November 21, 1994
EM/ER:94-J450
M992
505-667-0808

Mr. Joseph Vozella, Chief
Environment, Safety, and Health Branch
US Department of Energy
Los Alamos Area Office, MS A316
Los Alamos, NM 87544

Dear Mr. Vozella:

**SUBJECT: RESPONSE TO NOTICE OF DEFICIENCY (NOD) CONCERNING OPERABLE UNIT (OU) 1082 RESOURCE CONSERVATION AND RECOVERY ACT FACILITY INVESTIGATION (RFI) WORK PLAN WORK BREAKDOWN STRUCTURE NUMBER 1.4.2.6.1.7.1.2**

Enclosed is the Los Alamos National Laboratory's revised work plan pages incorporating all changes required in the Environmental Protection Agency's (EPA's) Notice of Deficiency concerning the OU 1082 RFI Work Plan and a certification form signed by the appropriate Laboratory official. The NOD was received at the Los Alamos Area Office on July 18, 1994. LANL stated that those revised pages would be delivered by December 1, 1994 in the response to the EPA NOD that was transmitted August 17, 1994.

The enclosed revisions show the comments from the NOD indicated in the margins and the text cahanges highlighted. LANL has also provided a coversheet that indicates where responses to specific NOD comments are located. A documented quality review of the enclosed response has been performed in accordance with procedure LANL-ER-AP-01.3.

Please let me know if there are questions about this response to the NOD, or contact Brad Martin of my staff at 667-6080. I would appreciate having the response and the signed certification form sent to the EPA, Region 6, by December 1 to meet the required deadline.

Sincerely,

Jorg Jansen, Project Manager
Environmental Restoration

JJ/rfr

Enclosure: Responses to NOD
Certification Form

3439

## CERTIFICATION

I certify under penalty of law that these documents and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violation.

Document Title:

Response to NOD for RFI Work Plan for OU 1082

Name: D.F. Collins for DE Date: 11/29/94
Dennis Erickson
Division Director
Los Alamos National Laboratory

Name: Date: 11/30/94
Joseph Vozella, Chief
Environment, Safety, and Health Branch
DOE-Los Alamos Area Office

Cy: T. Baca, EM, MS J591
J. Shipley, EM, MS J591
B. Martin, CST-6, MS E525
B. Koch, LAAO, MS A316
J. Levings, ERPO, MS A906
EM/ER File, MS M992
RPF, MS M707
CIC-10, MS A150, w/o enclosure

# TABLE SHOWING LOCATIONS OF RESPONSES TO EPA NOD COMMENTS ON OU 1082 RFI WORK PLAN

| Comment | Pages or Figs. | Notes |
|---|---|---|
| General Comment (GC) 1 | 4-36, 5-204, Fig. 5-74. | |
| GC 2 | | Determined at project-wide level. |
| GC 3 | 5-16 to 5-40 | Subsection 5.2 History section reorganized |
| GC 4 | | All sampling plans have been revised to provide additional detail and third party implementability. |
| GC 5 | 5-1 | |
| GC 6 | 4-13, 5-57 | |
| GC 7 | 5-16, 5-226, 5-242, 5-245, 5-279, 5-293, 5-296, 5-309 | LANL was unable to identify any units as permitted that are not already so indicated in the work plan. |
| GC 8 | 5-129, 5-291 | |
| GC 9 | Figs. 5-31, 32,33,34, 35,36, 38, 39,40, 41, 42, 43, 54, 61, 64, 65, 81 | All but the last five are new figures. |
| | | |
| 1 | | This information has been provided by the ER Project office. |
| 2 | 1-10 | |
| 3 | FIG. 3-1 | |
| 4 | 3-10 | Paragraph deleted. |
| 5 | 4-12 | |
| 6 | 4-13 | |

| | | |
|---|---|---|
| 7 | 4-13 | |
| 8 | 4-15, 4-16 | |
| 9 | 4-19 | |
| 10 | 4-36, 5-204, Fig. 5-74. | |
| 11 | | The statistical approaches used in the ER Project will be discussed in EPA's 12/94 visit to LANL in order to obtain final resolution of statistical issues. Based on the discussion between OU 1082 and EPA concerning the NOD on Addendum I (November 10, 1994), OU 1082 will not implement this statistical approach in future work plans. |
| 12 | 4-49, 5-189, 207, 221, 236. | |
| 13 | 5-5 | |
| 14a<br><br>14b | 5-5 | <br><br>No text modification required. |
| 15 | Fig. 5-4 | Fig. 5-4 is a duplicate of Fig. 5-1. |
| 16 | | No text modification required. ICF Kaiser is currently working on missing SOPs. |
| 17 | 5-10, 5-12, 5-13 | Note that the sampling figure required no changes as only screening points are shown |
| 18 | | Response to this question submitted September 16, 1994. |
| 19 | 5-24 | |
| 20 | 5-57 | We have deleted two paragraphs that are confusing. |
| 21 | 5-57, 5-58, 5-59, 5-61, 5-63 | The modified sampling plans for the sumps were provided in the September 16, 1994 submission. |
| 22a, b, c | | The text containing these corrections was supplied in the response submitted September 16, 1994. |
| 23 | | The text containing this correction was submitted September 16,1994 |

| | | |
|---|---|---|
| 24a<br><br>24b | 5-84,5-96, 5-98, 5-101-103. Fig. 5-29, Fig. 5-30. | The sample was collected and submitted for laboratory analysis on 8/3/94. LANL OU 1082 Team received NPDES and EPA SW 846 Method 8260 volatile analyses on 11/29/94. LANL continues to wait for HE analyses. No volatiles of concern were found in the Method 8260 analysis. LANL will provide copies of all of the laboratory analytical results when the complete dataset is available. |
| 25 | 5-96, 5-98, 5-101, Fig. 5-29. | |
| 26 | 5-116 | |
| 27 | 5-104, 5-122, Fig. 5-31 | |
| 28 | 5-104, 5-106, 5-108, 5-110, 5-121, 5-122, Figs. 5-31 to 5-36, Figs. 5-38-43. | It was not always possible to identify whether the drainfield of an individual tank was perforated or not. We have included the relevant available information for the drainfields on the new figures. |
| 29 | Figs. 5-38-43. | |
| 30 | 5-120, 5-129 | |
| 31 | | See response to general comment 5. |

| | | |
|---|---|---|
| 32 | Fig. 5-44 5-135, 5-136, 5-137. | |
| 33 | 5-141, 5-142, 5-143 | |
| 34 | 5-149, 5-150, 5-152, Fig. 5-47. | |
| 35 | 5-138, 5-141, 5-150, 5-152 | |
| 36 | 5-165, 5-169, Fig. 5-50. | |
| 37 | | See response to general comment 5 |
| 38a<br><br><br>38b<br><br>38c | 5-165, 5-166, Fig. 5-50<br><br>5-168<br><br>5-169 | |
| 39 | Fig. 5-51 | |
| 40a<br><br><br>40b | 5-177, Fig. 5-52<br><br>5-177 | |
| 41 | 5-179 | |
| 42 | 5-184 | |
| 43 | 5-193 | |

| | | |
|---|---|---|
| 44ai. | 5-189, 5-190. | |
| 44aii | 5-189 | See footnote. |
| 44bi | Fig. 5-54 | |
| 44bii | 5-189, 5-190 | |
| 44biii | 5-189, 5-192<br>Fig. 5-54 | |
| 44c | 5-173, 5-189, 5-192 | |
| 44d | | No text changes required. |
| 44e | 5-189, 5-194 | No figure modification needed. |
| 45 | 5-204 | |
| 46 | 5-205 | |
| 47 | 5-202, 5-204, 5-205, 5-206, 5-208 | |
| 48 | Fig. 5-60 | |
| 49 | 5-214 | |
| 50a | 5-221, 5-223. | |
| 50b | | No text change needed. |
| 51a | 5-223 | |
| 51b | 5-223, 5-225 | |

| | | |
|---|---|---|
| 52 | 5-221 | Table 5-58 is the new number for Table 5-55. |
| 53 | 5-229 | |
| 54a<br><br><br><br>54b<br><br>54c | 5-237, 5-236, 5-240, Fig. 5-65.<br><br>5-240<br><br>5-236, 5-240 | |
| 55a<br><br>55b | 5-252<br><br>5-251, 5-252, Fig. 5-67. | <br><br>Note that NOD response stated a total of at least 108 screening samples in the SWMU and the correct number is 144. |
| 56a<br><br><br><br>56b | 5-251, 5-252, 5-254, Fig. 5-67.<br><br>5-252 | Note that we suggested 8 total lab samples in the NOD response. We have upped this to 9. |
| 57 | 5-259, 5-260 | |
| 58 | | No text changes required |
| 59a<br><br>59b<br><br>59c<br><br><br>59d | Fig. 5-70<br><br>5-259<br><br>5-268, 5-272 | <br><br><br><br><br><br>No text changes required - pending EPA determination. |

| | | |
|---|---|---|
| 60a<br><br>60b<br><br>60c<br><br>60d<br><br>60e | 5-277<br><br>Fig. 5-72<br><br>5-277-278<br><br>5-279-280<br><br>5-281, 5-282 | |
| 61 | 5-282, 5-288, 5-289, 5-290, 5-291, Fig. 5-73 | |
| 62a<br><br>62b | 5-290, 5-291, Fig. 5-73<br><br>5-288, 5-290, 5-291 | |
| 63 | 5-293, 5-296 | |
| 64a<br><br>64b | 5-298, 5-300, 5-301, Fig. 5-76.<br><br>5-298 | |
| 65 | 5-308 | |
| 66a<br><br>66b | 5-311<br><br>5-311, 5-313, 5-314 | |
| 67 | 5-321 | |

| | | |
|---|---|---|
| 68 | 5-324, 5-326, Fig. 5-81. | |
| 69 | 5-325 | |
| 70 | | No text change required. |
| 71a<br><br><br>71b | <br><br><br>6-4 | Sampling plan for 16-005(g) was submitted October 16, 1994. |
| 72 | 6-7 | |
| 73 | | No text change required. |
| 74 | | No text change required |
| 75 | 6-14 | |
| 76 | | No text change required |
| 77 | | Sampling plan for 16-005(n) was submitted October 16, 1994 |
| 78 | 6-16 | |
| 79 | | No text change required |
| 80 | 6-18, 6-19 | |
| 81 | | No text change required |

