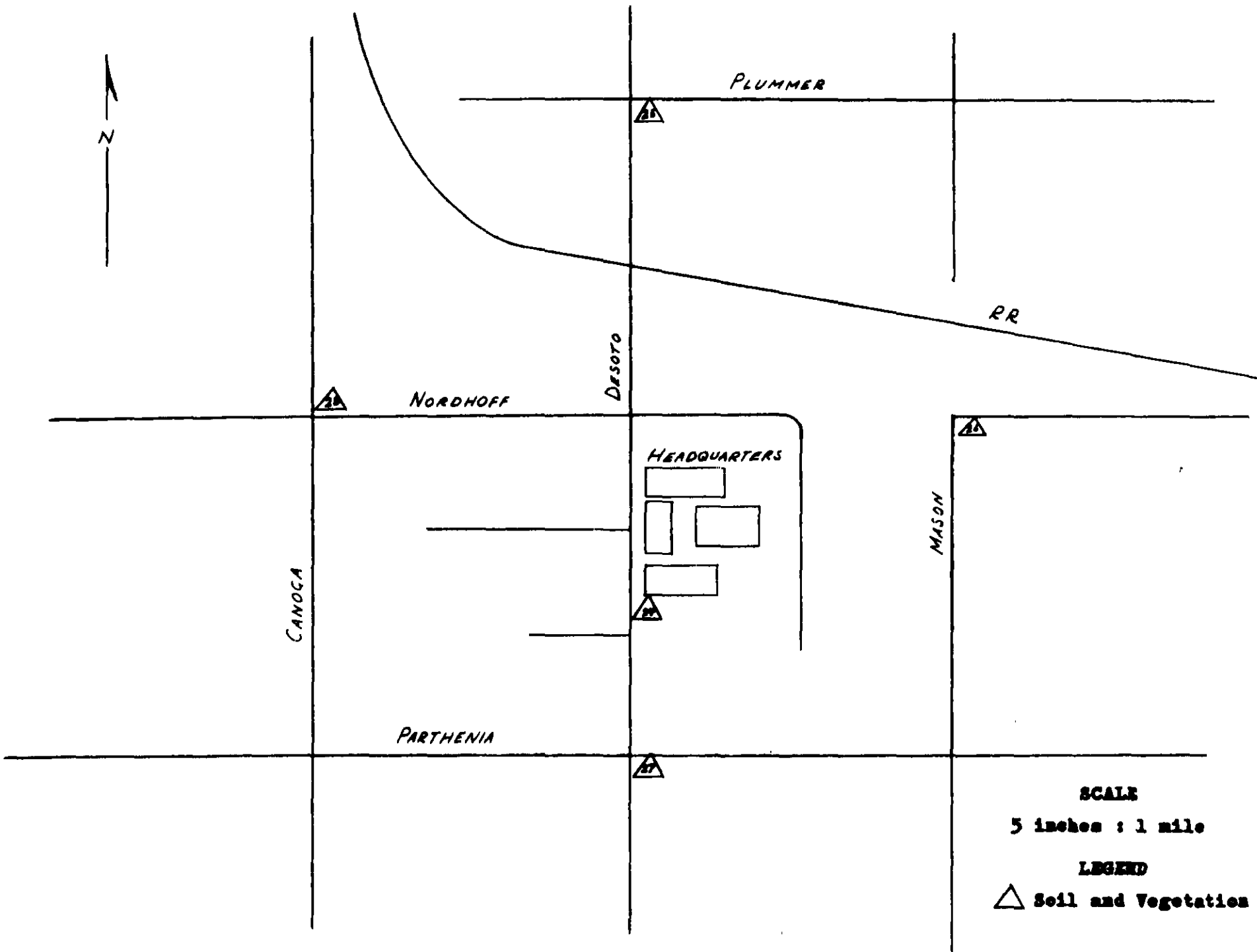
N
PLUMMER
RR
DESOTO
NORDHOFF
HEADQUARTERS
MASON
CANOGA
PARTHENIA
SCALE
5 inches : 1 mile
LEGEND
Soil and Vegetation

Figure III

ENVIRONMENTAL MONITORING REPORT

October 1, 1960, to December 31, 1960

Atomics International

Canoga Park, California

SUMMARY

The environs of Atomics International World Headquarters and Nuclear Development Field Laboratory near Los Angeles, California, are periodically surveyed to determine the radioactivity of typical surface soil, vegetation and water samples. In addition, continuous air samples taken at the above sites provide information concerning airborne particulate radioactivity. This report summarizes the environmental monitoring results for the fourth quarter of 1960.

Soil and vegetation are sampled monthly at forty-two locations. Ten of these are within the boundaries of Atomics International sites; the remaining thirty-two are within a ten mile radius of the sites.

