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STATUS AND PLANS

REPORT

FOR

FORMER TECHNICAL AREA ONE

AT

LOS ALAMOS SCIENTIFIC LABORATORY

HEALTH RESEARCH DIVISION

JANUARY 1976

los alamos
scientific laboratory
of the University of California
LOS ALAMOS, NEW MEXICO 87545

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February 11, 1976

Mr. Kenneth R. Braziel, Area Manager
U. S. Energy Research & Development Adm.
Los Alamos Area Office
Los Alamos, New Mexico 87544

Dear Mr. Braziel:

Enclosed are copies 11 and 12 of the revised "Status and Plans Report for Former Technical Area One at Los Alamos Scientific Laboratory."

Very truly yours,

for Harry S. Jordan
Asst. Division Leader
for Operations

HSJ:ed
Enclosure: a/s
cc: C. I. Browne, ADA, w/encl. Copies 13 and 14
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AN EQUAL OPPORTUNITY EMPLOYER

STATUS AND PLANS REPORT FOR FORMER TECHNICAL AREA ONE AT LOS ALAMOS SCIENTIFIC LABORATORY

INTRODUCTION

Because of increased official and public concern over low-level radioactive contamination of private lands or former ERDA (AEC) lands released to the public, the undeveloped part of the former main technical area of LASL (TA-1) was surveyed in 1974 at the request of ERDA (AEC)*. This effort was to determine whether any of the land (∿40 acres) was contaminated above fallout levels by uranium, transuranic elements, or other radioisotopes, and to estimate costs of decontamination. During the war years under the Manhattan Project and for several years thereafter, TA-1 was the site of research and development involving uranium, plutonium, fission products, tritium, and other hazardous substances. Postwar construction enabled abandonment and disposal to the public of TA-1 land in 1966 after demolition and removal of the buildings and after decontamination had been completed.

The initial 1974 survey identified an area with low levels (∿250 pCi/g) of plutonium contamination on the surface. Further investigation revealed a subsurface pocket of high-level (>100 000 pCi/g) plutonium concentration. On the basis of this information a more extensive resurvey and a major decontamination operation were undertaken.

Initial 1974 Survey

Prior to field work, a review of health physics records was conducted to identify former buildings that had contained possible sources of contamination. This contributed to developing a three-part sampling plan: a special survey at 29 points at or downslope from the

*Letters, J. A. Erlewine to H. C. Donnelly, September 14, 1971, and H. J. Blackwell to H. M. Agnew, November 17, 1971.

identified possible source buildings, general survey at 26 points established on the engineering reference grid at approximately 77 m (250 ft) intervals, and a control survey to establish the background radiation in the area due to fallout and natural radioactivity at 7 points located about 30-80 km (18.5-50 mi.) from Los Alamos. The TA-1 special and general survey points are shown in Fig. 1. In situ x- and γ-radiation measurements were made and samples of soil and vegetation were collected between March and July 1974. Field measurements for low energy x- and γ-rays associated with ^{239}Pu and ^{241}Am gave only negative results, indicating that surface plutonium and americium contamination was at a low level at the sampling points.

At each of the 62 sampling locations, 5 surface soil samples were collected from the corners and the center of an area approximately 10 m square and composited to form a single sample representing the sampling location. Additionally a soil core sample was collected by driving a 1-in. diameter plastic pipe about 18-in. into the ground. At three of the special locations where it was believed that the original TA-1 land surface had been covered by backfill, surface soil samples were supplemented by collecting auger drillings to a depth of $\sim$4 m ($\sim$12 ft) to obtain an approximate indication of possible contamination at depths greater than practical for coring. A few hundred grams of native grass was also collected at each sampling location.

By use of conventional radiochemical and instrumental procedures, the general location soil samples were analysed for: gross α and β activity, ^{137}Cs and gross γ activity, ^{238}Pu and ^{239}Pu, and uranium (total). The special soil samples were submitted for the above analyses and any supplemental analyses, including ^{241}Am, ^{226}Ra, and beryllium that were believed appropriate on the basis of historical information. Vegetation and core samples were submitted for analysis only for those locations at which significant surface soil contamination was detected. Laboratory analyses were completed by April 1975.

Results of Initial Survey

Concentrations higher than consistent with regional background were found at one or more TA-1 sampling locations for all of the contaminants except radium and beryllium. Table 1 summarizes the range of concentrations for the most important materials found in the TA-1 and regional background samples. The principal contaminated areas identified by the initial survey were as follows (see Fig. 1 for approximate location):

D and D-2 Buildings* - gross-α and specific plutonium contamination including the highest ^{239}Pu concentration (220 pCi/g) near septic tank 137 which served D-2. These were the buildings in which most of the plutonium handling operations occurred. Low-level ^{137}Cs contamination was also associated with the area.

Sigma, HT, and TU Buildings - uranium contamination found at and downslope from these buildings where uranium was known to have been handled.

Many of the TA-1 locations had levels of ^{239}Pu and uranium that were above background (see Table 1). Some ^{241}Am was associated with four samples showing ^{239}Pu contamination.

Investigation of Septic Tank 137

The highest concentration of plutonium in soil (220 pCi/g) encountered in the initial survey was located south of D-2 directly below the outfall pipe of septic tank 137. Thus, it was decided to investigate the tank and its contents. Records indicated that a rectangular concrete tank filled with dirt would be found. Instead, a cylindrical metal tank full of water (0.01 pCi/g ^{239}Pu) and sludge (114 pCi/g ^{239}Pu) was found. The tank was removed on August 11, 1975. During removal a pocket of ^{239}Pu contamination was found 4 ft below the surface on ERDA property just south of the Los Alamos Inn property line. A sample taken from this pocket gave a gross alpha level of

*For convenience, reference is made to "buildings" meaning the former location of the designated structure.

TABLE 1

SUMMARY OF SURFACE SAMPLING RESULTS

FROM 1974 SURVEY

Contaminant	Units	Number of Samples	Range	Median	Average
			All TA-1 Locations		
Gross Alpha	pCi/g	51	1.1 to 23.9	2.8	3.6
^{239}Pu	pCi/g	55	0.11 to 224	0.25	8.7
Uranium	µg/g	45	1.6 to 55	6.2	8.7
^{241}Am	pCi/g	20	-0.12 to 2.4	0.07	0.33
^{226}Ra	pCi/g	13	0.8 to 5.2	2.1	2.1
^{137}Cs	pCi/g	51	0.26 to 12.5	0.89	1.4
Beryllium	µg/g	6	0.86 to 2.9	1.2	1.5
			Northern New Mexico Reference Locations		
Gross Alpha	pCi/g	7	1.8 to 4.0	2.6	2.6
^{239}Pu	pCi/g	7	0.010 to 0.034	0.025	0.024
Uranium	µg/g	7	1.4 to 2.9	1.7	2.0
^{241}Am	pCi/g	7	-0.47 to 0.11	0.01	-0.06
^{226}Ra	pCi/g	7	1.6 to 3.9	2.3	2.3
^{137}Cs	pCi/g	7	1.2 to 2.5	1.7	1.8
Beryllium	µg/g	7	0.58 to 1.2	1.0	0.96

88 000 pCi/g as measured by a zinc sulfide counter. This was identified as ^{239}Pu by radiochemistry, with one aliquot of the heterogeneous sample showing 80 000 pCi/g and another 122 000 pCi/g of ^{239}Pu. Isotopic ratios identified this contaminant as early-1945 Hanford plutonium. During the tank removal operation a pipe fragment contaminated to levels easily detected by portable alpha survey instruments was found nearby on the ground surface.

The discovery of even a small soil volume containing as much as 122 000 pCi/g of ^{239}Pu, the presence of alpha-contaminated debris on the surface, and the discrepancies between old records and actual conditions all combined to indicate that additional sampling and exploratory excavation would be necessary to define the extent of contamination.

The excavation was temporarily backfilled while a detailed plan for evaluating the entire TA-1 area could be developed.

Plan for Additional Survey and Cleanup Operations

A general plan for TA-1 was devised to identify all areas of contamination and to remove that contamination to levels that were not only considered safe, but in fact to remove such contamination to the lowest levels which LASL, in consultation with ALO and LAAO, found practicable to attain. The general problem and the plan was explained to property owners, the news media, and other interested individuals in a public meeting, and necessary permission to conduct the work was obtained from the various affected property owners.

Survey and Exploration

The effort to identify contaminated areas included several tasks. Detailed searches of health physics records and interviews with personnel who had worked in TA-1 were undertaken to define any possible sources of contamination for each TA-1 structure. Field exploration included extensive surveys with portable instruments, a sampling program consisting of collecting surface samples, core samples and auger samples, and the digging of deep exploratory trenches to be surveyed

with portable instruments or used for subsurface soil sample collection. First efforts were concentrated on adequately defining the areas found by the initial survey to be contaminated, in order to permit decontamination operations to get underway. Additional exploration then proceeded concurrently with decontamination.

Decontamination and Cleanup

The field cleanup plan started with the removal of all surface debris conceivably associated with TA-1. Remaining septic tanks would be located and removed. Contaminated areas would be excavated and the contaminated soil trucked to the LASL radioactive solid waste disposal site.

"As Low As Practicable" Concept

There are no official health standards for radioactive contamination in soil. For plutonium in soil, an interim standard of 230 pCi/g of ^{239}Pu in the top 1 mm of soil has been proposed by LASL* for surface contamination. This interim standard is based on a careful evaluation of possible pathways for transporting plutonium surface contamination into humans. In lieu of an accepted standard, ERDA has chosen to operate on the principal that uranium and plutonium contamination should be reduced to as low as practicable (ALAP) levels.

In the context of a field operation these levels are determined on a case-by-case basis with due consideration given to all relevant factors. The principal factors include

- the nature of the contaminant (plutonium and uranium differ substantially),
- the location of the contaminant (contamination on the surface and at depth must be considered differently),
- the ability to detect different types of radioactivity in field situations (field instruments are less sensitive than laboratory procedures, but they must be

*LA-5483-MS, A Proposed Interim Standard for Plutonium in Soils, J. W. Healy, January 1974.

relied on for the hour-to-hour decisions demanded by ongoing, costly field operations), and

- the cost of decontamination (in some situations it may be very expensive to remove contamination that is measurable but cannot be considered a serious hazard and judgments must be made balancing costs against expected reductions in already low levels).

For the TA-1 decontamination operation, these criteria have been applied by joint consultation of personnel from LASL and ERDA-LAAO and ALO offices. These decisions are reflected in part by the next section on current status. The ALAP concept is examined in greater detail in the Appendix.

STATUS OF TA-1 OPERATIONS, JANUARY 1976

A major portion of the exploration and decontamination of the privately-owned land in the TA-1 area has been completed. This section will summarize work to date and describe the present status of decontamination, largely by use of tables and maps. The Appendix includes additional detail on methods and operations. Two aerial photographs (Figs. 2 and 3) taken January 19, 1976, are provided with overlays identifying the major areas of interest that will be discussed.

Environmental Sampling

The environmental sampling, consisting of exploratory surveys, support efforts for cleanup, and post-cleanup documentation during 1975 included collection of samples from 1642 locations and 2546 separate field laboratory gross-alpha analyses. Details of sampling are given in Table 2. Additionally, 321 radiochemical analyses had been performed as of January 6, 1976, and are detailed in Table 3. Figure 4 maps the general TA-1 area and indicates the extent of the sampling program by symbols representing sample locations and trenches. Exploratory survey samples and some post-cleanup samples are plotted.

General Debris Cleanup

A total of about 50 000 kg (∿55 tons) of surface debris conceivably associated with TA-1 was removed during initial policing of the area. Only about 0.1% of this was found by portable field instruments to be contaminated. Most of the contamination (up to 20 mR/hr open window on a GM survey meter and up to 4000 c/m on an alpha survey meter) was associated with pipe shards.

Plutonium Contaminated Areas

D and D-2 Buildings

The current status of ongoing cleanup operations in the vicinity of former buildings D and D-2 is indicated in Figure 5. Within the area enclosed by the temporary work fence and north of the ERDA property line, about 7190 m^3 (9400 yd^3) of earth had been removed

TABLE 2

GENERAL SUMMARY OF ENVIRONMENTAL SAMPLING

FOR TA-1 CLEANUP OPERATIONS

Area	Number of Sampling Locations				Total Gross-α Analyses Performed*
	Surface	Core	Drillhole	Trench & Grab	
1974 Survey					
Total Area	55	67	2	0	159
1975 Operations Through 12-31-75					
Sigma Bldg.	14	2	0	63	79
HT Bldg.	9	0	0	0	9
TU and TU-1	3	4	0	43	50
Warehouse 19	1	0	0	14	15
J-2 Bldg.	5	4	0	86	95
Acid Sewer Trenches	0	0	0	43	43
Water Line Trenches	0	0	0	44	44
Q-Bldg.	3	0	0	0	3
Delta Bldg.	2	4	0	27	33
Manhold 189	0	0	0	4	4
Septic Tank 134	0	0	0	22	22
Septic Tank 135	0	0	0	24	24
Septic Tank 140	0	0	0	8	8
Septic Tank 141	0	0	0	17	17
Septic Tank 137	44	2	0	63	115
Septic Tank 139	0	0	0	3	3
H-Bldg.	2	1	13	0	72
Y-Bldg. Trenches	0	0	0	41	41
D-Bldg.	0	209	92	0	1100
D-2 Bldg.	225	4	0	319	575
Q-Bldg.	8	0	4	0	28
Septic Tank 138 & Hillside	9	0	0	87	96
Miscellaneous (roads, trucks, etc.)	12	0	0	58	70
1975 Totals	337	230	109	966	2546

*Total number of analyses is larger than sum of samples because cores and drillholes are sectioned vertically and each portion analyzed separately.