SWMUs that are similar in physical characteristics, use, or waste type are described in the SWMU Report as sub-SWMUs within a larger SWMU description. Sub-SWMUs were grouped to eliminate repetition of information. Each sub-SWMU is considered to be a SWMU for the purposes of corrective actions and this work plan. The 1990 SWMU Report (LANL 1990, 0145) identifies 32 SWMUs in TA-11, 5 in TA-13 (now part of TA-16), 301 in TA-16, 0 in TA-24, 1 in TA-25 (now part of TA-16), 0 in TA-28, and 1 in TA-37. Table 1-3 provides a SWMU cross-reference of HSWA Module tables and Laboratory SWMU Reports for those SWMUs covered in this work plan. As noted above, the remaining PRSs will be covered through RFI addenda no later than July 1995.

Laboratory activity and SWMU and AOC identification for those SWMUs and AOCs addressed in this work plan were verified during a series of tours conducted by the OU 1082 project team in late 1991 and early 1992.

All PRSs have been aggregated based on their common characteristics and/or the common approach that can be applied to them in the RFI work plan. The seventeen aggregates and their locations in Chapter 5 of the RFI work plan are tabulated in Table 1-4.

Subsection 3.5 of the IWP states that each OU work plan may contain an application for a Class III permit to modify Table A of the HSWA Module when it is determined that a PRS needs no further investigation. Table 1-3 includes the Tables A and B SWMUs to be addressed in this work plan. Table 1-5 lists the PRSs proposed for NFA or deferred action. Those SWMUs from Tables A and B of the HSWA Module proposed for NFA are listed in Table 1-6. EPA will indicate which units do not need to be added to the permit for a RCRA facility investigation and which may be requested for removal from the permit following a Class III permit modification. The latter SWMUs will be proposed for a permit modification and formal EPA approval will occur when the permit modification is accepted.

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## 1.4 Organization of This Work Plan and Other Useful Information

This work plan follows the generic outline provided in Table 3-3 of the IWP (LANL 1992, 0768). Following this introductory chapter, Chapter 2 provides background information on OU 1082, which includes a description and

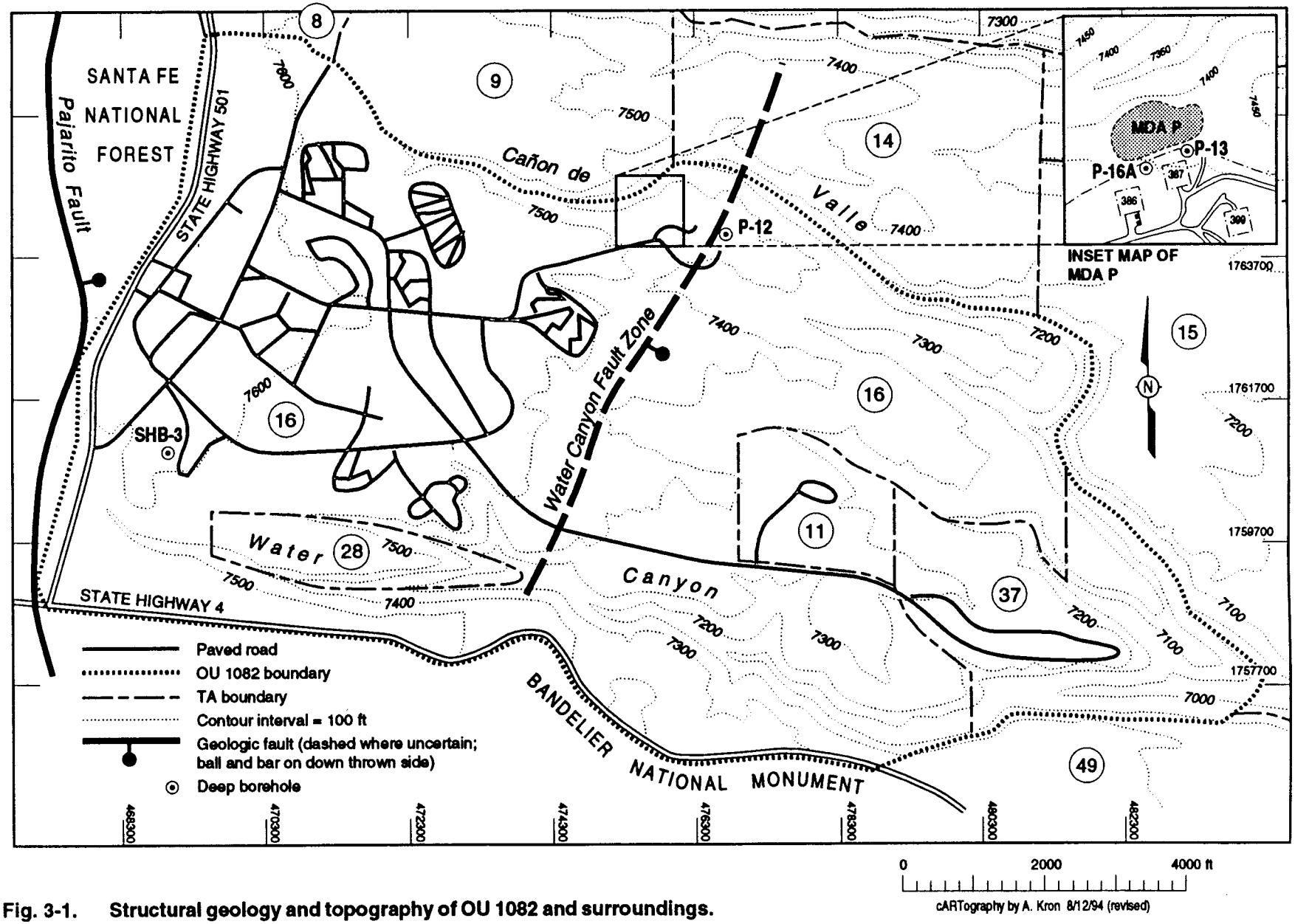


**Fig. 3-1. Structural geology and topography of OU 1082 and surroundings.**

**TABLE 3-1**

**TA-16 SOILS**

| ABBRE-VIATION | NAME | LOCATION | PERMEABILITY | WATER HOLDING | THICKNESS |
|---|---|---|---|---|---|
| TC | Typic Eutroboralfs skeletal | Administration area | Low | Low | 46-122+ cm |
| TS | Typic Eutroboralfs fine | 260-Line, 340-Line | Low/moderate | Medium | 51-94 cm |
| TO | Tocal very fine sandy loam | Burning ground, WW II area | Low/moderate | Low | 28-36 cm |
| TR | Typic Ustorthents | South TA-16 | Moderate | Low | 13-35 cm |
| PG | Pogna fine sandy loam | Scattered | Moderate/high | Low | 13-30 cm |
| TV | Totavi gravelly loam | Scattered | Very high | Low | 0-152 cm |
| SA | Sanjue-Arriba complex | Rare-east | High/very high | Very low | 46-153 cm |
| FR | Frijoles very fine sandy loam | East S-Site | Very high in subsoil | Very low | 46-152+ cm |
| CR | Carjo loam | TA-37 | Moderate | Medium | 51-102 cm |

A wide variety of soil types occurs at TA-16 (Table 3-1). These include: Typic Eutroboralfs (both clayey-skeletal and fine), Tocal very-fine sandy loam, Frijoles very-fine sandy loam, Pogna fine sandy loan, Totavi gravelly loam, Sanjue-Arriba complex, Carjo loam, and Rabbit-Tsankawi rock outcrop (Fig. 3-4). These soil units grade into outcrops of Bandelier Tuff along the margins of the mesa tops. Soils are generally thicker in the western portions of OU 1082 (Fig. 3-5).

**4 text deleted**

#### 3.4.3.3 Erosional Processes

Erosion on the mesa tops in OU 1082 is caused primarily by shallow runoff on the relatively flat mesa surfaces, by deeper runoff in channels cut into the mesa surfaces, and by rock falls and colluvial transport from the steep canyon walls. Erosion within the canyon bottoms occurs primarily by channelized flow along stream courses on the canyon floors.