The average soil and vegetation activities are shown in Tables I and II:

Table I - Soil

Location	Activity	1960		Fourth Quarter 1960	
		No.Samples	Average uuc/gram	No.Samples	Average uuc/gram
On Site	α	104	0.45	17	0.27
	β-γ	114	23.	30	26.
Off Site	α	324	0.36	58	0.29
	β-γ	360	19.	96	22.6

Table II - Vegetation

Location	Activity	1960		Fourth Quarter 1960	
		No.Samples	Average uuc/gram(ash)	No.Samples	Average uuc/gram(ash)
On Site	α	89	0.41	21	0.33
	β-γ	113	136.	30	115.
Off Site	α	281	0.28	67	0.32
	β-γ	358	135.	96	125.

Two water wells at the Nuclear Development Field Laboratory are sampled monthly. The average water activity is shown in Table III.

Table III - Well Water

Location	Activity	1960		Fourth Quarter 1960	
		No. Samples	Average uuc/liter	No. Samples	Average uuc/liter
N.D.F.L.	α	12	0.14	3	0.03
	β-γ	19	2.0	4	1.5

Environmental air sampling is performed continuously at the Headquarters and N.D.F.L. sites. The average concentration of long lived airborne beta emitters is shown in Table IV.

Table IV - Air

Location	Activity	1960		Fourth Quarter 1960	
		No. Samples	Average uuc/m^3	No. Samples	Average uuc/m^3
Head-quarters	β-γ	182	0.24	56	0.23
N.D.F.L.	β-γ	44	0.44	20	0.74

Table I indicates that the fourth quarter 1960 soil alpha radioactivity is somewhat lower than the 1960 average, whereas the beta-gamma activity is slightly higher. Table II indicates that the fourth quarter 1960 vegetation alpha radioactivity is lower on-site and is higher off-site. Beta-gamma activity is somewhat lower for both on-site and off-site samples.

Since N.D.F.L. operations do not release significant levels or quantities of radioactivity to the soil, the variation in well water radioactivity, Table III, is attributed to natural causes.

Table IV indicates that airborne beta-gamma activity at the Headquarters site was approximately the same as the 1960 average, while at the N.D.F.L. an increase is evident.

SUMMARY

The environs of Atomics International World Headquarters and Nuclear Development Field Laboratory near Los Angeles, California are periodically surveyed to determine the radioactivity of typical surface soil, vegetation, and water samples. In addition, continuous air samples taken at the above sites provide information concerning airborne particulate radioactivity. This report summarizes the environmental monitoring results for the second quarter of 1960.

Soil and vegetation are sampled monthly at forty-two locations. Ten of these are within the boundaries of Atomics International sites; the remaining thirty-two are within a ten mile radius of the sites.

The average soil and vegetation activities are shown in Tables I and II.

Table I - Soil

Location	Activity	1959		Second Quarter 1960	
		No.Samples	Average uuc/gram	No.Samples	Average uuc/gram
On Site	α	107	0.41	28	0.44
	β-γ	107	15.	28	22.
Off Site	α	377	0.31	99	0.38
	β-γ	380	14.	96	16.

Table II - Vegetation

Location	Activity	1959		Second Quarter 1960	
		No.Samples	Average uuc/gram(ash)	No.Samples	Average uuc/gram(ash)
On Site	α	96	0.24	20	.20
	β-γ	107	220.	28	150.
Off Site	α	286	0.18	78	0.18
	β-γ	380	170.	95	140.

Two water wells at the N.D.F.L. are sampled monthly. The average water activity is shown in Table III.

Table III - Well Water

Location	Activity	1959		Second Quarter - 1960	
		No.Samples	Average uuc/liter	No.Samples	Average uuc/liter
N.D.F.L.	α	18	0.076	1	0.38
	$\beta-\gamma$	16	2.8	5	2.8

Environmental air sampling is performed continuously at the Headquarters and N.D.F.L. sites. The average concentration of long lived airborne beta emitters is shown in Table IV.

Table IV - Air

Location	Activity	1959		Second Quarter - 1960	
		No.Samples	Average uuc/M^3	No.Samples	Average uuc/M^3
Headquarters	$\beta-\gamma$	215	2.5	6	0.63
N.D.F.L.	$\beta-\gamma$	257	0.93	8	0.21

Table I indicates that the second quarter 1960 soil radioactivity is slightly higher than the 1959 average. The difference between on-site and off-site levels is generally within the accuracy of the measurement. Table II indicates that the second quarter 1960 vegetation alpha activity is virtually the same, whereas the beta-gamma level is lower than the 1959 average.

Since N.D.F.L. operations do not release significant levels or quantities of radioactivity to the soil, the slight variation in well water radioactivity, Table III, is attributed to natural causes.

Table IV indicates a considerable decrease in airborne beta-gamma activity from the 1959 averages for Headquarters and N.D.F.L. The higher 1959 average is believed to have been caused by fallout.