TABLE 3

SUMMARY OF RADIOCHEMICAL ANALYSES
PERFORMED FOR TA-1 CLEANUP OPERATIONS
THROUGH JANUARY 6, 1976
(EXCLUSIVE OF INITIAL SURVEY)

Analysis	Number of Analysis
Tritium	129
^{90}Sr	9
Uranium	60
Plutonium	120
^{137}Cs	3

as of January 16, 1976. Most of this area is now considered to be decontaminated to levels meeting ALAP criteria. The current status is shown by the sampling grids depicted on the map. One small portion (enclosed by dashed lines) in the SW corner of the area will be rescraped and excavation in the open area will be finished before the last surface samples are taken to complete documentation of the cleanup.

On ERDA property south and west of D-2 building, in the vicinity of septic tank 137, contamination remains to levels of about 500 pCi/g gross-alpha. Radiochemistry has identified this contamination as ^{239}Pu.

To the north and west of the temporary work fence a number of auger and core samples have indicated low levels (generally <100 pCi/g) of gross-alpha activity (see Fig. 4). These samples lie outside the D-building outline. Most of the alpha contamination in the D and D-2 areas was due to ^{239}Pu; however, the alpha activity outside the work fence has not yet been identified. Radiochemistry on selected samples has indicated that neither plutonium nor uranium is responsible for the observed alpha activity. Additional radiochemical analysis is in process to attempt identification of the activity.

Vicinity of Tank 138

Septic tank 138 was located beneath the floor of a storage shed attached to an office building which belongs to the Bonnie Jean Corporation (see Fig. 6). The tank itself was not contaminated but soil in the pit around it showed gross-alpha contamination to several hundred pCi/g. The contamination was removed. Gross-alpha analyses on 8 samples taken from the pit showed 6 to be less than the detection limit (about 20 pCi/g) and the other 2 with levels of 47 and 56 pCi/g. This was considered an ALAP level and the excavation was backfilled immediately because of its proximity to an occupied building. A concrete floor was poured inside the shed.

In an attempt to determine the source of contamination in the pit, trenches were dug both up- and down-slope of the tank location (see Fig. 6). Of 62 samples from the trenches only 3 showed any contamination and they were all on ERDA property. Surface samples taken from the hillside below the tank showed gross-alpha contamination up to about 4000 pCi/g. Radiochemical results indicate ^{239}Pu is the major contaminant. The samples from the pit were also submitted to radiochemical analyses and showed low levels of ^{239}Pu (up to 100 pCi/g) as indicated in Fig. 7. It has been determined that the private lands have been cleaned to levels meeting ALAP criteria. The source of the remaining cliffside contamination has not been established.

Tritium Contamination, D Building Area

The southwest corner of the Los Alamos Inn parking lot was excavated as part of this operation to remove plutonium contaminated soil. This excavation also removed fill soil which contained the highest concentrations of tritium in soil moisture (maximum sample 690 pCi/ml) discovered in auger samples. The highest tritium concentrations in samples from locations not excavated are about 120 pCi/ml. These remaining values are only a few percent of the ERDAM 0524 radioactivity Concentration Guide value of 3000 pCi/ml for tritium in drinking water in uncontrolled areas. It seems probable that the tritium may have originated in the vicinity of U and W buildings and was moved with fill material pushed to the southwest during demolition.

Uranium Contaminated Areas

HT Building

Approximately 27 m^3 (35 yd^3) of soil and a concrete slab contaminated with uranium was removed from the south end of HT building. The post-cleanup status is shown in Fig. 8. The area was determined cleaned to levels meeting ALAP criteria.

Sigma Building

Approximately 54 m^3 (70 yd^3) of soil contaminated with uranium was removed from within the area occupied by Sigma building. The post cleanup status in shown in Fig. 9. The area was determined to be cleaned to levels meeting ALAP criteria.

Warehouse 19 Building

Approximately 300 m^3 (392 yd^3) of soil contaminated with uranium was removed from an area just south of Warehouse 19. The post-cleanup status is shown in Fig. 10. The area was determined to be cleaned to levels meeting ALAP criteria.

TU and TU-1 Buildings

Approximately 2110 m^3 (2760 yd^3) of soil contaminated with uranium has been removed from the area surrounding TU and TU-1 buildings. The present status is shown in Fig. 11. Some known uranium contamination remains at depths of 3 to 10 ft at the northern edge of the presently excavated area. The extent of this contamination has not yet been fully defined. Some additional work will be required to follow the contamination which might be following an old drainage course.

J-2 Building Area

Some mixed activity contamination was removed from the J-2 building area. Both gross-gamma and gross-alpha contaminated pipe and soil were found and removed from trenches dug to determine whether the former acid sewer line had been removed. Figure 12 shows the trenching and other sampling in the J-2 area. Figure 13 shows a cross-section of the long trench after cleanup. The area was determined to be cleaned to levels meeting ALAP criteria.

Septic Tanks

A total of eight TA-1 septic tanks have been located and removed during the cleanup operation. Three of the tanks were contaminated: tanks 137 and 138 were plutonium contaminated and have

been discussed, tank 140 was uranium contaminated. Table 4 summarizes the disposition of the tanks. Locations are indicated on Fig. 4.

ARMS Survey

The TA-1 area was included in an aerial radiation survey performed in October 1975 by EG&G Inc., using the Aerial Radiation Monitoring System (ARMS). Interim reports and preliminary maps indicated that no radiation other than expected natural radiation background was detected in the TA-1 area.

Air Quality Documentation

Airborne gross-alpha activity was monitored near the major plutonium excavations at D and D-2 building areas. Measurements throughout the period to date showed levels consistent with normal background gross-alpha activities as determined by the LASL-operated 26-station environmental air sampling network in Los Alamos County.

Findings During Survey and Decontamination

The present status of areas cleaned or undergoing cleanup is presented in the next section, and some details of contamination found during cleanup are given in the Appendix. However, it is possible to argue, with certain assumptions, that experience during the operations has indicated that no situations posing hazard to human health or safety were present. It is not considered likely, even without the special precautions taken during the cleanup work, that conventional construction activities would have created any hazards for workers or the general public. Because the contamination was highly localized, any excavation by earth-moving equipment resulted in dilution of the contaminated soil. Conceivably, disturbance of a spot of contamination could create momentary airborne concentrations higher than Concentration Guides, but time weighted average concentrations over periods of several hours would be well below Concentration Guides

TABLE 4

SUMMARY OF DISPOSITION OF

SEPTIC TANKS FOUND

IN TA-1 CLEANUP OPERATION

Tank Number	Contamination	Status
134	None	Removed 9/26/75
135	None	Removed 9/26/75
137	Plutonium in sludge and water (∿100 pCi/g in sludge)	Original discovery, removed 8/11/75
138	Plutonium in surrounding soil	Removed 10/16/75
140	Uranium in sludge and water (60 000 count/min Phoswich)	Removed 1/20/76
141	None	Removed 9/29/75
142	None	Removed 1/16/76
Unknown (in TU Area)	None	Removed 11/10/75

FUTURE PLANS

Plan for Additional Exploratory Sampling

Additional sampling will be necessary to complete the evaluation of possible contamination in the former TA-1 area. The major components of the program described briefly here are in addition to the sampling that will be required for final documentation of any areas currently being cleaned or known to require cleanup. (Refer to Fig. 4 for general locations.)

A thorough sampling of locations suspect because of past history will be completed to give reasonable assurance that such locations have been evaluated to the best of our ability. These locations include the areas between H and Theta buildings (general location of old acid sewer line leak), and the southwest corner of the J-2 area (possible near-surface contamination).

Areas that have received minimal sampling to date and areas that have potential for water transport will be investigated more thoroughly. These include the warehouse area south of TU building, the area between D-5 and Theta buildings, and the area between X and D-8.

The hillside (on ERDA land) below septic tanks 137 and 138 will have to be sampled more to fully define the extent of known plutonium contamination.

Some further sampling may be required to the north and west of D-building. A large number of samples in that area indicated low-level (<200 pCi/g) gross-alpha activity. However, radiochemical studies of a number of the positive samples indicates the activity is neither plutonium nor uranium. Additional analyses are underway to determine the isotope(s) reponsible for this contamination. Determinations of sampling needs will depend on the results of that work and on what may be found in additional exploratory trenches dug to follow the path of the acid sewer line from D-building.

The extent of remaining uranium contamination in the TU area will be further defined by auger drilling.

Additional sampling for tritium contamination will be limited to vegetation sampling (∿10 leaf, needle, and grass samples) in the vicinity of the Los Alamos Inn buildings. This is the area of U and W buildings, the likely former sources of tritium contamination. During decommissioning a great deal of soil from the vicinity of U and W buildings was bulldozed to the southwest. With just a thin remaining layer of soil (1-2 ft above the tuff) vegetation sampling is considered suitable for identifying any contamination because it should give tritium concentrations representative of soil moisture in that area. If the results of this sampling indicate any significant contamination, this approach will have to be reconsidered.

All soil samples will be analyzed for gross-alpha activity in the field laboratory trailer. Urgent analyses will be done, as it has in the past, by the Environmental Studies Group; low-priority ones will be done by a commercial laboratory.

Table 5 summarizes the currently estimated magnitude of the proposed sampling effort.

Should these efforts reveal additional areas of contamination, further sampling will be done. Should any samples contain a great deal of soil moisture, tritium analyses will be performed.

Plan for Future Excavation and Restoration

The remaining areas of contaminated earth in the D and D-2 areas will be removed and then the area will be restored to its approximate original contours with clean fill. Erosion control and drainage structures will be constructed to ensure the stability of fill on private land.

Trenching along the acid sewer trench from D-building will be done to assure that no more hot spots or contaminated debris from the former sewer line remain in the D-building area.

TABLE 5

PROGRAM FOR ADDITIONAL SOIL SAMPLING TA-1

Location	Type and Number of Samples							Gross Alpha Analyses	Plutonium Chemistry Analyses*
	Surface Samples	Core		Auger Drill		Trench			
		No.	Samples	Holes	Samples	Length	Samples		
TU Area				6	60			60	
137, 138 Hillsides	40	15	60	6	30			130	15
Between H & Theta				10	40	75'	125	165	5
SW of J-2				6	30			30	5
Warehouse Area So. of TU				10	50			50	
Between D-2 & Theta				10	50			50	
Water Drainage Areas	50			25	125			175	10
General Auger Grid				15	120			120	10
Between X & D-8				6	30			30	5
Totals	90	15	60	94	535		125	810	50

*Number of samples submitted for chemistry analyses is dependent upon results of gross alpha analyses; if many above background samples are found, the chemistry load would increase.

All contaminated lines and soil associated with septic tank 140 will be removed. The extent of the known seams (and any others that might be found) of uranium contamination near TU will be evaluated by further sampling.

A decision concerning further action in connection with contamination on the hillsides (ERDA land) below the location of former septic tanks 137 and 138, will be made after further definition of the extent of the contamination. The hillside is steep, with vertical drops of as much as 16 m (~50 ft) in several places, (see Fig. 14).

All areas that have been filled will be seeded with native grasses similar to the grass presently on the site.

Final Administrative Survey

After cleanup operations are considered complete, a final field survey using portable instruments will be conducted under the direct field supervision of administrative-level personnel. This survey will cover the entire undeveloped portion of the TA-1 area to ensure that no major surface contamination has been inadvertently overlooked.

Cost Estimates

The estimated costs for completing the anticipated remaining cleanup of private land are detailed in Table 6. The projected cost for this effort is $350,000 and assumes that Zia and LASL nonincremental costs will be absorbed by LASL. Further testing and monitoring will be performed and additional funding may be required in FY-1976A or FY-1977 if additional safety or health hazards are encountered.

TABLE 6

PROJECT COST

DECONTAMINATION OF FORMER

TECHNICAL AREA 1

LOS ALAMOS SCIENTIFIC LABORATORY

ZIA SUPPORT CONTRACTOR COSTS

ITEM	DESCRIPTION OF WORK	BASE COST DIRECT	BASE COST ESCL	SUB TOTAL	CONT	TOTAL
1	Remaining Work					
	(a) Removal of contaminated material & D Building, TU Building and Tank #140 outfall	10	0	10	2	12
	(b) Retaining wall and drainage structure below D-2 Building	14	1	15	4	19
	(c) Fill @ D-2 Building, D-Building, and TU Building	36	0	36	7	43
	(d) Drainage ditch, D-Building to canyon	4	0	4	1	5
	(e) Repave parking lot	4	0	4	1	5
	(f) Final cleanup and seeding, all areas on private land	6	0	6	1	7
2	Expenditures and Obligations thru January 23, 1976	222	0	222	1	223
	Reserve					36
	TOTAL PROJECT COST					350

$ IN THOUSANDS ESCL (ESCALATION) CONT (CONTINGENCY)

LOS ALAMOS SCIENTIFIC LABORATORY COSTS — Nonincremental Costs

LASL Budget	LASL	Zia	Grand Total
To Date	96	62	158
Projected Cost	70	26	96
Total	166	88	254

CONCLUDING STATEMENT

It must be stressed that it will be impossible to give absolute assurance that all contamination has been or will be found. Contaminated lines have been found 50-60 ft from their indicated location on drawings. An uncharted septic tank was accidentally found. On general area surveys, surface contamination was found behind Warehouse 19 and on the hillside below septic tank 138, and we have no clues as to the source. Construction debris (concrete supports, steam pipe insulation, etc.) in the fill in the D-building area has been found to be contaminated. Due to topography, it is believed that debris from other areas was pushed in over D-building debris. About 1000 to 2000 yd^3 of fill and debris from the southwestern portion of the filled area near D and D-2 were used for fill along Trinity Drive from the Los Alamos Inn to the Trinity Village Apartments during the 1966 widening-repaving project as recalled by the then Zia Road Section Field Superintendent. Based on experience gained during this operation it is considered likely that pockets of highly contaminated soil would have been greatly diluted by construction activities involved in the gathering and spreading the backfill for road construction.

All likely sources of contamination have been or are being investigated. All known contamination has been or is being reduced to levels meeting ALAP criteria. It is conceivable that other people or agencies might, in the future, find contamination that could be publicly embarrassing although it is highly unlikely that any health hazard would be encountered.