Erosion of colluvial materials may occur as: 1) small masses of material that tumble down canyon walls, 2) small debris flows that issue from the mouths of subsidiary channels to the main canyon drainages, or 3) slides of large, relatively coherent landslide blocks from the steeper mesa edges.

## TABLE 4-1 (continued)

## POTENTIAL CONTAMINANTS OF CONCERN AT OU 1082

| POTENTIAL CONTAMINANTS OF CONCERN (1) | PRS AGGREGATE (2) | LAB METH. (3) | LAB PQL (WATER/ SOIL) (µg/L/ppm) (4) | MOBILE LAB METH. | MOBILE LAB PQL IN SOIL (5) | FIELD SCREEN METH. | FIELD SCREEN PQL IN SOIL (ppm) (6) | LANL BACK-GROUND IN SOIL (ppm) (7) | SAL IN WATER (µg/L) (8) | SAL IN SOIL (ppm) (8) |
|---|---|---|---|---|---|---|---|---|---|---|
| Tripicrylmelamine (e) | | | | | | | | 0 | | |
| Uranium – natural | 5.2, 5.3, 5.4, 5.7, 5.8, 5.9, 5.10, 5.11, 5.12, 5.13, 5.14, 5.15, 5.16 | | | XRF | 10 | | | 1-13 | 100 | 240 |
| Uranium-235 | 5.14, 5.15, 5.16 | α spec | 0.2 pCi/L / 0.05 pCi/g | Gross α/β | 25 pCi/g | Phoswich | 35 pCi/g | | | 18 pCi/gm |
| Uranium-238 | 5.14, 5.15, 5.16 | α spec | 0.2 pCi/L / 0.05 pCi/g | Gross α/β | 25 pCi/g | Phoswich | 35 pCi/g | | | 59 pCi/gm |
| Zinc | 5.7 | 6010 | 2/0.2 | XRF | 34 | | | | 10 000 | 16 000 |

Additional entries will be made in this table as they become available.

Note: All MDLs are extremely case specific because of varying sample matrices and geometries and count times.

(1) Potential contaminants of concern include all chemicals specifically listed in Chapter 5, potentially hazardous HE components (see Appendix D), and HE co-contaminants (see Appendix D).
(2) Potential Release Sites in which the PCOC is of concern based on archival research.
(3) SW 846 Method unless otherwise indicated.
(4) Method detection limits for EPA methods are taken directly from those listed in the appropriate SW 846 method or from the QAPjP. ICP metals detection limits in soils estimated as 100x water MDLs.
(5) Estimated by EM-9.
(6) Beryllium, lead, and chromium from Han and Cremers 1990 (15-16-470). PID from manufacturers' specifications. Uranium and plutonium = HS-4 estimate. TNT from Baytos 1991, 0741. HMX, RDX, TATB, and PETN estimated by WX-12.
(7) LANL metal and radionuclide background values from Ferenbaugh et al. 1990, 0099, Purtymun et al. 1987, 0211, and Duffy and Longmire 1993 (15-16-480). Some data from TA-16.
(8) SALs for TCL and TAL materials from IWP. HE SALs calculated using method described in IWP Appendix J. Water SALs are the lowest of those calculated for IWP Table J-1 and those listed in IWP Table J-2 as Safe Drinking Water Act or State of New Mexico MCLs. Radionuclide SALs calculated using RESRAD assuming a 10 mrem/yr exposure limit.
(a) HE impurity or environmental breakdown product
(b) HE component used at TA-16 (est.>500 000 lbs; all estimates for 50 year timeframe 1944-1993 by L. Hatler of WX-3)
(c) HE component used at TA-16 (est. 10 000 to 100 000 lbs)
(d) HE component used at TA-16 (est 1 000 to 10 000 lbs)
(e) HE component used at TA-16 (est 100 to 1 000 lbs)
(f) HE component used at TA-16 (est. <100 lbs)
(g) HE component used at TA-16 (unknown, but low, quantities)
(h) HE burn products

**Abbreviations**

ADNT – 3,5-dinitro-1,2,4-triazole
BDNPA – Bis(dinitroproponyl) acetal
BDNPF – Bis(dinitroproponyl) formal
BTX – 5,7-Dinitro-1-pricrylbenzotriazole
DATB – Diaminotrinitrobenzene
DNB – Dinitrobenzene
DNPA – 2,2-Dinitropropyl acrylate polymer
DNT – Dinitrotoluene
EDD – Ethylenediamine dinitrate
HMX – Cyclotetramethylenetetranitramine
MAN – Methylamine nitrate
NT – Nitrotoluene
NTO – 1,2,4-Nitro-triazole-5-one
PCB – polychlorinated biphenyls
PETN – Pentaerythritol tetranitrate
PYX – 2,6-Bis(picylamino)-3,5-dinitropyridine
RDX – Cyclotrimethylenetrinitramine
TAGN – Triaminoguanidine nitrate
TATB – Triaminotrinitrobenzene
TCP – Tricresylphosphate
TNB – Trinitrobenzene
TNT – Trinitrotoluene

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to perform a baseline risk assessment. For a VCA to be implemented the remedy must be obvious, feasible, and effective. A VCA may be proposed during any phase of the RFI. The PRSs that are likely to have VCAs include: sump outfalls in Subsections 5.2 and 5.3, and a RCRA closure of MDA P, which is described in Subsection 6.1.4.1. Any VCAs that will produce mixed waste will be postponed until the mixed waste disposal facility is available, unless the site presents an immediate health hazard. VCAs will be consistent with ER Project guidance at the time of implementation. All VCAs that represent a final remedy for permitted PRSs will require submission of a Class III permit modification to EPA.

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### 4.2.4 Active Sites

Many PRSs or portions of PRSs in OU 1082 are integral components of active site operations or are buried under an active area (TA-16 sumps, Subsections 5.2, 5.3; TA-11 and TA-16 septic systems, Subsection 5.4; the materials testing outfall, Subsection 5.5; the photoprocessing outfall, Subsection 5.6; and TA-11 firing site aggregate SWMUs, Subsection 5.14). Portions of the burning ground (Subsection 5.8) are still active and operated under RCRA interim status, so only the inactive part will be sampled. Current on-site health and safety risks for active PRSs are the responsibility of the active operations and will not be addressed in this RFI. Furthermore, it is not appropriate to characterize active surface PRSs to evaluate final corrective actions at this time because the active operational groups are continually changing site conditions. Subsurface PRSs at most active sites present no current health hazard and characterization of such PRSs would seriously disrupt active operations. Some RFI investigations and most permanent corrective actions for active PRSs and PRSs beneath active sites are most appropriately implemented when the site is decommissioned. However, EPA will evaluate corrective actions at active or buried inactive sites on a case-by-case basis. In some cases initial characterization of historic releases from active or subsurface inactive sites will occur during Phase I RFI investigations. In addition, it is appropriate to ascertain if off-site migration of contaminants from these PRSs is occurring or is likely to occur. If off-site migration of potential contaminants is occurring, then either a Phase II survey will be conducted or a VCA will be implemented. It is also

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4. estimate if the concentration of each PCOC is greater than some method threshold.

These data will be used to determine if any site PCOC exceeds some specified, unacceptable concentration that would be considered a problem. If a site problem is determined, then these data will provide information needed to design a Phase II data collection survey that would further define the extent of the unacceptable area or volume of contaminated media and the potential risk to receptors from the site.

Table 4-1 lists the constituents of potential concern that have been identified through archival information as PCOCs for OU 1082. Any chemical or radiological substance considered hazardous to human health will be identified in the RFI work plan for characterization and eventual cleanup; however, chemicals that are essential human nutrients present at low concentrations and toxic at very high levels (e.g., potassium, magnesium) will not be quantified in a baseline risk assessment.

The PCOCs in Table 4-1 can be divided into three general categories: 1) substances determined to have been used in specific processes at TA-16 based on archival research, including VOCs and cyanide; 2) components used in HE formulations identified in WX Division SOPs; and, 3) environmental breakdown products and impurities of commercial HE (see Appendix D). Several plastic components and salts (e.g., potassium nitrate) used at TA-16 but deemed not to be hazardous to human health were not included in the table.

Many of the substances included in number one above are building or process specific. Aggregates in which these materials are known to have been used are listed in the second column of Table 4-1. A number of HE components are listed in Table 4-1. However, only a few of these are identified as having been used at TA-16 in quantities greater than 10 000 lbs (see Appendix D). These are barium nitrate, TNT, HMX, and RDX, all of which were used in quantities greater than 500 000 lbs over the past 50 years; nitroguanidine and TATB, which were used in quantities from 50 000 to 500 000 lbs; and cyanuric acid, DATB, nitromethane, and PETN, which were used in quantities from 10 000 to 50 000 lbs. RFI Phase I analytical activities will be most strongly focused on compounds that were

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used in large quantities (>10 000 lbs). These are the PCOCs most likely to represent a significant health risk to future receptors. In many cases, the compounds used in small quantities do not have toxicological data, and hence they have no SALs, nor are they easily quantified using standard EPA methods. However, during RFI Phase I analytical activities those compounds will be identified on chromatographic scans when they occur. If they are found during Phase I analyses, then efforts will be made to estimate their toxicity and likely risk to health and the environment.

Similarly, a large number of compounds have been identified as environmental breakdown products, HE impurities, and other HE co-contaminants in the laboratory (see Appendix D). However, only DNT, DNB, and TNB are frequently identified in the field as contaminants at open burn/open detonation facilities.