In the absence of accepted standards for plutonium and uranium contamination in soil, professional judgment has been used to define the concentrations of these contaminants in soil meeting ALAP criteria and the extent of required excavation in different areas.

Because of the subjective nature of the ALAP decisions and the fact that there can be widely divergent opinions as to what is ALAP, LASL, with the concurrence of ERDA's Albuquerque Operations Office and Los Alamos Area Office recommends that no outside committee or group be brought in to review and evaluate the TA-1 cleanup operation.

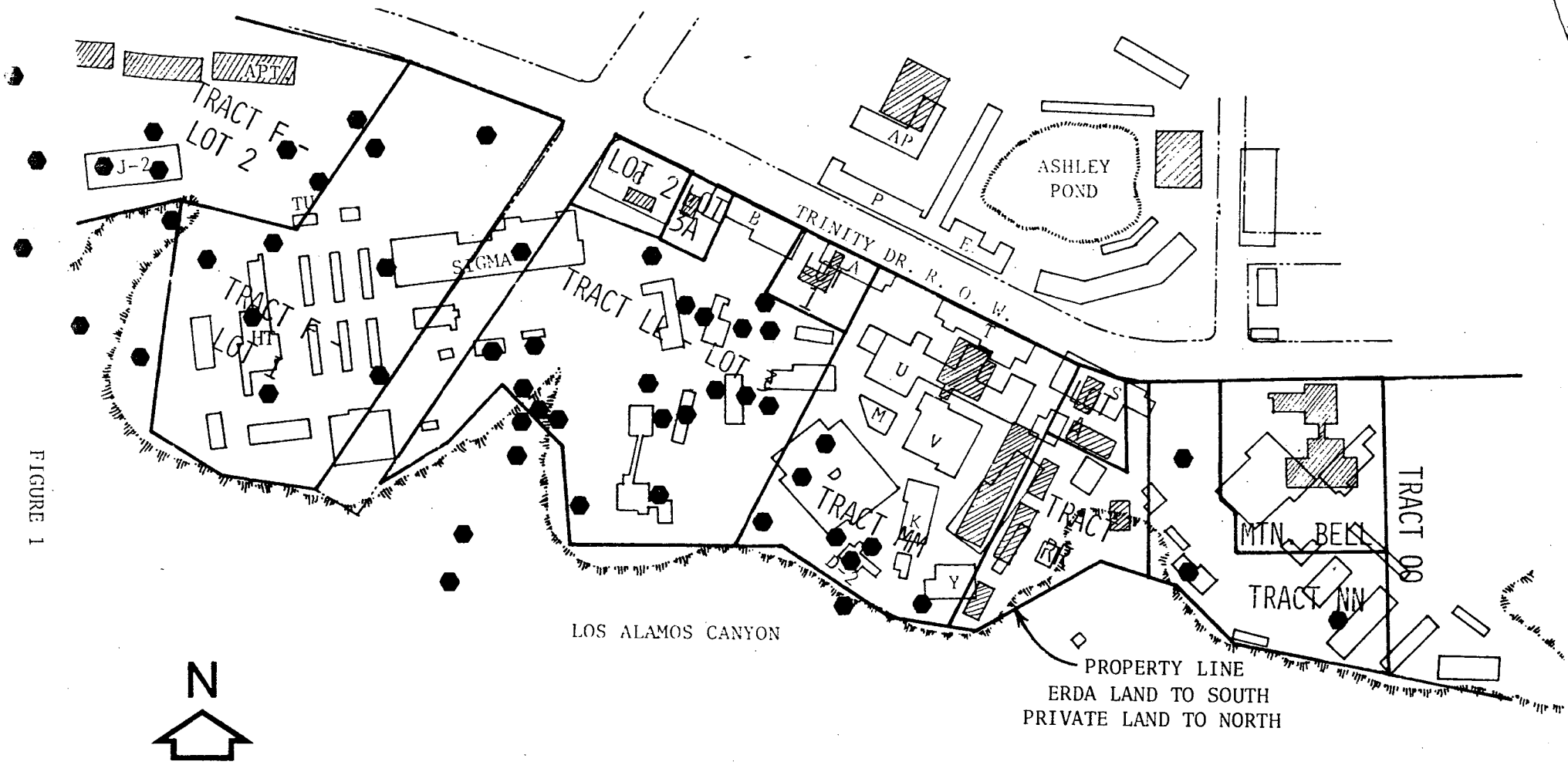


FIGURE 1

TA-1 BASE MAP

STANDING BUILDINGS

DEMOLISHED TA-1 BUILDINGS

SAMPLING STATIONS FOR INITIAL 1974 SURVEY

GRAPHIC SCALE

M	0	61	122	183
FT.	0	200	400	600

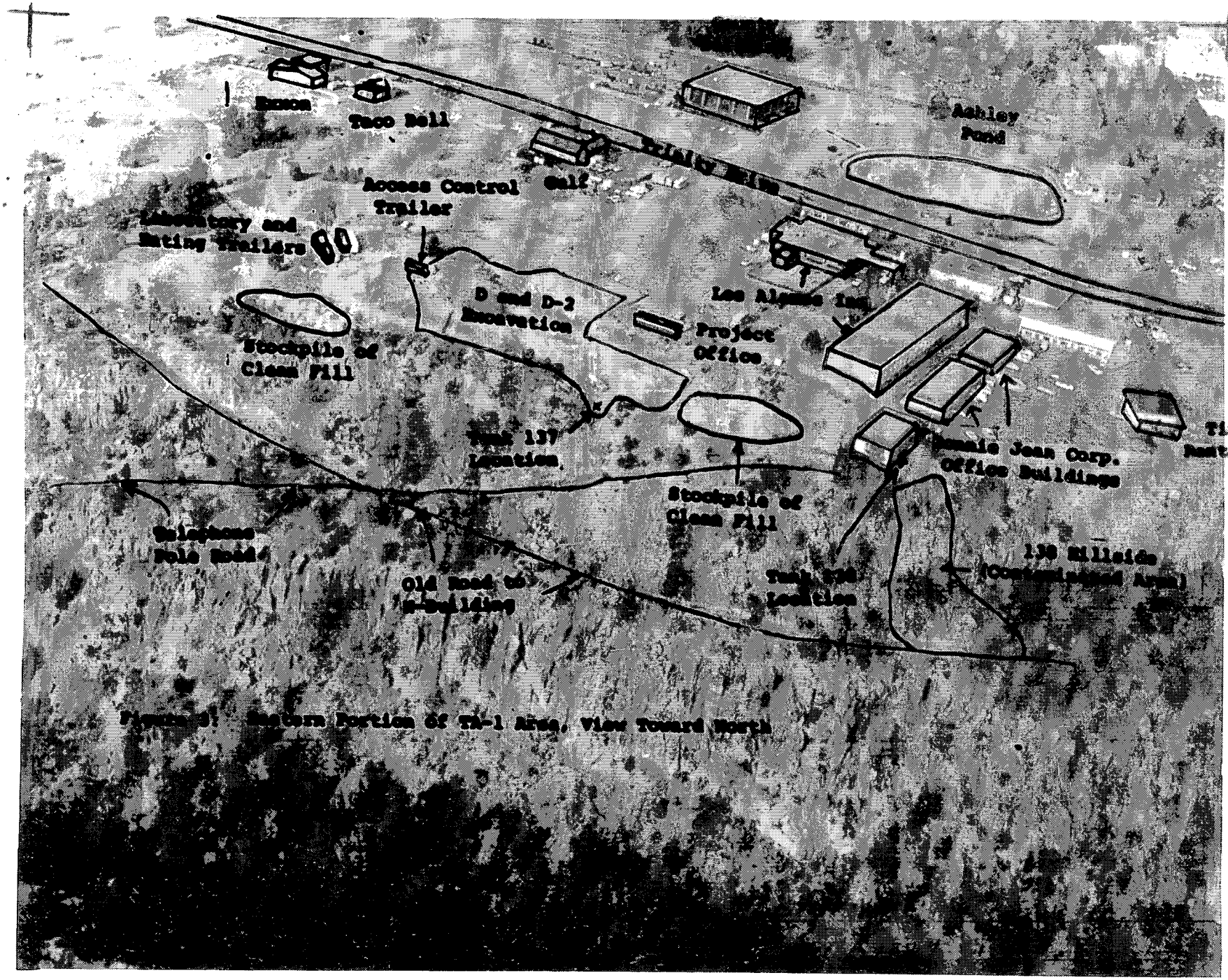
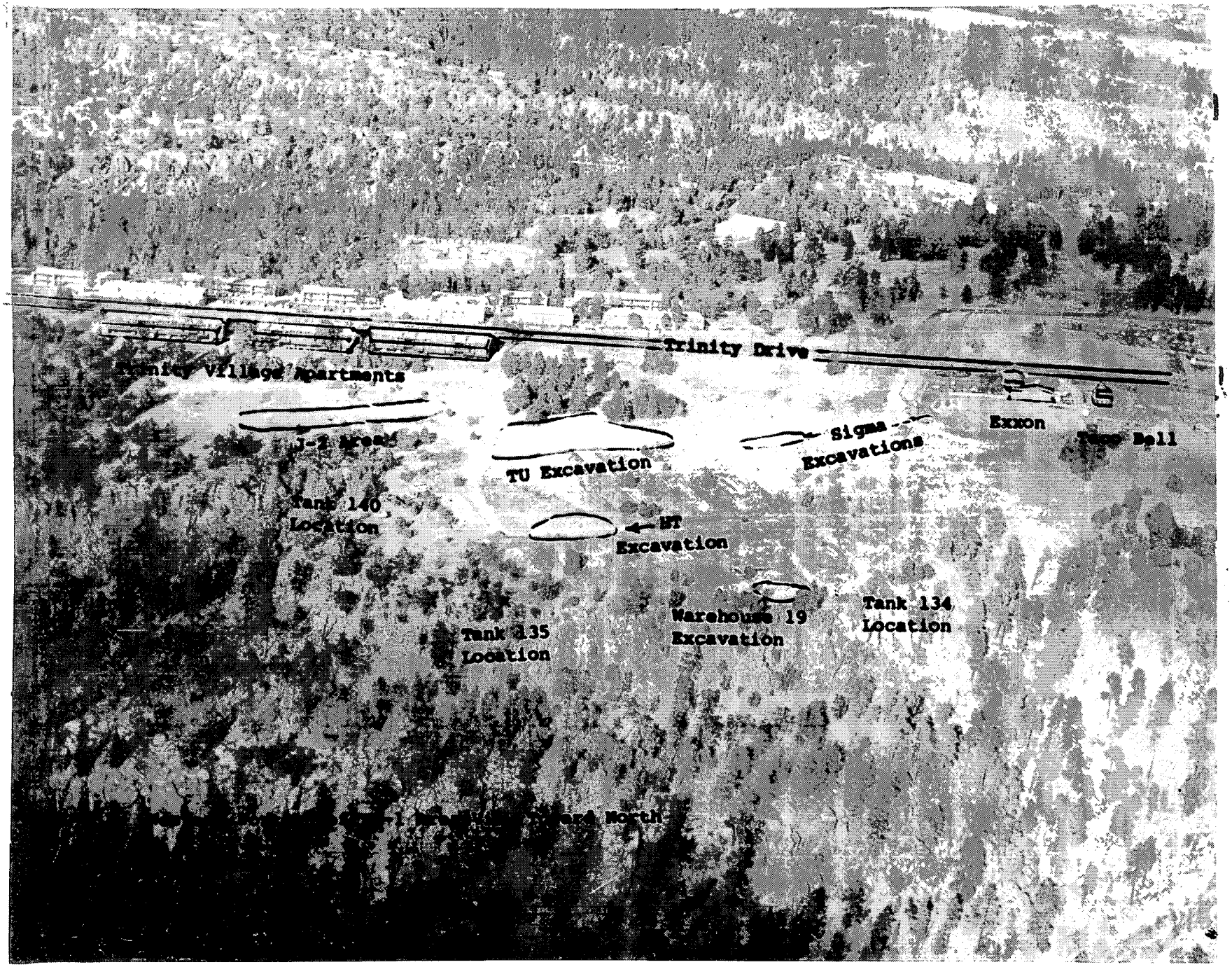
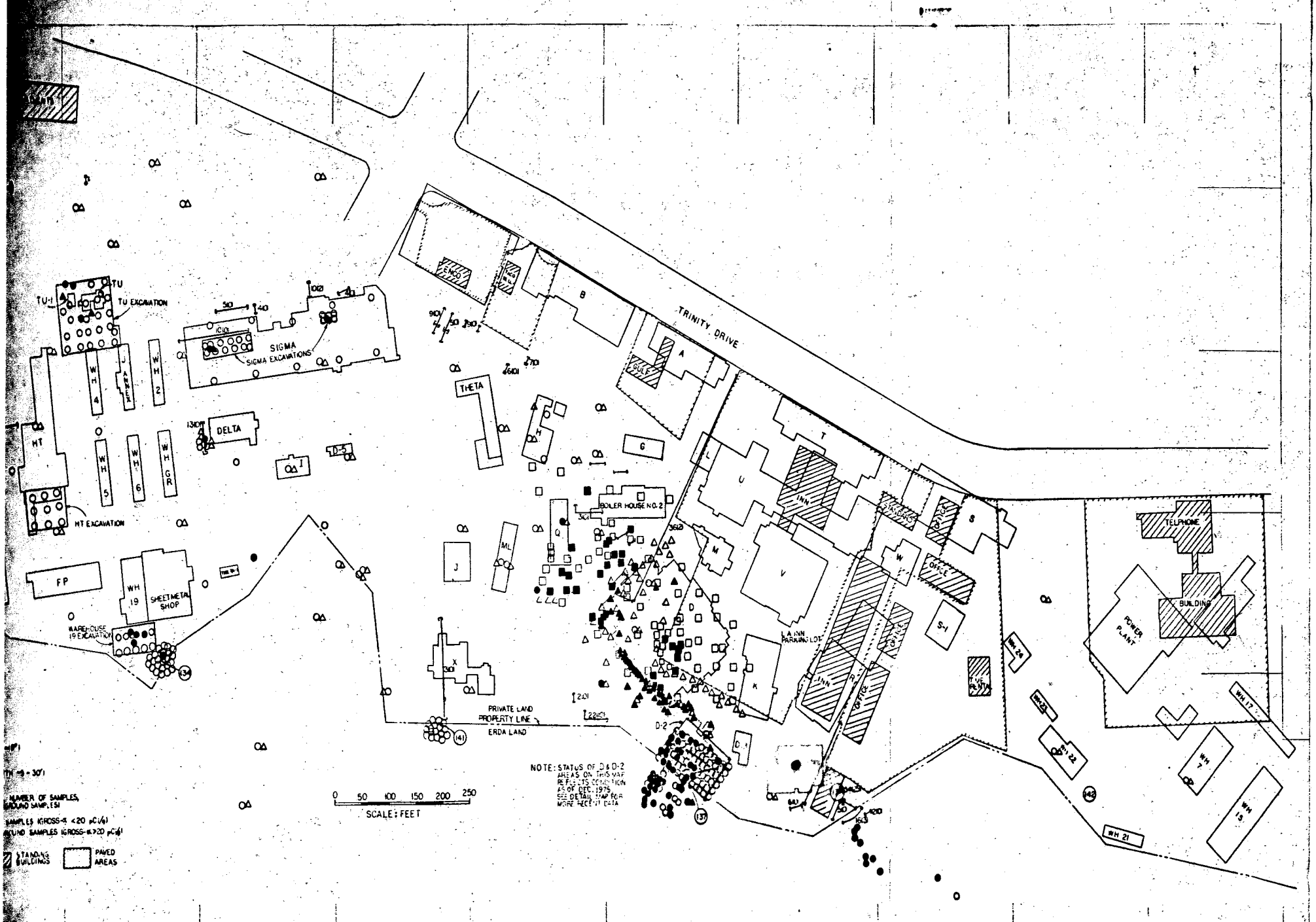