The above discussion allows us to focus our efforts on PCOCs likely to present a significant risk. Laboratory analysis will focus on HE and HE by-products listed above. Certain of these HE constituents (nitroguanidine, TATB, DATB, and nitromethane) are not determined in standard EPA methods for HE by high-pressure liquid chromatography (SW-846 8330) or gas chromatography (GC)/mass spectrometry (MS) (SW-846 8270). These will be determined qualitatively using these methods.

To summarize, the main classes of chemicals potentially located at OU 1082 are explosive components, barium nitrate, and some volatile organic compounds (VOCs). Potentially hazardous explosive device components, by far the major PCOC group at OU 1082, include: HE, semivolatile organic compounds (SVOCs) (i.e., explosive impurities and polycyclic aromatic hydrocarbons), metals, cyanide, and asbestos.

### 4.3.2 Potential Environmental Pathways

The primary release mechanism of potential contaminants at OU 1082 is through operations associated with the manufacturing and testing of explosives. Potential contaminants may have been released to the environment through drains, outfalls, sumps, and landfills, as shrapnel from firing areas, through spills and spattering to surface soil, from storage areas and surface impoundments, or through burning in disposal operations.

#### 4.3.3.1 Conceptual Site Model

The on-site conceptual models identify historical sources of potential contamination, historical migration and conversion, potential current sources of contamination, release mechanisms, contact media, and exposure routes for each PRS or aggregate. Conceptual exposure models are used to illustrate how chemicals can move in the environment from potential release sites to human receptors. They are used to help identify appropriate media and locations for sampling and to determine if the PRS poses a threat to human health or the environment. Generally, surface soil is defined as the upper 24 in. and subsurface soil is from 24 in. to 12 ft or bedrock. In this RFI work plan the interval from 0 in. to 6 in. is considered to be the shallow surface and 6 in. to 24 in. is considered the deep surface. At TA-16, the A soil horizon is generally less than 6 in. thick, so a 0 in. to 6 in. sampling domain will generally include part of both the A and B soil horizons. Infiltration on or leaching into the vadose zone is not a significant pathway unless contamination is located in subsurface soils. Elements of the conceptual models are presented in Table 4-3. These elements summarize the assumptions used to create aggregate-specific conceptual models. The aggregate-specific conceptual models are presented in Figs. 4-3 through 4-10.

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The conceptual models for OU 1082 are formulated based on available PRS information only. Further refinement of the conceptual models, or development of separate models may be necessary based on data gathered through the RFI investigation.

Site specific information on PRS aggregates is presented in Chapter 5.

#### 4.3.3.2 Potential Human Exposure

To identify the presence of COCs, sampling plans proposed for OU 1082 involve comparing analytical data from samples to SALs. As mentioned in Subsection 4.2.2, SALs are based on a conservative, residential exposure scenario. If measured concentrations exceed SALs or if several chemicals come close to SALs, then further investigation will be conducted, even though none of the individual chemicals exceed SALs. If contaminated media are found in Phase I or Phase II, the human exposure potential to these contaminants will be quantified in a baseline risk assessment. Human

(LANL 1992, 0768) presents a detailed discussion of the rationale for NFA or DA based on archival information.

- NFA recommendations based on screening assessments (Fig. 4-2) will include an evaluation of combined effects from multiple contaminants and ALARA criteria for radioactive contaminants.

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NFA recommendations after baseline risk assessments will be based on acceptable risks, $10^{-6}$ for carcinogens in the absence of stakeholder input, and a hazard index less than one for non-carcinogens. These NFA recommendations will also consider ALARA criteria for radioactive contaminants.

### 4.4.2 Disposal and Treatment Options

Disposal and treatment options for contaminated materials at OU 1082 include: removal to a RCRA-permitted treatment, storage, and disposal (TSD) facility, removal to the Laboratory mixed waste facility when it is in operation, incineration and removal, or decontamination (burning or treatment by supercritical water), bioremediation, and recycling. This list is not all-inclusive. New technologies will be considered as they develop.

### 4.4.3 Conditional Remedies

Conditional remedies for PRSs at OU 1082 include: capping and monitoring of surface soil or installation, maintenance, and monitoring of in-stream barriers. Conditional remedies are most appropriate for active sites.

### 4.4.4 Access Restrictions

All PRS are within a secured portion of the Laboratory, with security fences or no trespassing signs posted. Access restrictions to all PRS will continue for the foreseeable future.

### 4.4.5 *In Situ* Remediation

While bioremediation of HE is the most likely *in situ* remediation option for some PRSs in OU 1082, at the time of actual field remediation all *in situ* options for all PCOCs will be evaluated for applicability.

### 4.7.3 Analytical Laboratory Methods

See the PCOC summary table for a listing of the principal analytical methods (Table 4-1). We have defined a subset of the SW-846 6010 metals as the OU 1082 metals suite. In many cases only this subset of metals will be reported. These metals include: barium, beryllium, cadmium, chromium, copper, lead, nickel, silver, thallium, and zinc. This suite is defined as all the toxic metals known to be used in processes at TA-16. This list was determined based on an extensive review of H-Division, X-Division, GMX-Division, and WX-Division documents, and on interviews with many TA-16 site workers.

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## 4.8 Quality Assessment

### 4.8.1 Laboratory Quality Assessment Samples

Refer to Annex II for a description of the type and number of laboratory quality assessment samples. The purposes of these samples are to assess analytical precision and bias, and to help discover fraud.

### 4.8.2 Field Quality Assessment Samples

The purpose of field quality assessment samples is to quantify the performance of a sampling technique (surface samples taken by a hand auger, boreholes taken by a diamond drill, etc.). Thus, adequate data should collected within OU 1082 to evaluate each sampling method. Many kinds of quality assessment samples can be collected (e.g., collocated samples, homogenate subsamples, field duplicates), and the type and number of these samples depends on the major source of variation in the sample collection process. The implementation plan for OU 1082 will use guidance in the IWP and survey-specific requirements in determining the number and type of field quality assessment samples. A brief discussion of the types of field quality assessment samples proposed in reconnaissance and baseline risk assessment surveys is presented below.

Reconnaissance sampling surveys usually involve collecting discrete samples from the surface or a segment of a soil core. These samples are selected by field screening or judgment to represent the maximum concentration in the PRS. Quality assessment samples will be taken to quantify the effectiveness of the biasing by collecting additional samples at random (within the PRS or in the soil core). Another quality assessment

# 5.0 EVALUATION OF POTENTIAL RELEASE SITE AGGREGATES

Chapter 5 describes the history, data quality objectives, and sampling plans for the Operable Unit (OU) 1082 potential release sites (PRSs) for which sampling is deemed appropriate at this time. The solid waste management units (SWMUs) that are covered here are from Tables A and B of the Hazardous and Solid Waste Amendments (HSWA) Module and other PRSs that fit systematically into this work plan activity. The remaining OU 1082 PRSs will be addressed in subsequent Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) work plan addenda.

The framework for sample collection strategies and use of data as applied in Chapter 5 is found in Chapter 4, Subsections 4.5.1.1 and 4.5.1.2. Annex II, Quality Assurance Project Plan, describes the quality control issues pertinent to this work plan. Occupational Safety and Health Administration (OSHA) requirements for current site workers are the responsibility of the operating groups and are not addressed in this work plan.

All PRSs were field surveyed during development of the work plan. These surveys consisted of: 1) location of each PRS based on descriptions provided in the SWMU Report and examination of engineering drawings; 2) examination of the topography and drainage at each PRS in order to identify locations for biased sampling; 3) investigation of visible evidence of contamination such as debris or staining; and 4) tape and compass location of approximate Phase I sampling locations. A few PRSs, such as the firing site at P-site, were also screened using field methods such as the HE spot test or beta-gamma detectors in order to locate sampling points.

GC5

## 5.1 Blowdown Tanks and Dry Wells, SWMUs 16-001(a-d)

### 5.1.1 Background

Four SWMUs compose the blowdown tank and dry well SWMU aggregate (Table 5-1). These SWMUs, 16-001(a-d), are grouped as a SWMU aggregate for two reasons: 1) the SWMUs are all located on the western edge of Technical Area (TA) 16 in or near the administration area of the site (Fig. 5-1); and 2) the structures associated with these SWMUs received liquid wastes that may have infiltrated the subsurface.

tank TA-16-456. The dry wells previously received overflow from the blowdown tank, but were bypassed after 1988 because their capacity was inadequate.

**SWMU 16-001(c).** SWMU 16-001(c) is tank TA-16-541, which received blowdown from the steam plant, TA-16-540. This tank was 4 ft in diameter by 7 ft long with a volume of approximately 650 gal. (ENG-C 28874). It was installed in 1962; blowdown was diverted to tank TA-16-456, SWMU 16-001(a) in 1968. The tank is still in place on level ground just south of TA-16-456. It is covered with a concrete pad and is equipped with a wire-mesh vent. A standpipe vent is located about 8 ft east of the tank. About 100 ft further downslope is a ditch that may have received outfall from this tank.

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**SWMU 16-001(d).** SWMU 16-001(d) is an abandoned dry well that has not been located. The date the dry well was abandoned is not known. Engineering drawing ENG-R 867, dated June 1959, shows a dry well northeast of TA-16-208; notation indicates the well was 3 ft in diameter and 9 ft deep, connected to the building with a 4-in. pipe. The location shown on the drawing is in a slight depression running parallel to the north side of TA-16-208 in a broad, level field covered with grass. The area around the building is paved on the other three sides. The building is a 10 ft long x 30 ft wide metal structure on a concrete foundation. It was built in 1952 and designed to house 55-gal. drums on racks along the long walls.

14a

The building is still used to store drums of chemicals, including dimethylsulfoxide, acetone, chloroethene, electrolyte liquid, ethyl acetate, ethylene glycol, toluol, trichloroethelyene, and lubricating fluid. The drums are set on their sides with the spigots over a groove cut in the concrete floor. The floor of the building is contoured, with a slight ridge down the center, so that the sides slope to the grooves on each side. The floor is hosed down once a week. At the front of the room is a channel with grated wells on each side. Liquid accumulating in these wells once drained to the outside grassy area, perhaps to the dry well, but the outlets have been plugged. These grooves were plugged in May 1993. Liquid is now collected in buckets for permitted disposal.

14a

subsurface soils and tuff beneath dry wells 16-001(b) and 16-001(d) and adjacent to blowdown tanks 16-001(a) and 16-001(c) will be considered from the surface 2.5 ft into bedrock. Based on previous studies in which metal contamination has been found within bedrock, it is expected that the highest concentrations of PCOCs in tuff will occur within 2.5 ft of the soil/ bedrock interface (Nyhan et al. 1984, 0166; McLin 1989, 15-16-405).

**Decision Logic (DQO Step 5)**

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To examine potential surface contamination at SWMUs 16-001(a) and 16-001(c), ten samples will be field screened for total chromium and the highest samples sent to the analytical laboratory for analysis. The chromium concentration from this sample will be used in the screening assessment. For all samples, the sample maxima of the concentrations of metals and/or organics will be compared to SALs.

If contamination is shown to be present which is different from background and above screening action limits in Phase I, then a more detailed Phase II source characterization study of extent of contamination applicable to risk studies, transport modeling, and evaluation of remediation alternatives will be undertaken. This would include the area surrounding the dry wells and blowdown tanks. If contaminants are not different from background or are detected below SALs, then the SWMUs will be proposed for NFA.

**Design Criteria (DQO Step 6)**

The sampling philosophy for this aggregate is to use field screening to bias laboratory sampling, in order to detect PCOCs above SALs within the SWMUs.

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Since blowdown deposition of potential surface metal contamination is assumed to be uniformly distributed, and the probability of metal contamination is low, three judgmentally-located laboratory surface samples will be selected at the blowdown tanks at the steam plant. The location of the sample to be submitted for laboratory analysis will be determined by chromium field screening of 10 sample locations located 1 ft from the blowdown stacks at evenly spaced points around the dry wells. The location with the highest chromium readings from the field screening will be selected as the location of the laboratory samples.

**TABLE 5-2**

**STANDARD OPERATING PROCEDURES FOR FIELD ACTIVITIES**

| LANL-ER-SOP | TITLE | NOTES |
|---|---|---|
| 01.02, R0 | Sample Containers and Preservation | Applied to all laboratory samples |
| 01.04, R1 | Sample Control and Field Documentation | Applied to all laboratory samples |
| 06.10, R0 | Hand Auger and Thin-Wall Tube Sampler | VOC-bearing soil samples |
| 06.11, R0 | Stainless Steel Surface Soil Sampler | All 0 to 6 in. surface samples |
| 12.01, R0 | Field Logging, Handling, and Documentation of Borehole Materials | All cored samples |

#### 5.1.4.2 Geophysical Surveys

The location of the dry well associated with drum-storage building TA-16-208, SWMU 16-001(d), is unknown. A small-scale electromagnetic and magnetics survey will be undertaken northeast of TA-16-208 in order to locate this missing dry well. SOPs for geophysical investigations are currently in preparation. This survey will extend southeast-northwest for roughly 50 ft and southwest-northeast for roughly 50 ft (Fig. 5-3).

#### 5.1.4.3 Sampling

At the blowdown tanks, ten surface sampling points will be field screened for chromium using LIBS. These screening samples will consist of 0 to 6 in. of soil and will be taken at roughly evenly spaced locations within 2 ft of the two tanks, 16-001(a) and 16-001(c) (Fig. 5-3). The three samples containing the highest chromium concentration will be selected for laboratory analysis.

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One drilled core will be taken of the bottom soils from within each dry well 16-001(b) for a total of two cores (Fig. 5-3). In addition, three coreholes will be drilled adjacent to the blowdown tanks [16-001(a) and (c)] (Fig. 5-3). All of these cores will extend at least 2.5 ft into the underlying tuff. The cores will be field screened on 6-in. intervals for chromium and organics. A 6 in. sample will be taken of each core, and analyzed for metals and organics. The location of these core samples will be biased for positive field screening

**TABLE 5-3**

**SUMMARY OF SITE SURVEYS, SAMPLING, AND ANALYSIS FOR BLOWDOWN TANKS/ DRY WELLS**

| PRS | PRS TYPE | SAMPLED MEDIA | LABORATORY SAMPLES: STRUCTURE | STRUCTURE FIELD DUP | SURFACE | SURFACE FIELD DUP | DEEP SURFACE/ SUBSURFACE | DEEP SURFACE/ SUBSURFACE FIELD DUP | FIELD SCREENING: GROSS ALPHA | GROSS GAMMA/BETA | ORGANIC VAPOR | HE SPOT TEST | GEOPHYSICS SURFACE | CHROMIUM - LIBS | A GEOLOGICAL CHARACTERIZATION | FIELD: GROSS ALPHA | GROSS GAMMA/BETA | TRITIUM | VOLATILE ORGANICS | B XRF | SOIL MOISTURE | LABORATORY ANALYSES: ALPHA SPECTROSCOPY | GAMMA SPECTROSCOPY | C BETA SPECTROSCOPY | TOTAL URANIUM | ISOTOPIC PLUTONIUM | ISOTOPIC URANIUM | D VOA (SW 8240) | E SEMIVOLATILES (SW 8270) | F METALS (SW 6010) | G PCBs (SW 8080) | H HIGH EXPLOSIVES (SW 8330) | CYANIDE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16-001 (a) | Tank | Soil | | | 3 | | 3 | | | | # | | | 10# | | | | | | | | | | | | | | 6 | 6 | 6 | | | |
| 16-001 (b) | Dry Wells | Soil | | | | | 2 | | | | # | | | # | | | | | | | | | | | | | | 2 | 2 | 2 | | | |
| 16-001 (c) | Tank | Soil | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 16-001 (d) | Dry Well | Soil | | | | | 2 | 1 | | | # | | x | | | | | | | | | | | | | | | 2 | 2 | | | | |

*16-001 (a) and 16-001 (c) sampling plans are considered together.

# = The number of field-screening samples for subsurface will depend on the depth to bedrock and the geometry of the excavation for 16-001 (d).

A, B, C, G, H = not applicable; D, E = full suite; D = subsurface samples only; F = 1082 suite.

**NOTE: The entire history section of this aggregate was reorganized for clarity in response to GC3**

## 5.2 HE Sumps and Outfalls, SWMUs 16-003(a-j, l-o), 16-026(b-e,v,h2,j2), 16-029(a-g), 16-001(e)

This aggregate consists of 36 high explosive (HE) sumps and associated drain lines and outfalls as well as one dry well associated with HE processing (Table 5-4). Twenty-six of the drain lines and outfalls are currently considered inactive because the outlets from the sumps recently have been plugged, or are expected to be plugged, to prevent discharge. The other ten sumps and associated outfalls are currently active, they continue to discharge to the environment. However, the sumps are included in a single aggregate, because it is not known specifically which of these sumps will be active during Phase I of the RFI. The SWMU Report (LANL 1990, 0145) also refers to active and inactive sumps, SWMUs 16-003(a-q) being active and SWMUs 16-029(a-g2) being inactive. The active and inactive sumps in this section do not necessarily correspond to similar designations in the SWMU Report, either because the sumps were plugged since the SWMU Report was issued, or because there are errors in the designations outlined in the SWMU Report.

We propose a generic sump sampling plan that will be applied to all sumps and their associated drain lines, outfalls, and drainages.

### 5.2.1 Background

**GC7**

Because the sumps operated for more than 40 years before they were plugged, the following discussion applies to both plugged and unplugged sumps (inactive and active outfalls). In most cases the exact dates that sumps were plugged are unknown. Most were plugged during the last 10 years and all those with EPA NPDES designations were plugged since initiation of the NPDES permits in the late 1970s. It also applies to the thirteen sumps at TA-16-260 discussed in Subsection 5.3.

The SWMUs include the HE sump, its drain lines and outfall, and the drainage channel from the outfall. A list of National Pollutant Discharge Elimination System- (NPDES) permitted discharges and associated HE sumps is given in Table 5-4. Building numbers and manufacturing processes are also listed.