Figure 3: Eastern Portion of TA-1 Area, View Toward North


Trinity Drive
Trinity Village Apartments
J-2 Areas
TU Excavation
Sigma
Excavations
Exxon
Tank 140
Location
HT
Excavation
Tank 135
Location
Warehouse 19
Excavation
Tank 134
Location



Best Available Copy

FIGURE 4

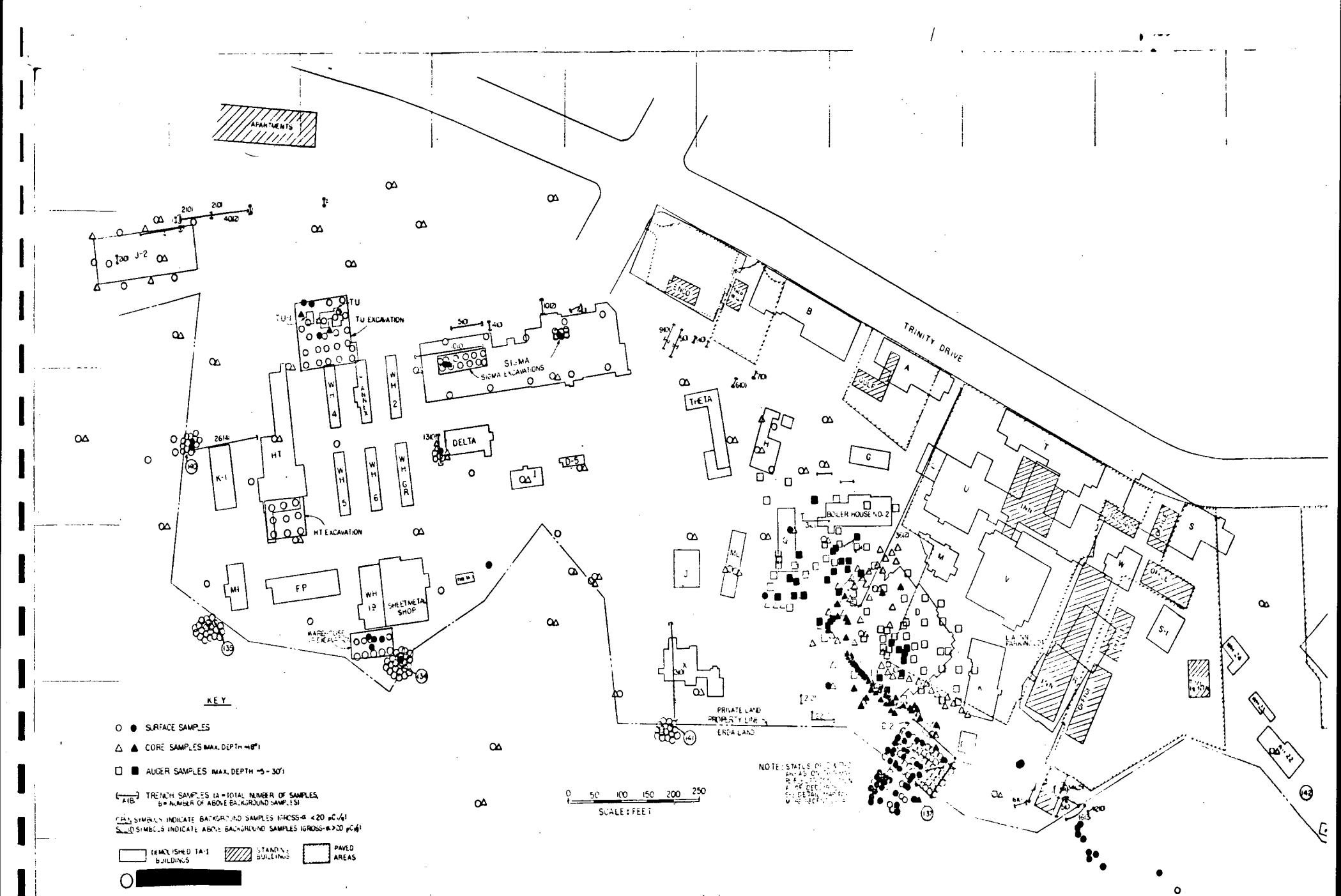


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FIGURE 4

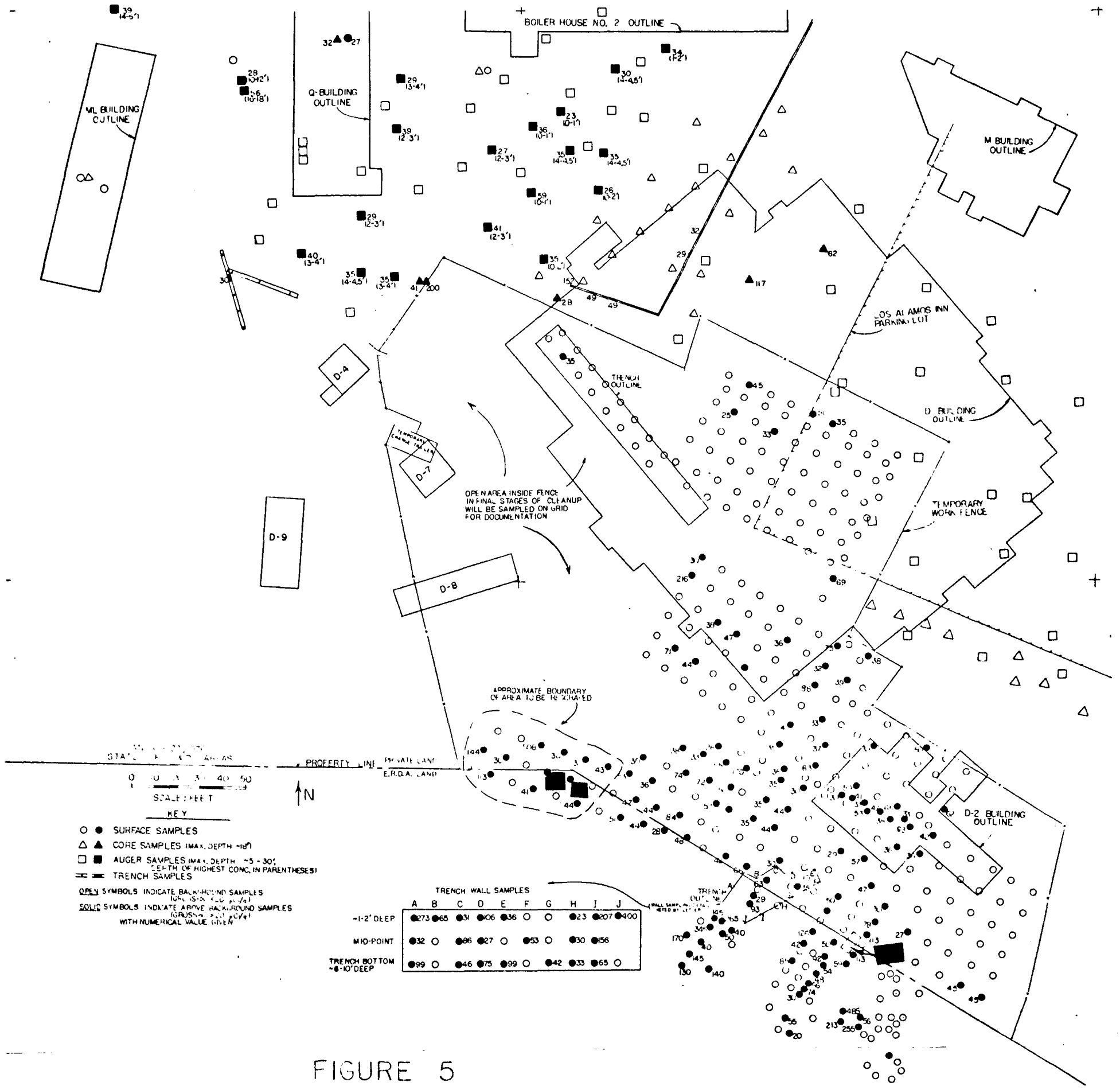
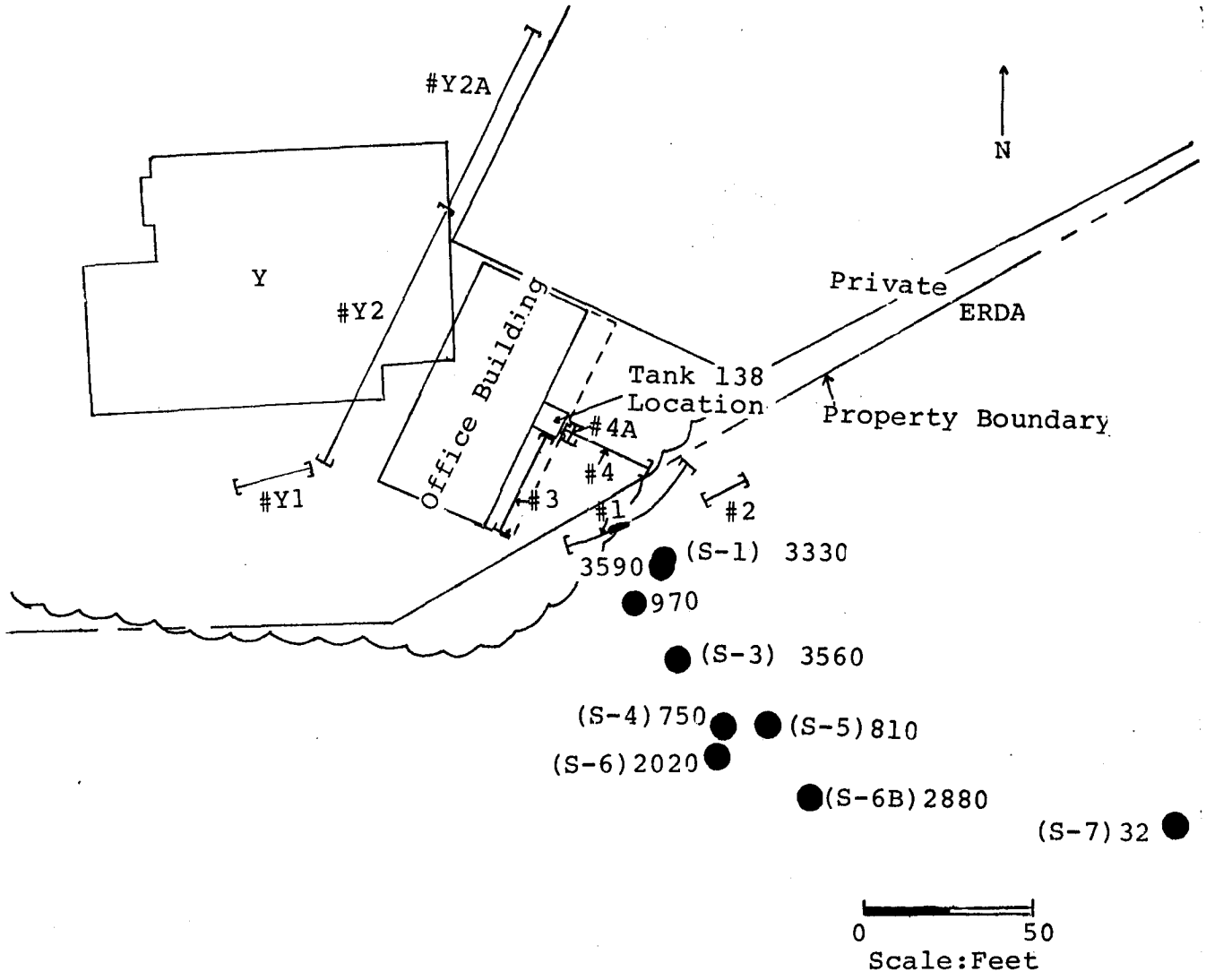

BOILER HOUSE NO. 2 OUTLINE
ML BUILDING OUTLINE
Q-BUILDING OUTLINE
M BUILDING OUTLINE
LOS ALAMOS INN PARKING LOT
D BUILDING OUTLINE
D-2 BUILDING OUTLINE
D-4
D-7
D-8
D-9
TRENCH OUTLINE
TEMPORARY WORK FENCE
OPEN AREA INSIDE FENCE IN FINAL STAGES OF CLEANUP WILL BE SAMPLED ON GRID FOR DOCUMENTATION
APPROXIMATE BOUNDARY OF AREA TO BE EXCAVATED
PROPERTY LINE
PRIVATE LAND
E.R.D.A. LAND
N
SCALE: FEET
KEY
SURFACE SAMPLES
CORE SAMPLES (MAX. DEPTH ~18')
AUGER SAMPLES (MAX. DEPTH ~5 - 30'; DEPTH OF HIGHEST CONC. IN PARENTHESES)
TRENCH SAMPLES
OPEN SYMBOLS INDICATE BACKGROUND SAMPLES
SOLID SYMBOLS INDICATE ABOVE BACKGROUND SAMPLES
WITH NUMERICAL VALUE GIVEN
TRENCH WALL SAMPLES
A B C D E F G H I J
~1-2' DEEP
MID-POINT
TRENCH BOTTOM ~8-10' DEEP

FIGURE 5



SURVEY DETAIL OF TANK 138 VICINITY

Summary

10 surface samples on hillside, 9 >background. Lab analyses on selected samples identify Pu-239 as major contaminant

Trench 1, 16 samples, 3 >background

Trench 2, 2 samples, all background

Trench 3, 5 samples, all background

Trench 4 & 4A, 19 samples all background

Trench Y1, 6 samples, all background

Trench Y2, 15 samples, all background

Trench Y2A, 22 samples, all background

See separate documentation for immediate area of tank.