**TABLE 5-4**

**HIGH EXPLOSIVES SUMPS AND OUTFALLS**

| SUMP SWMU | OUTFALL SWMU | BUILDING | EPA ID NUMBER | NUMBER OF SUMPS | MANUFACTURING PROCESS |
|---|---|---|---|---|---|
| 16-003(a) | * | 16-410 | 05A 053 | 1*** | Assembly |
| 16-003(b) | * | 16-400 | 05A 063 | 1** | Truck wash |
| 16-003(c) | 16-026(v) | 16-460 | 05A 072 | 1 | Analytical chemistry |
| 16-003(d) | * | 16-300 | 05A 058 | 2*** | Mock HE |
| 16-003(e) | * | 16-302 | 05A 058 | 2*** | Casting |
| 16-003(f) | * | 16-304 | 05A 058 | 2*** | Plastics |
| 16-003(g) | * | 16-306 | 05A 058 | 2** | Plastics |
| 16-003(h) | 16-030(d) | 16-280 | 05A 061 | 1*** | Inspection |
| 16-003(i) | * | 16-265 | 05A 057 | 1** | In-line assembly |
| 16-003(j) | * | 16-267 | 05A 149 | 1** | In-line assembly |
| 16-003(k) | 16-021(c) | 16-260 | 05A 056 | 13 | Machining |
| 16-003(l) | 16-030(h) | 16-430 | 05A 071 | 3*** | Pressing |
| 16-003(m) | 16-030(g) | 16-380 | 05A 052 | 1** | Powder inspection |
| 16-003(n) | * | 16-342 | 05A 062 | 1 | HE preparation |
| 16-003(o) | * | 16-340 | 05A 054 | 6 | HE preparation |
| 16-029(a) | 16-026(b) | 16-307 | none | 2** | Rest house |
| 16-029(b) | 16-026(c) | 16-305 | none | 2** | Rest house |
| 16-029(c) | 16-026(d) | 16-303 | none | 2** | Rest house |
| 16-029(d) | 16-026(e) | 16-301 | none | 2** | Rest house |
| 16-029(e) | 16-026(h2) | 16-360 | 05A 159 | 1** | Shipping |
| 16-029(f) | 16-026(j2) | 16-345 | none | 1 | Rest house |
| 16-029(g) | * | 16-450 | 04A 091 | 1 | Testing |

SWMUs include the HE sump, its drain line and outfall, and drainage channel from the outfall.
SWMUs 16-003(k) and 16-021(c) are covered in Subsection 5.3.
* Outfall is incorporated into sump SWMU.
** Sump outlet(s) plugged; no discharge to outfall.
*** Sump outlet(s) planned to be plugged.

The sumps were constructed in the early 1950s when TA-16 (S-Site) was modernized to replace the World War II complex. The sumps are an integral part of the process buildings which they serve. The sumps were modified in 1966 to improve their effectiveness and to reduce HE handling (Engineering drawing ENG-C 34240).

Each building in the modern S-Site complex was designed with a specific role in the HE-component fabricating process. In general, unless specified otherwise, operations within a specific building or building complex have not changed materially since the early 1950s. What has changed is the nature and quantity of explosives used in each building. The principal change in HE formulation is a decreased emphases on cast explosives, such as Composition B, and since the 1950s an increased reliance on plastic-bonded explosives. Volumes of HE processed have also decreased significantly since the 1950s.

**Operating Principles - HE sumps**

HE sumps remove suspended solids from process waste water prior to discharge to an outfall. HE manufacturing processes, such as machining, produce scrap of various sizes (< 0.5 microns to 1 inch). Process water is used as a coolant-lubricant in the machining of HE, to clean contaminated parts and equipment, and to wash down processing bays. HE-contaminated water is routed to the sumps through drain troughs in the floor of the process bay. Scrap is collected from the sumps and treated at the S-Site burning ground; the water is filtered and tested before it is discharged to an outfall.

HE sumps are rectangular, concrete tanks with removable, 0.25 in. aluminum lids. The outside dimensions of a typical sump are approximately 12 ft long, 4 ft wide, and 5 ft high. The walls and bottom are 8-in.-thick steel-reinforced concrete. As initially constructed, HE fines (scrap) were collected in a cloth filter bag secured inside a metal filter basket. The baskets and filter bags were periodically collected and cleaned at the basket washing facility, TA-16-390, which is located at the burning ground. HE fines too small to be collected by the filter bags settled to the bottom of the sump. To assist separation of the suspended solids, the water flowed under an aluminum baffle and over a concrete weir before it discharged to an outfall. HE in the bottom of the sump was periodically removed and burned.

In the mid-1960s, water-tight, aluminum tanks were installed in the sumps, eliminating the filter baskets and cloth bags. Each tank has two baffle and weir separation stages on the long axis of the sump. Waste products in the sumps are periodically removed and burned in the sand beds at the TA-16 burning ground, SWMU 16-010. This unit operates under RCRA interim

status provisions of 40 CFR 265. A RCRA Part B permit application was submitted to NMED in 1988.

#### 5.2.1.1 SWMU Descriptions and Histories

The sumps and their associated process buildings are discussed individually below. Characteristics of each sump are listed in Tables 5-5 and 5-6. Process buildings are described in a geographical framework; those located on the west of TA-16 are described first and those located on the east of TA-16 are discussed last.

**400 Building - Truck Wash**

**SWMU 16-003(b): TA-16-400.** SWMU 16-003(b) is a single inactive HE sump and an outfall associated with TA-16-400 (Fig. 5-4). Waste consists of equipment wash-down water. Wilder found that use of HE was low and the probability of HE in the sump was low (Wilder 1970, 15-16-282).

The outfall receives effluent from the HE sump and a steam-pit drain as shown on LASL drawing 13Y-192102 (Palmer and Abercrombie 1991, 15-16-366). The effluents flow into a common drain line that discharges into a level meadow on the southeast.

TA-16-400 is a truck washing facility, although it has also been used for cleaning other HE-contaminated materials such as drain pipe excavated from the World War II HE sumps (Courtright 1969, 15-16-318; LASL Photograph No. 665241).

Most of the trucks were used for transporting boxed HE and process equipment. Periodic wash down is required for maintenance and administrative control purposes.

The sump receives HE-bearing water from washing the trucks. The SWMU Report (LANL 1990, 0145) states that solvents are discharged to the sump, but no evidence has been found to support the claim.

**460-Line - Analysis**

**SWMU 16-003(c) and SWMU 16-026(v): TA-16-460**. SWMU 16-003(c) is an active HE sump associated with TA-16-460 (Fig. 5-5). SWMU 16-026(v) is its associated outfall. The waste consists primarily of fine grains of HE from

**TABLE 5-5**

**HIGH EXPLOSIVES SUMPS AND DRAIN LINES WITH INACTIVE OUTFALLS**

| SUMP SWMU | LENGTH*, QUANTITY | SUMP DRAIN LINE** | ENGINEERING DRAWING NUMBERS |
|---|---|---|---|
| 16-003(a) | 111", 1 | 8" VC and CM pipe | 13Y-192114 ENG-R888 |
| 16-003(b) | 172", 1 | 6" VC pipe | 13Y-192102 ENG-R875 |
| 16-003(d) | 123", 1<br>203", 1 | 6" VC pipe<br>8" VC pipe | 13Y-192092 ENG-R871 |
| 16-003(e) | 123", 1<br>203", 1 | 6" VC pipe<br>8" VC pipe | 13Y-192094 ENG-R871 |
| 16-003(f) | 123", 1<br>203", 1 | 6" VC pipe<br>10" VC pipe | 13Y-192096 ENG-R879 |
| 16-003(g) | 123", 1<br>203", 1 | 10" VC pipe | 13Y-192098 ENG-R879 |
| 16-003(h) | 117", 1 | 15" VC pipe | 13Y-192113 ENG-R870 |
| 16-003(i) | 76", 1 | 16" x 6" concrete trench | 13Y-192117 ENG-R862 |
| 16-003(j) | 76", 1 | 16" x 6" concrete trench | 13Y-192075 ENG-R862 |
| 16-003(l) | 88", 2<br>114", 1 | 6" WS pipe | 13Y-192071 ENG-R883 |
| 16-003(m) | 192", 1 | 15" CM pipe | 13Y-192091 ENG-R891 |
| 16-029(a) | 84", 1<br>160", 1 | 6" CI pipe<br>6" VC pipe | 13Y-192099 ENG-R885 |
| 16-029(b) | 84", 1<br>160", 1 | 6" CI pipe | 13Y-192079 ENG-R879 |
| 16-029(c) | 84", 1<br>160", 1 | 6" CI pipe | 13Y-192095 ENG-R878 |
| 16-029(d) | 84", 1<br>160", 1 | 6" CI pipe | 13Y-192093 ENG-R871 |
| 16-029(e) | 160", 1 | 6" soil pipe | 13Y-192111 ENG-R885 |

* All sumps are 41" wide by 31" high

** VC: Vitrified clay
CI: Cast iron
CM: Corrugated metal
WS: Welded steel

analytical chemistry experiments. In 1970, Wilder classed use of HE in the building as low and probability of HE in the sump as very low (Wilder 1970, 15-16-282). Solvents and other chemicals were previously discharged to this sump. A wide range of solvents has been used in this facility. According to Panowski and Salgado's report, significant quantities (> 10 lb) of acetic

**TABLE 5-6**

**HIGH EXPLOSIVES SUMPS AND DRAIN LINES WITH ACTIVE OUTFALLS**

| SUMP SWMU | LENGTH*, QUANTITY | SUMP DRAIN LINE** | ENGINEERING DRAWING NUMBERS |
|---|---|---|---|
| 16-003(c) | 90", 1 ea | 8" VC pipe | 13Y-192067 ENG-R875 |
| 16-003(n) | 88", 1 ea | 6" VC pipe | 13Y-192101 ENG-R872 |
| 16-003(o) | 124", 6 ea | 10" VC pipe | 13Y-192074 ENG-R873 |
| 16-029(f) | 88", 1 ea | 1-1/2" steel pipe | 13Y-192180 ENG-R873 |
| 16-029(g) | 159", 1 ea | 6" soil pipe | 13Y-192110 ENG-R881 |

* All sumps are 41" wide by 31" in height.
** VC: vitrified clay.

acid, acetone, chloroform, and hydrochloric acid were used during late 1970 and early 1971. Other chemicals used included diethlylene triamine, cupric oxalate, cupric oxide, sodium bichromate, magnesium perchlorate, potassium bromide, potassium hydroxide, 1,2-dichloroethane, dimethylformamide, isopropyl alcohol, and hydrobromic acid (Panowski and Salgado 1971, 15-16-038). Currently, solvents are drummed to prevent their reaching the sump. The outfall, EPA 05A072, receives effluent from the HE sump and the floor drains, bench-sink cup drains, steam cup drains, sink drains, and a drinking fountain drain on the first floor of TA-16-460, as shown in Laboratory drawing 13Y-192067 (Palmer and Abercrombie 1991, 15-16-366). The effluent flows into a common drain line that discharges into the meadow on the southeast.

TA-16-460 functions as an analytical chemistry laboratory. In 1971, Panowski and Salgado determined that small to moderate amounts of hazardous effluent may have been discharged to the environment (Panowski and Salgado 1971, 15-16-038). In 1968, a small mercury spill occurred in one of the laboratories. Group H-5 found no mercury vapor in the room. There is no record that the mercury reached the drain system (Fletcher 1968, 15-16-132; LANL 1989, 15-16-363).

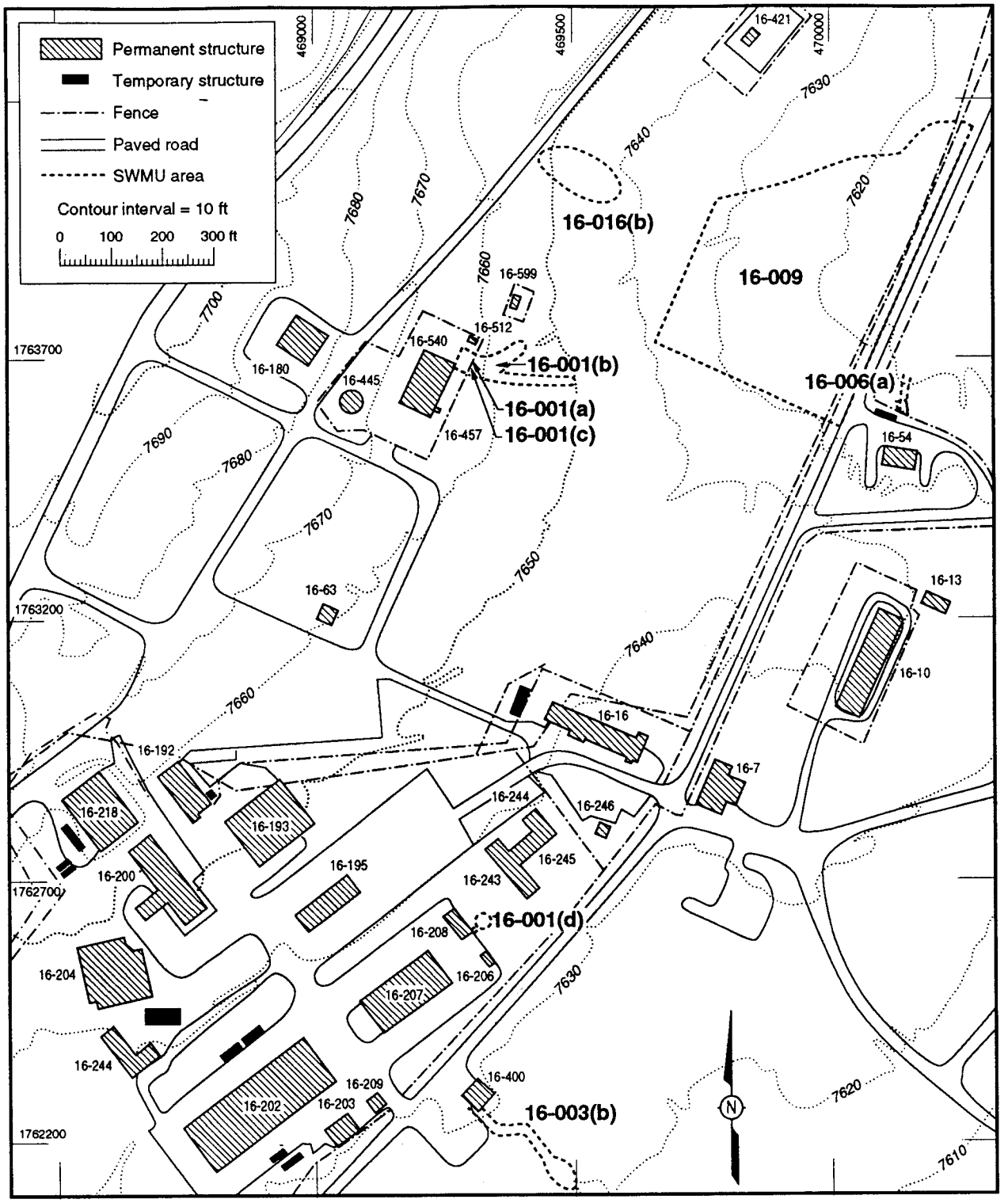


**Fig. 5-4. TA-16 administration area.**

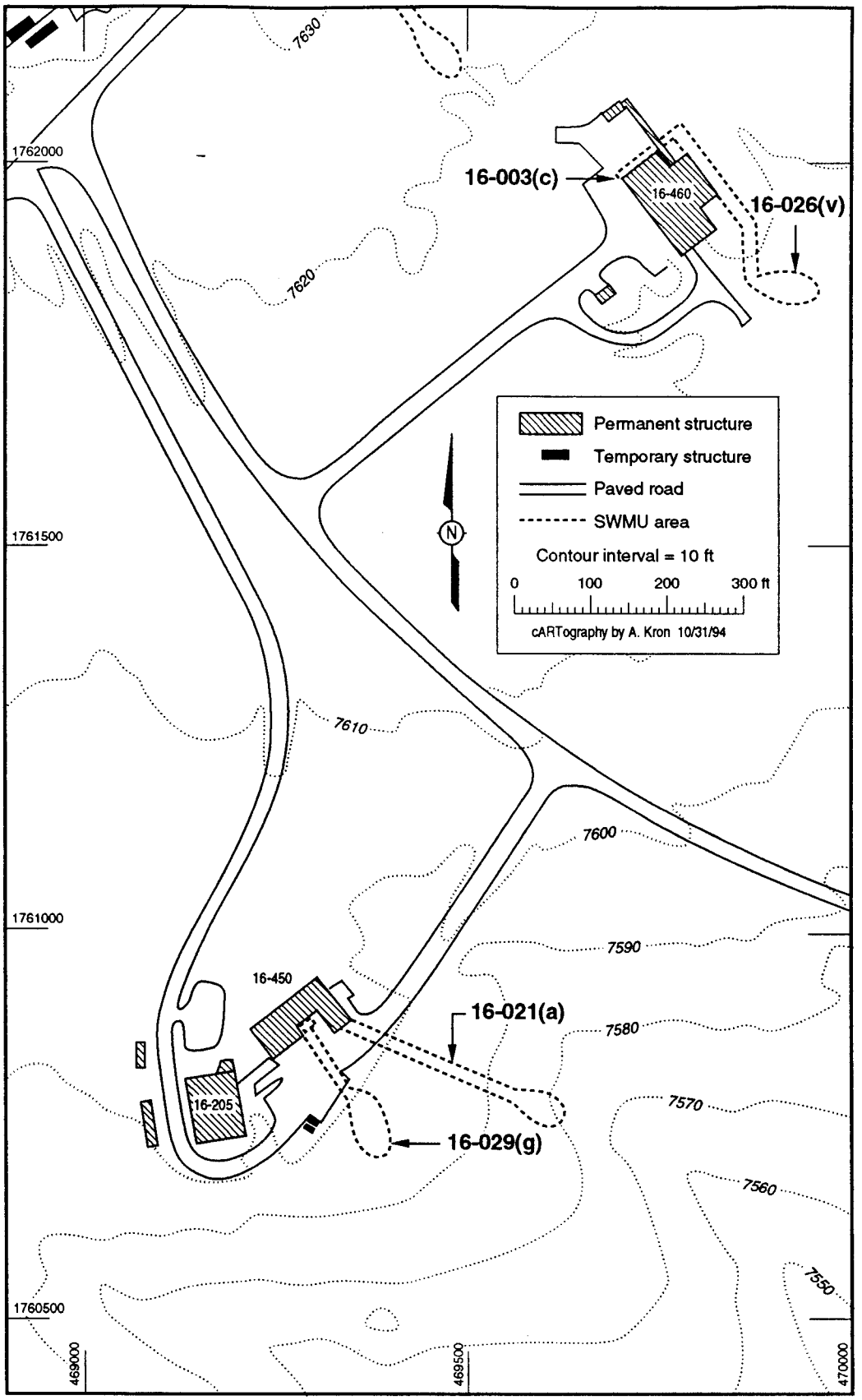


**Fig. 5-5. TA-16-460 and TA-16-450 areas.**

### 450 Building - Non-HE Testing

**SWMU 16-029(g): TA-16-450**. SWMU 16-029(g) is an active HE sump associated with TA-16-450 (Fig. 5-5). The sump receives wash-down water from floor trenches in Room 101.