Key

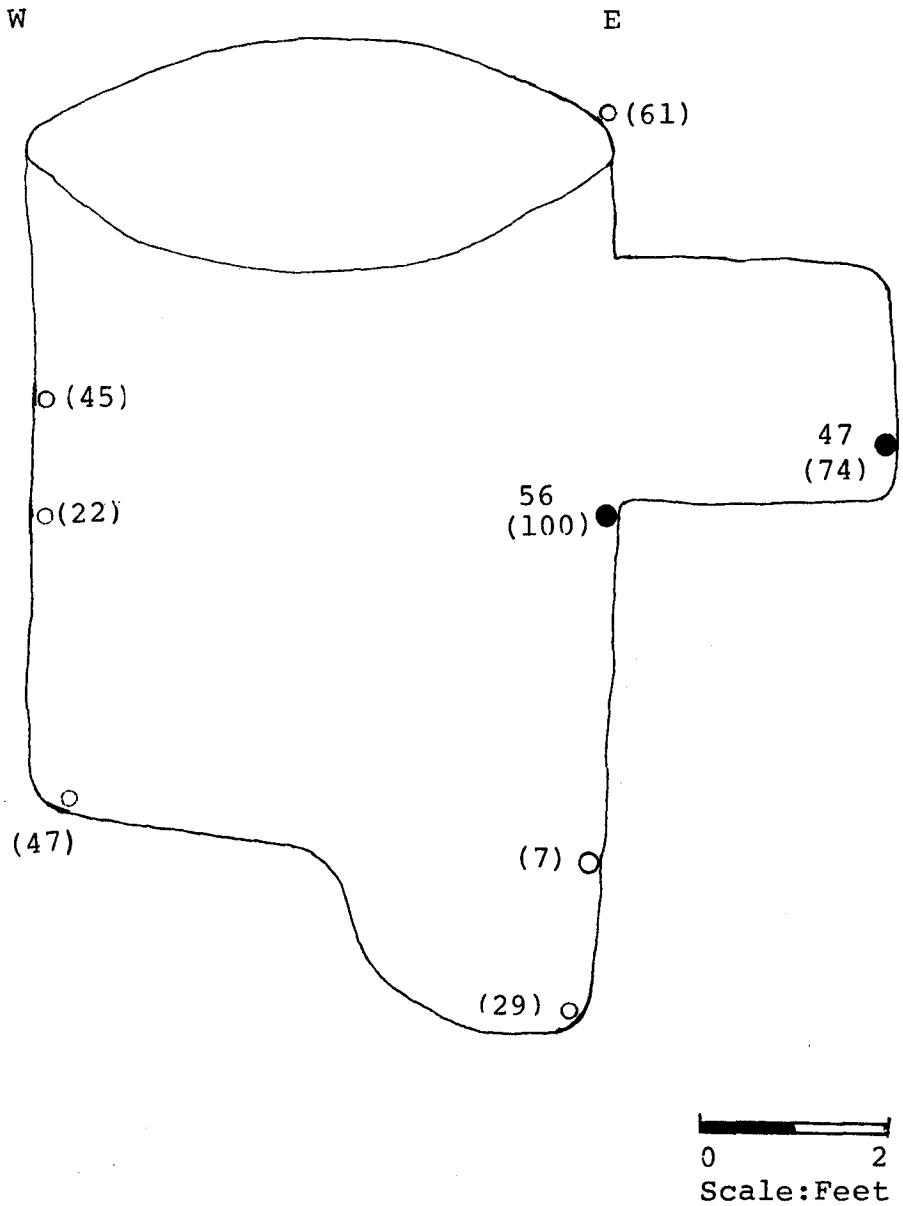
○ Background surface sample (<20 pCi/g)

● Above background surface sample

#5 Trench location and identification

Above background trench sample

Figure 6



POST-CLEANUP DETAIL OF TANK 138 PIT

Summary

8 samples, 2 >background
Radiochemistry performed

Key

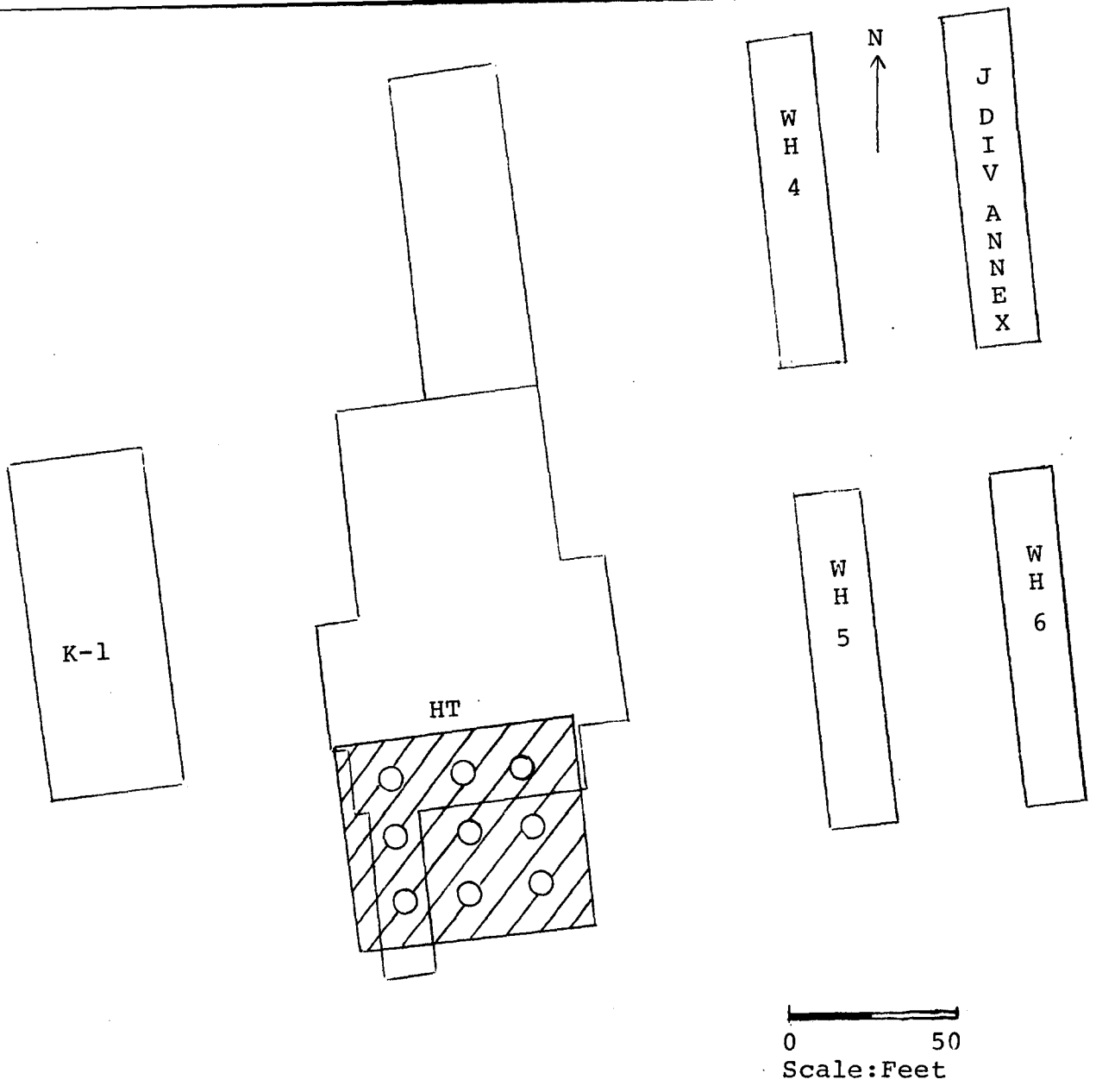
○ Background Gross-α (<20 pCi/g)

● Above Background Gross-α (>20 pCi/g)

22 Gross alpha in pCi/g

(22) Pu-239 in pCi/g

Figure 7



POST-CLEANUP DETAIL OF HT BUILDING

Summary

Contamination located by field instruments and identified as uranium, concrete slab and soil removed 0.5 to 2.5 feet deep, total 35 cubic yards.

9 surface samples, all background

Key

○ Background surface sample

▨ Excavated Area

Figure 8

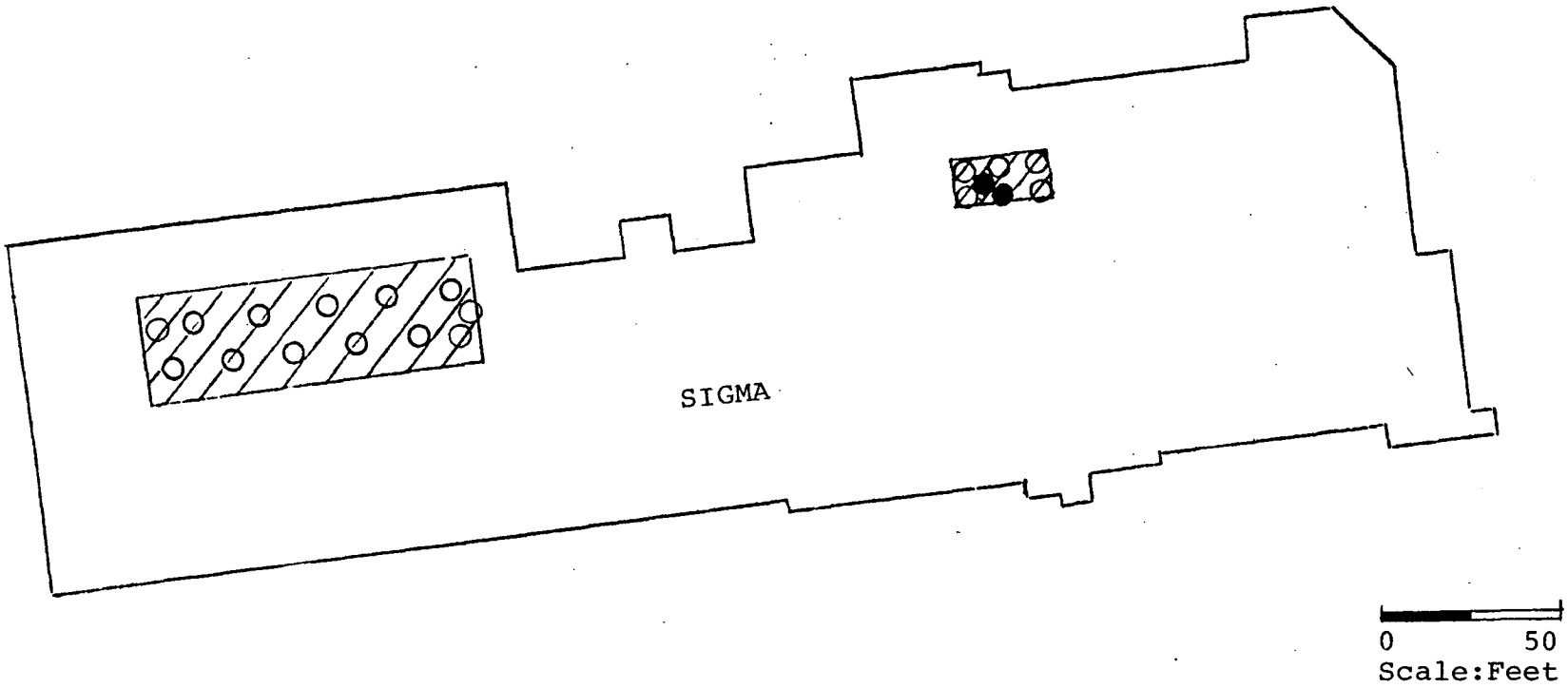


Figure 9

POST-CLEANUP DETAIL OF SIGMA

Summary

Soil removed to depth of 0.5 to 1.5 feet in two areas, 29' x 92' and 12.5' x 26', total 70 cubic yards

13 surface samples from large area all background

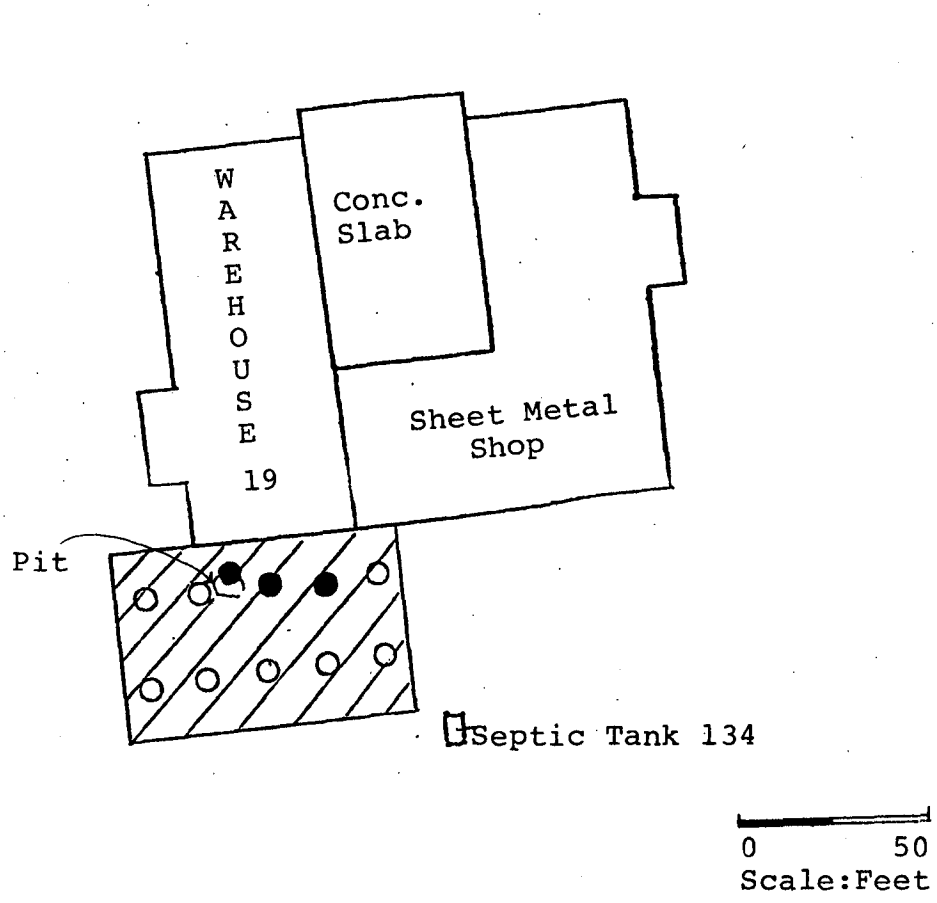
7 surface samples from small area, 2 >background values of 23-28 pCi/g

Key

○ Background surface sample

● Above background surface sample (>20 pCi/g)

Excavated area



POST-CLEANUP DETAIL OF WAREHOUSE 19

Summary

Soil removed 0.5-2 feet deep from 48' x 73' area. Pit about 4' x 6' x 6' deep excavated to follow large joint. 392 cubic yards total.

10 surface samples, 8 background, 2 above background, 30-42 pCi/g

3 samples from pit, 2 background, 1 above background, 64 pCi/g

Septic tank 134 removed, no evidence of any contamination

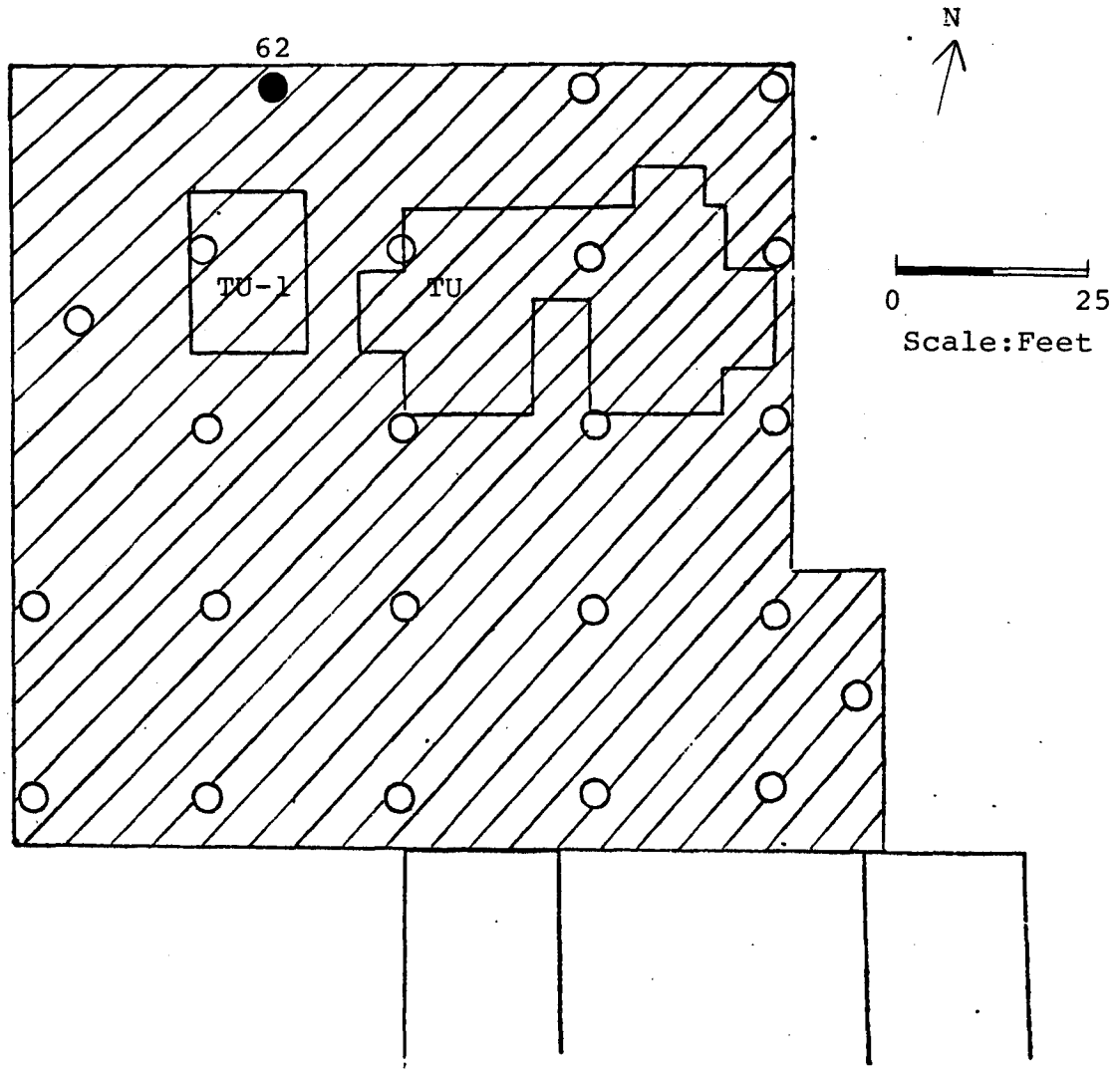
Key

○ Background surface sample (<20 pCi/g)

● Above background surface sample (>20 pCi/g)

Excavated area

Figure 10



POST-CLEANUP DETAIL OF TU AND TU-1

Summary

Soil removed to depths of as much as 8 feet in area about 100 feet square, total 2760 cubic yards as of 12/1/75. Some removal still to be accomplished north of TU-1.

22 surface samples, all background in area considered completed, 1 >background in area needing further work.

Key

○ Background surface sample (<20 pCi/g)

● Above background surface sample (>20 pCi/g)

Excavated Area

Figure 11

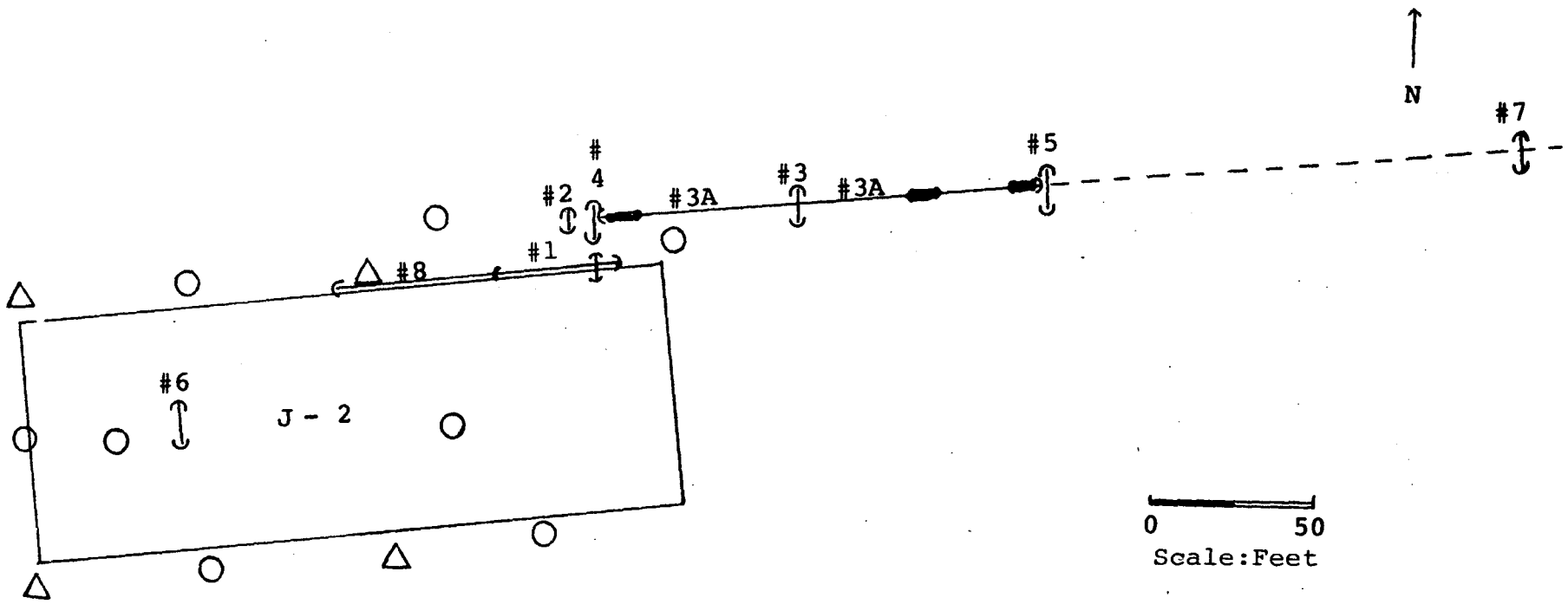


Figure 12

Survey Detail of J-2 Building Area

Summary

8 Surface Samples, All Background

4 Core Samples, All Background

Trench 1, 8 Samples, All Background

Trench 2, 1 Sample, Background

Trench 3, 2 Samples, All Background

Trench 3A, 40 Samples, 7 > Background
(See Cross-Section)

Trench 4, 2 Samples, All Background

Trench 5, 1 Sample, Background

Trench 6, 2 Samples, All Background

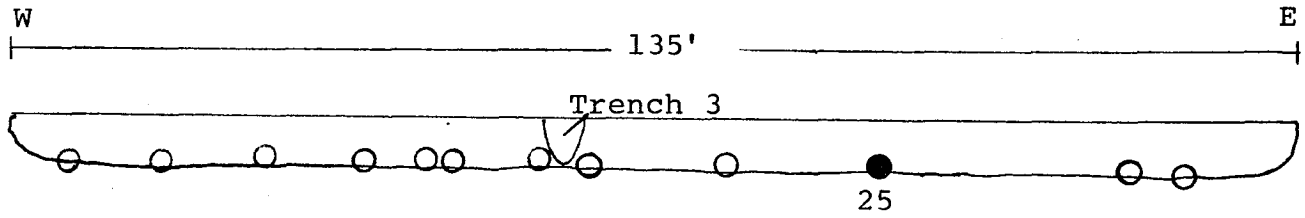
Key

○ Background Surface Sample (<20 pCi/g)

△ Background Core Sample (<20 pCi/g)

#1 ⟵⟶ Trench Location and Identification

⟵▬⟶ Above Background Trench Sample



Post Clean-Up Detail
Cross-Section of J-2
Trench 3A After
Pipe Removal
Looking North

0 20
Scale:Feet

○ Background

● Above background
(≥ 20 pCi/g) with
values in pCi/g

Figure 13

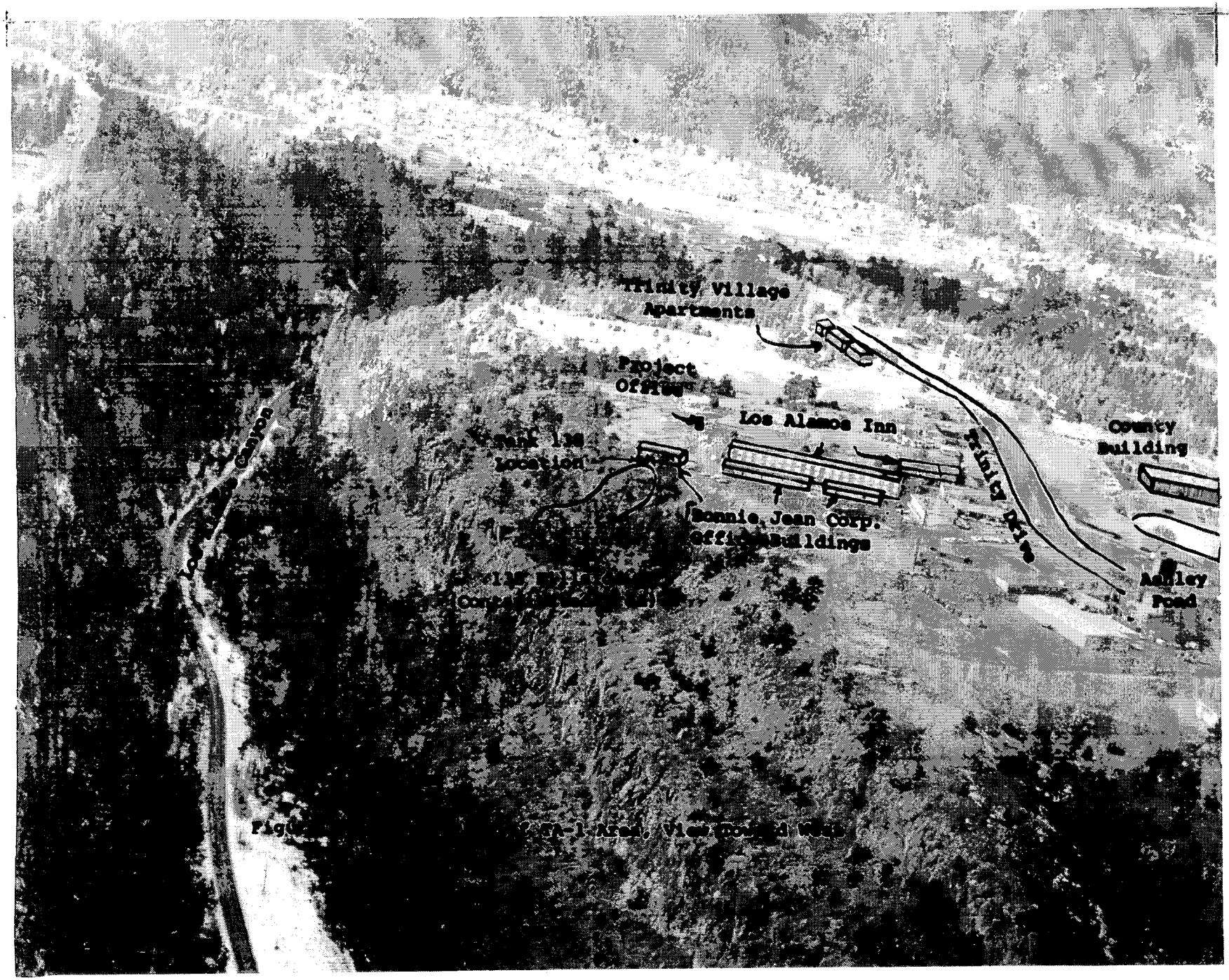


Figure [illegible] SA-1 Area, View Toward West

APPENDIX

Methods, Procedures, and Equipment

Survey and Analytical

A phoswich probe was developed as the primary portable field survey and monitoring instrument for TA-1 operations. The phoswich probe (a sandwich of two phosphors), a commercially available laboratory device, was adapted for use as a field detector by putting the electronics in a vehicle and equipping the probe with a long cable. The threshold of detection of the phoswich is about 1000 pCi/g for ^{239}Pu and about 500 pCi/g for normal uranium when the activity is on the surface. It will also respond to gamma emitting isotopes.

The phoswich probe is used to survey large areas for any gross indications of Pu, U, or gamma activity. During trenching or other excavations it can be used to guide the digging to follow or outline areas of major contamination. The probe is used for surveys after excavation to provide preliminary determinations that an area has been successfully cleaned, before any additional soil samples are collected. The phoswich is also used to monitor vehicles leaving fenced contaminated areas where work is in progress.

Soil samples are collected by three techniques:

1. a stainless steel scoop is used to obtain surface samples to depths of about 2 cm (∿1 in.) or to collect grab samples from the walls or bottoms of trenches,
2. PVC plastic pipe 24-in. long and 1-in. diameter is used to collect soil core samples by driving as deep as 18 in. It can be sawed into desired depth increments for analysis,
3. a truck-mounted rig is used to drill auger holes as deep as 30 ft. The bit is used to drill down in controlled increments followed by spinning the auger to lift the cuttings from the hole. Cuttings are sampled, generally in 2-ft increments, to obtain an approximate depth profile of contamination. Geologic logs are kept of the type of material encountered.

Survey and exploratory samples are collected by any of the three techniques as are appropriate to the sampling location, depth of interest, or conditions such as frozen or rocky soil. Post-cleanup samples are normally surface samples taken on a suitable grid pattern.

Gross-alpha analysis of soil samples is done in a laboratory trailer on site. A 10 cm (4-in.) plastic Petri dish is filled with soil, dried under an infrared lamp and counted for gross alpha activity by a Ludlum zinc sulfide phosphor-photomultiplier detector for five minutes. The 3σ limit of detection is $\sim$20 pCi/g. Conventional radiochemical and instrumental procedures and equipment are used in the laboratory to identify specific isotopes and to measure concentration value with increased accuracy.

Decontamination Procedures

Excavation in large areas is done with ripper and blade attachments on a crawler tractor. The area and material are kept wet by hose sprays from a water truck or a fire hydrant to suppress any dust generated by handling. The soil, tuff, and debris are loaded by front-end loaders into dump trucks. Smaller areas or trenches to follow lines have been excavated by a backhoe, or in some cases by hand. The contaminated material removed by these operations is also loaded into trucks. The truck beds are lined with sheet plastic and the load is securely covered during transit to prevent spillage of soil on the roadways while the truck is enroute to the contaminated solid waste disposal site--a round trip distance of 24 km (15 miles). Part of the cost of the project is the replacement of pit capacity used for this purpose.

Restoration of excavated areas involves backfilling the excavation with clean fill material to approximately the original surface contours. The fill material is obtained from a stockpile at TA-53. The fill is suitably compacted and any required erosion control measures taken. Reseeding will complete the restoration.

Safety and Health Physics Protection

The excavation operations in the D and D-2 building areas required the erection of a temporary work fence to control inadvertent entry into the contaminated area where heavy equipment was working.

Field labor crews are provided standard health physics protection such as anticontamination clothing, working area air monitoring, and personnel monitoring.

Air sampling stations have been established at the three commercial establishments nearest to the D and D-2 excavation areas in order to provide air quality information about the nearest areas open to the general public. Airborne gross-alpha activity measurements at these stations have shown levels consistent with gross-alpha activities from the LASL-operated 26-station environmental air sampling network in Los Alamos County. These measurements have all been within the range of normal background for the vicinity.

Narrative of Operational Aspects in 1975

Written notice of a more detailed survey and a cleanup operation at old TA-1 was given to the affected landowners. A public meeting of owners, news media, and other interested individuals was held on September 5, 1975. Response was favorable. The plan for an intensive and elaborate survey of the area using sensitive instrumentation and a detailed record search was described. The onsite field effort involving general cleanup of surface debris, removal of septic tanks, extensive survey with portable field instruments, a soil sampling program consisting of surface samples, core samples, auger samples, and digging of deep exploratory trenches was also discussed. It was emphasized that contaminated areas were to be excavated and contaminated soil trucked to the contaminated solid waste dump.

Operations at TA-1 began September 9, 1975, with cleanup of surface debris conceivably associated with the TA-1 project. A total of about 50 000 kg (∿55 tons) of this debris was hauled to the contaminated solid waste dump at TA-54 on Mesita del Buey. Only about 50 kg (25 lb) was found by field instruments to be contaminated.

A field instrument survey was made of items (e.g., concrete blocks or slabs) too large to move to the dump without excessive cost. None were found to be contaminated. Careful ground monitoring was conducted in the TA-1 area south of Trinity Drive except for developed areas. This monitoring located significant uranium contamination on or near the sites formerly occupied by Warehouse 19, Sigma building, and TU building. Minor contamination was found in the vicinity of HT building. With the exception of a small portion of the TU area, this known contamination has all been removed.

As part of the various exploration activities, exploratory trenches with a total length about 630 m (1930 ft) were dug and their bottoms and sidewalls surveyed. A major objective of trenching was to provide assurance that the contaminated liquid waste sewer lines, which connected the various buildings to the radioactive waste treatment plant, had been removed. About 50 m (160 ft) of line contaminated with low levels of ^{137}Cs were uncovered and removed from the J-2 area. No other intact portions of the acid sewer lines were found.

During trenching to determine the status of the acid sewer laterals from Sigma, a considerable number of pipe shards and other uranium contaminated material were uncovered and removed. The soil in a portion of what could be identified as the former trench for the contaminated liquid waste line within D-building footprint was found to be highly contaminated.

Another goal was to locate and remove all known septic tanks in the TA-1 area. A total of eight have been removed. Five were found to be uncontaminated. One of these was discovered accidentally during excavation in the TU area; it was not shown on any old drawings. Another was found at least 50 ft from the location shown on a drawing.

The three contaminated tanks and their surrounding areas deserve discussion.

Tank 140 (see Fig. 4) was found to be full of sludge and roots, all highly contaminated with uranium. The inlet and outlet lines were also contaminated. Final cleanup will require tracing the lines and exploring for related surface contamination.

Tank 138 was found underneath the floor of a storage shed attached to an office building (see Fig. 3). While the tank was not contaminated, some gross-alpha contamination (up to a few hundred pCi/g) was found in the pit after tank removal. The results of decontamination were described in the earlier section, "Status of TA-1 Operations, January 1976." In an attempt to determine the source or release points of this contamination several trenches were dug adjacent to the office building (see Fig. 6). Only 3 of more than 60 samples showed alpha activity above background. These were clustered together in one trench on ERDA property near the cliff edge. Field survey instruments detected activity on the cliff face below the presumed outfall location. Surface samples confirmed the presence of gross-alpha activity up to about 3600 pCi/g and radiochemistry has identified the contamination as ^{239}Pu. The proportion of ^{137}Cs associated with ^{239}Pu contamination in this area was higher than that found in the vicinity of tank 137, indicating the probability of different sources. A long trench was dug upslope of tank 138 (see Fig. 6) in an attempt to intercept possible pipe lines or residues of flows in or on the soil that would account for the plutonium contamination. Several lines were found, including a concrete pipe containing globules of mercury, but no radioactivity above background was found. Consequently, the source of the cliffside contamination has not been clearly established.

Tank 137, the original discovery near D-2 building, was contaminated with plutonium as was much of the surrounding area. Effluent from drain lines not connected to any sewage treatment unit and discharging on the surface near building D-2 which housed the contaminated laundry (1943-1945) is the probable source of the contamination near septic tank 137. A May 1945 monthly progress report states, "The contaminated water discharge pipes draining behind the laundry have now been placed below the ground level with no open drain until the pipes are past the south side of the (security patrol) road...The complete area behind the laundry has been covered with dirt to a depth of several inches to prevent the spread of contamination."

Two highly contaminated lines believed to be the referenced drain line extensions from D-2 were found about 50 ft west of the location indicated on old drawings and subsequently removed together with associated contaminated soil.

The two gullies (on ERDA property, see Fig. 3) which drained run-off water from the D-2 area were found to be contaminated. The gullies have been decontaminated to the extent possible with heavy equipment. Several small areas that cannot be reached with heavy equipment have surface contamination to 500 pCi/g. This contamination will be removed. Subsurface contamination to a maximum of 400 pCi/g remains on ERDA property in and along the walls of the deep trench resulting from decontamination of one portion of the area. Continued operations in the trench to further reduce the relatively low level contamination would have been extremely expensive and hazardous to the workers. The trench was backfilled so operations could continue toward completion of the D and D-2 areas. The present status of the area is shown on Fig. 5.

Application of the As Low As Practicable (ALAP) Concept

In radiation protection work, the limits are based upon an assumption of linearity between dose and effect. For this reason, the numerical values for official standards are considered as the maximum levels which should be permitted (thus the NCRP nomenclature of "maximum permissible"). A very important admonition of all groups involved with radiation protection is that the actual exposures should be kept as far below these maximum levels as is practicable. The term "practicable" includes the concepts of technical and economic feasibility. ERDA has adopted this admonition as official policy and it was applied to this cleanup effort.

For soils, there are no official maximum levels established. LASL has proposed an interim standard for plutonium in surface soils (and extended to buried materials by consideration of the fact that they may eventually reach the surface) of 230 pCi/g. This standard is currently under review. Similar values have not been proposed for other materials.

In this cleanup project, the maximum value that could be left was not defined numerically but was assessed on a case-by-case basis by the experienced personnel involved considering the depth of the deposit, the area involved, and the potential hazard of the contaminant. (Uranium and tritium, for example, are less hazardous per unit of activity than plutonium.)

The application of ALAP took place in two major ways:

1. In the excavation operations it is necessary to have a rapid method of assessing the degree of contamination in an area so that operations can be conducted efficiently. Chemical analyses capable of sensitivity near background levels are expensive and time-consuming. If chemical analyses were required to control the cleanup it would be necessary to have crews and equipment wait for many hours or days until results were available to define the next operation. For this reason, primary reliance was placed upon procedures with lower sensitivity but which could give answers within minutes. For plutonium this procedure was the measurement of the alpha emissions from the surface of a dried sample using a zinc sulphide counter. The sensitivity is about 20 pCi/g. For uranium a portable phoswich was used as a survey instrument in the field. This provided a sensitivity of about 500 pCi/g. Thus, in the interest of practicality, there may be quantities left which will be well above background.

2. During excavations, soil and tuff were removed when positive readings were obtained until a point was reached where it became apparent that further excavation would be of little use unless really major operations were instituted or until the conditions were such that a physical hazard was involved for the operators.

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JANUARY 1976

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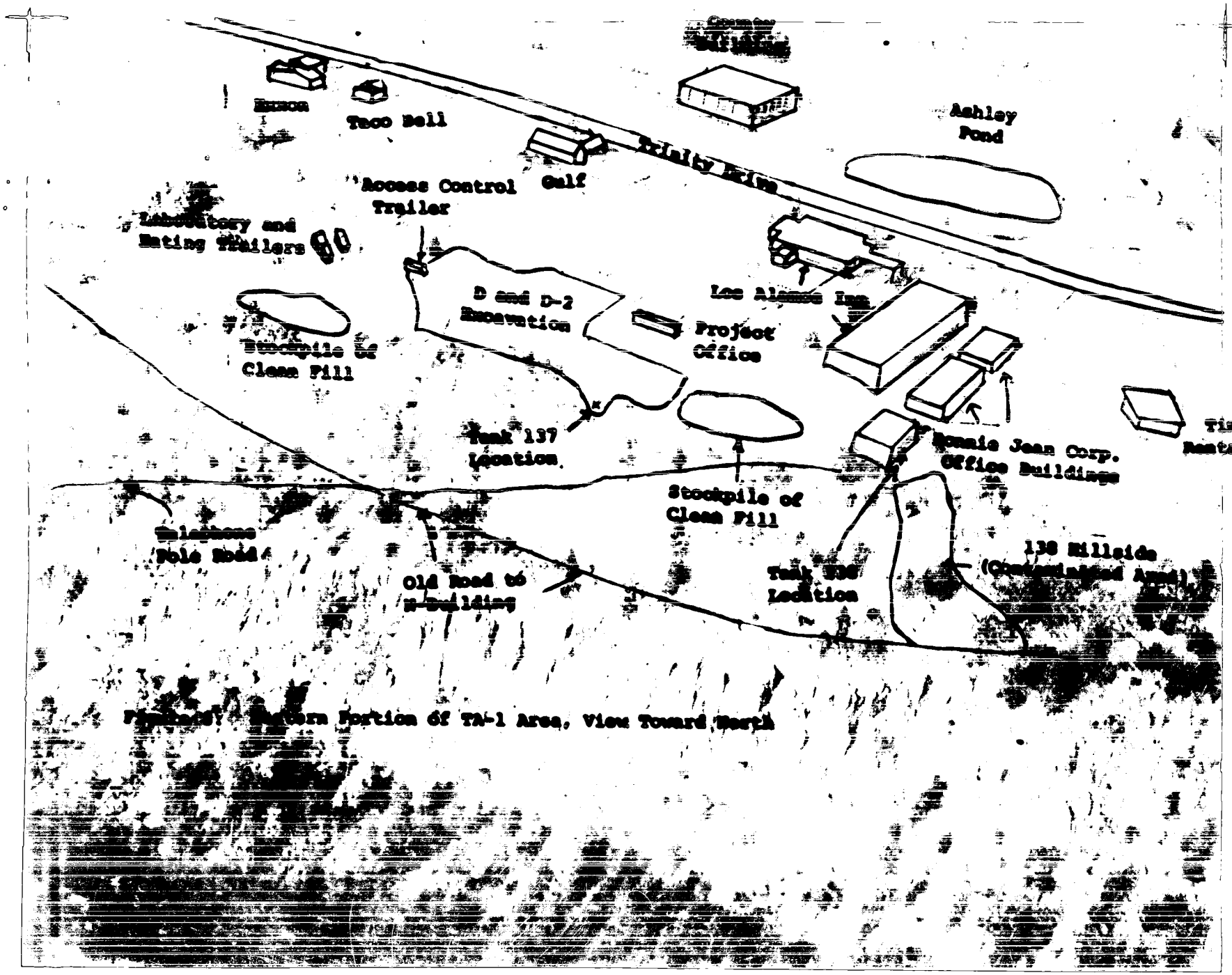
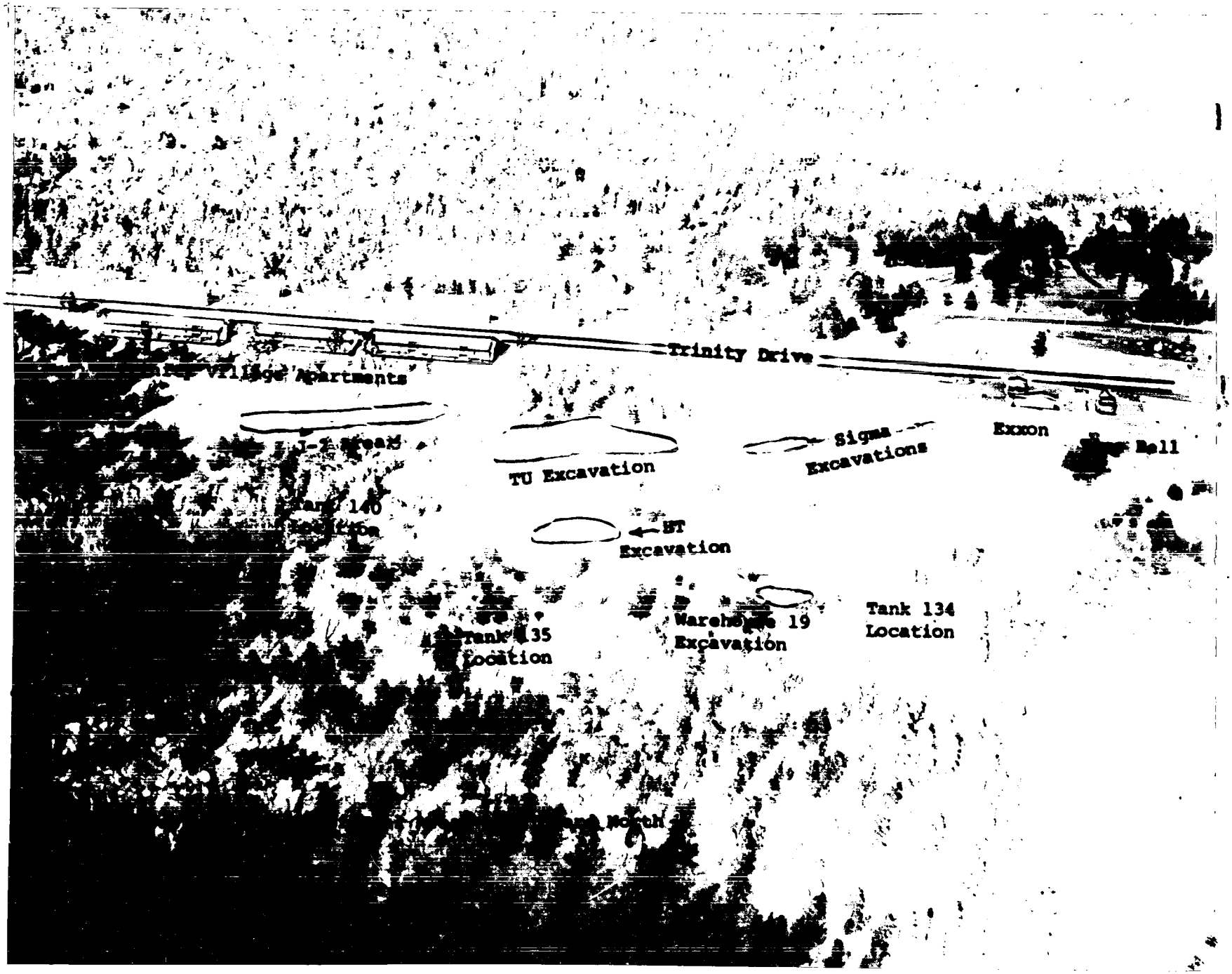


Figure 3. Southern Portion of TA-1 Area, View Toward North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Location

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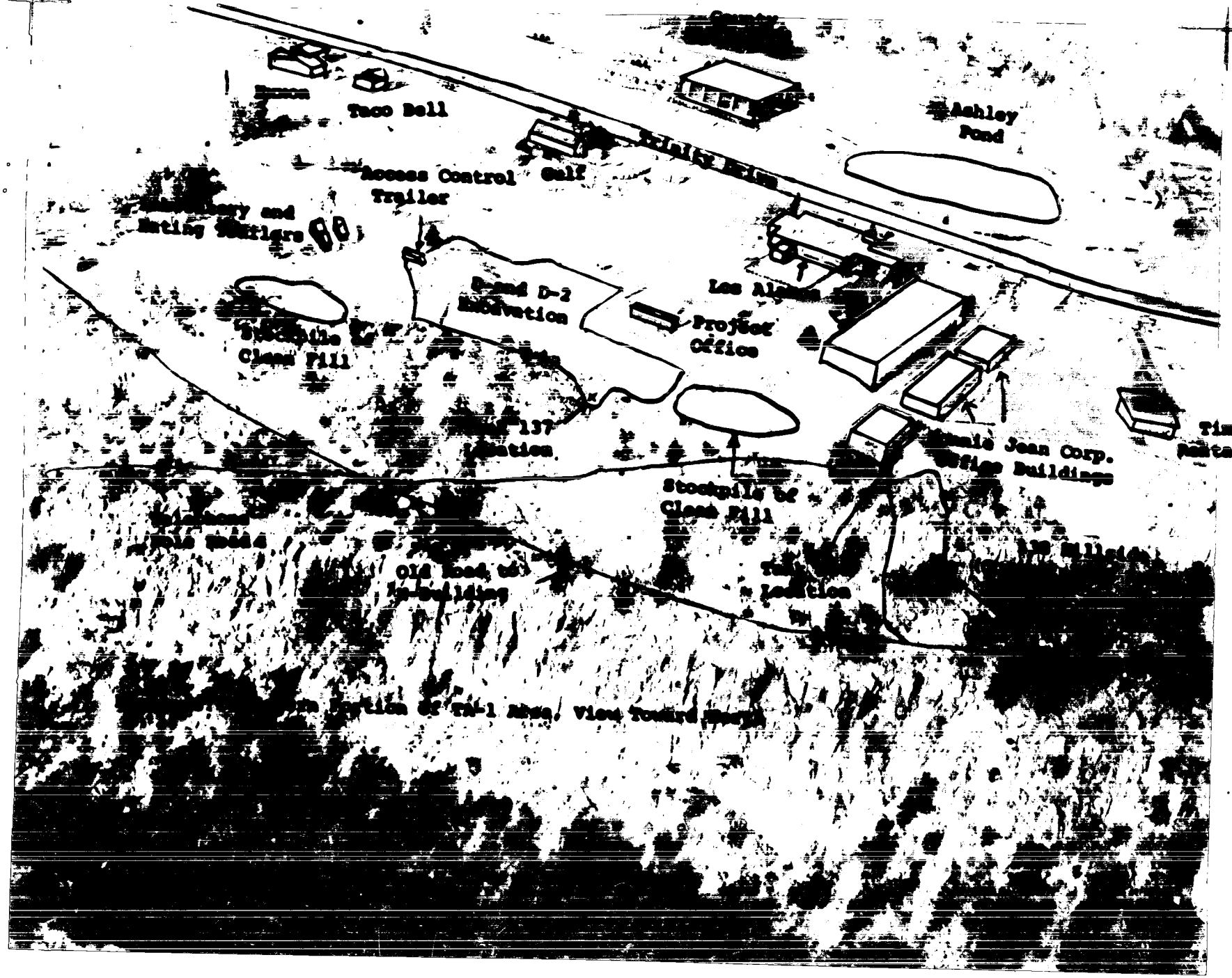
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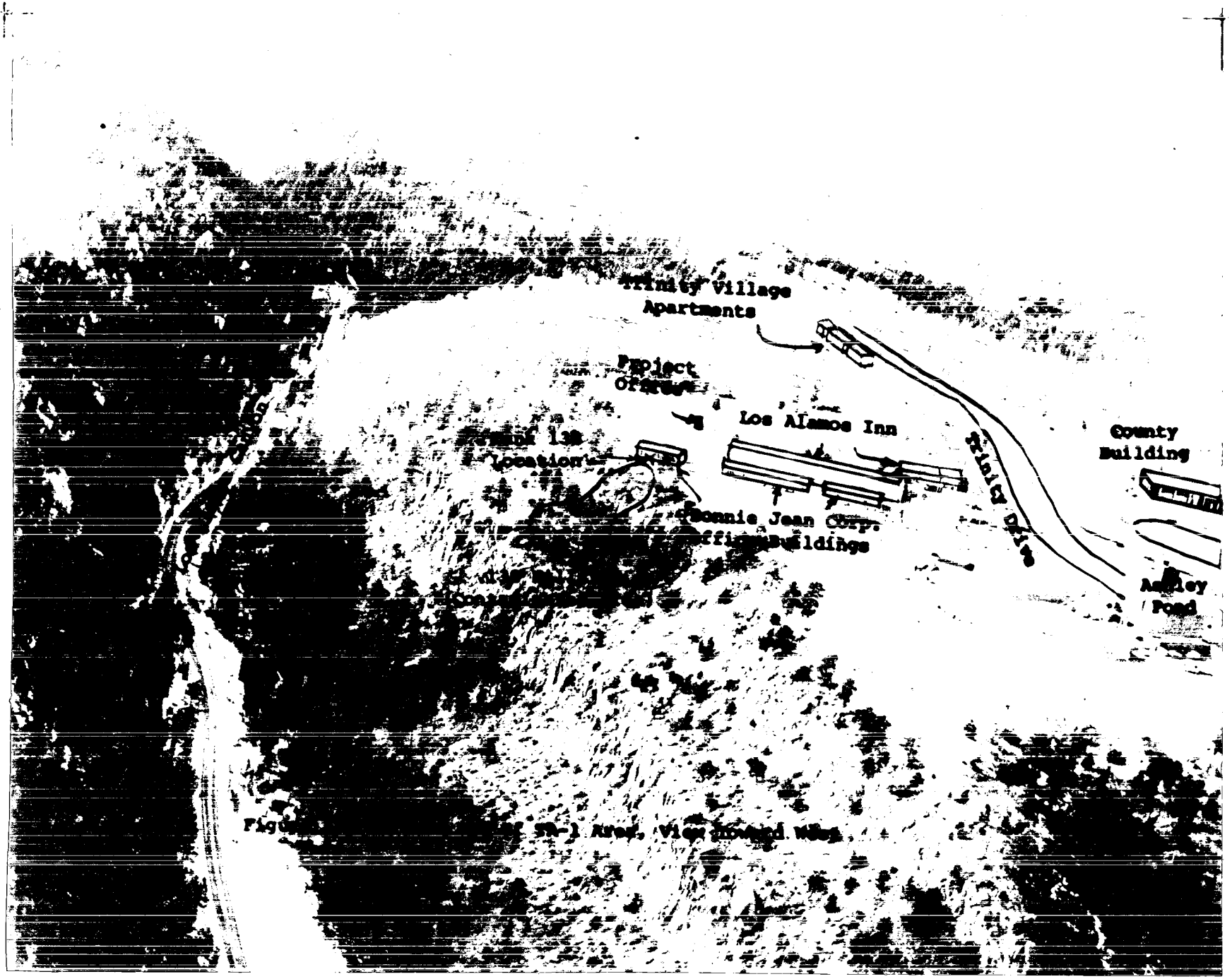
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