The outfall, EPA 04A091 located to the southeast of TA-16-450, receives effluent from the sump as shown in Laboratory drawing 13Y-192110 (Palmer and Abercrombie 1991, 15-16-366).

TA-16-450 is a materials testing facility. Activities such as tensile and compression tests are performed on non-explosive objects (LANL 1989, 15-16-363). TA-16-450 was constructed in the early 1950s as a chemical engineering laboratory in which explosives could be processed. It was not used as such and HE was never introduced into the building (Griffin 1992, 15-16-341).

The CEARP Report states that at one time TA-16-450 housed an electroplating operation (DOE 1987, 0264; 15-16-370). No evidence has been found to support this claim. Richard Daly, who was employed at S-Site from 1956 to 1983 and who was group leader of WX-3 from 1980 to 1983, states that no plating operations were ever conducted in the building (Griffin 1992, 15-16-341). TA-16-93 was the S-Site plating facility discussed in Environmental Problem #24 (DOE 1989, Request LA824, 15-16-345).

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Panowski and Salgado classed TA-16-450 as emitting small or moderate amounts of hazardous constituents to the environment. They identified diethylene triamine as the only potentially hazardous material used at the building (Panowski and Salgado 1971, 15-16-038).

### 430-Line HE - Pressing

**SWMU 16-003(l) and SWMU 16-030(h): TA-16-430**. TA-16-430 functions as an HE pressing facility (Fig. 5-6). Plastic-bonded explosive and mock HE powders are pressed to shape. Waste consists primarily of small quantities of HE powder. Wilder classed the use of HE as high, but the probability of HE in the sumps as low (Wilder 1970, 15-16-282). Panowski and Salgado determined that small to moderate amounts of hazardous effluent may have been discharged to the environment, but did not specify the solvents used

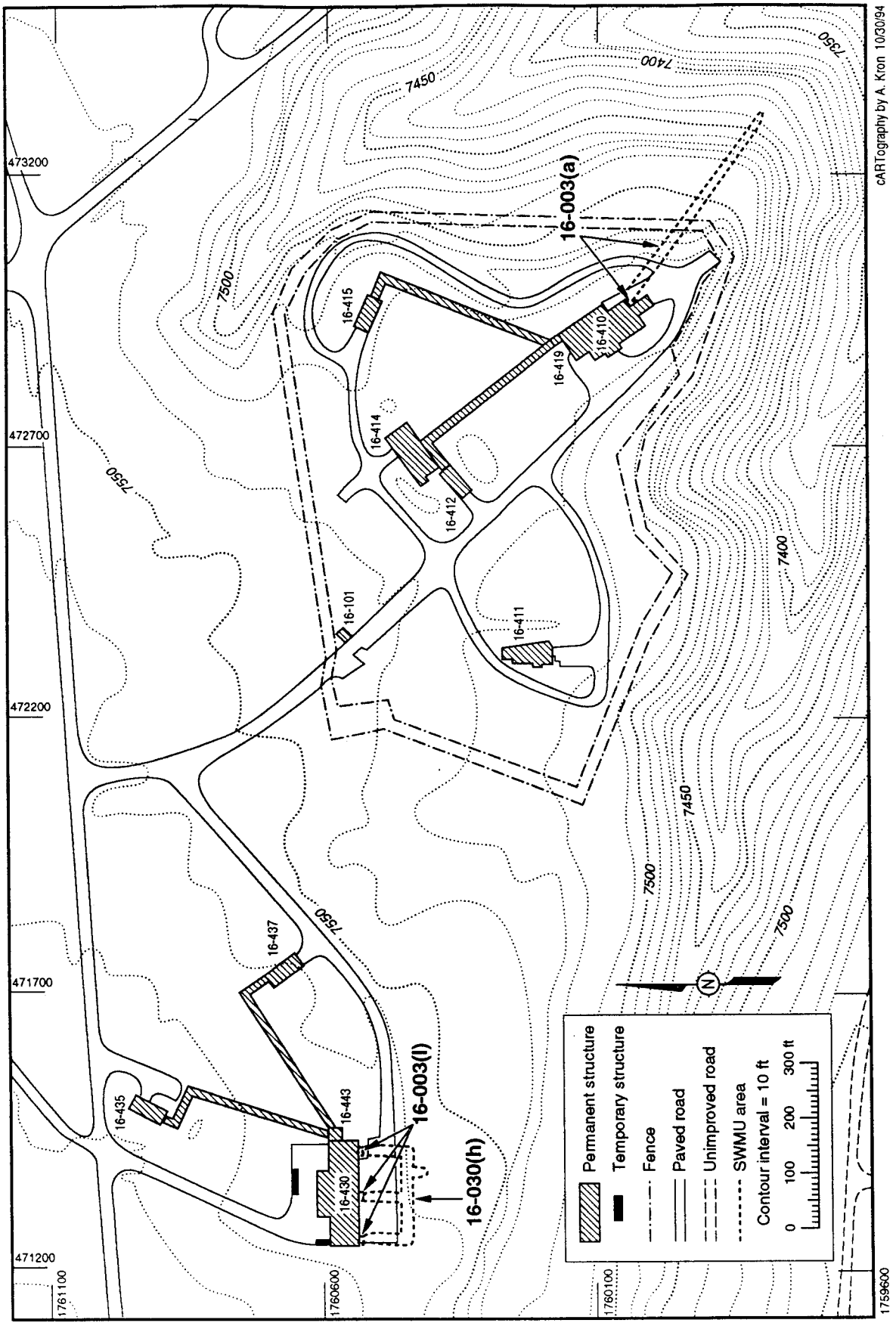


**Fig. 5-6. TA-16-410 and TA-16-430 areas.**

in the facility. The small quantities of solvents and HE collected in the sumps were burned (Panowski and Salgado 1971, 15-16-038).

An H-Division report mentions monitoring for trimethyl phenol at TA-16-430 (H-Division 1955, 0762). The SWMU Report states that known releases of acetone and methyl ethyl ketone have occurred (LANL 1990, 0145). No documentation of the releases has been found.

**SWMU 16-003(l).** SWMU 16-003(l) is three inactive HE sumps associated with TA-16-430. The sumps receive effluent from the five pressing bays, as shown on Laboratory drawing 13Y-192071 (Palmer and Abercrombie 1991, 15-16-366).

**SWMU 16-030(h).** SWMU 16-030(h) is three outfalls associated with the three HE sumps at TA-16-430 (Fig. 5-6). The outfalls receive effluent from the sumps.

**410-Line - Assembly**

**SWMU 16-003(a): TA-16-410.** SWMU 16-003(a) is a single inactive HE sump and an outfall associated with TA-16-410 (Fig. 5-6). Waste consists primarily of wash-down water. In 1970, Wilder classed use of HE as high, but the probability of HE in the sump as low (Wilder 1970, 15-16-282). Panowski determined that small to moderate amounts of potentially hazardous effluent may have been discharged to the environment (Panowski and Salgado 1971, 15-16-038).

The outfall receives effluent from the HE sump; and floor, roof, and equipment drains, as shown on Laboratory drawing 13Y-192114 (Palmer and Abercrombie 1991, 15-16-366). The effluents flow into a common drain line that discharges over a steep canyon wall into the main course of Water Canyon to the southeast of TA-16-410. Water Canyon will be investigated as part of OU 1049, Canyons.

TA-16-410 is a test device assembly building. Explosive charges and other components are assembled into finished test devices. Some components may contain, or have been fabricated from, natural or depleted uranium. No machining or scrap-producing processing of radioactive materials is performed (LANL 1989, 15-16-363). TA-16-410 is also used for disassembly

of devices that have undergone environmental and other types of nondestructive tests.

Materials that have been used during assembly and disassembly operations include: explosives, natural and depleted uranium, ethylene glycol (Panowski and Salgado 1971, 15-16-038), metals, and other solvents.

**280-Line - Inspection**

**SWMU 16-003(h) and SWMU 16-030(d): TA-16-280.** SWMU 16-003(h) is an inactive HE sump associated with TA-16-280. SWMU 16-030(d) is the outfall from SWMU 16-003(h) and is located northeast of TA-16-280. They are shown in Fig. 5-7. Wilder listed the use of HE in the building as high, but the probability of HE in the sumps as nil (Wilder 1970, 15-16-282).

The sump receives effluent from a room in which HE testing (density measurements) is conducted and from two roof drains as shown on Laboratory drawing 13Y-192113 (Palmer and Abercrombie 1991, 15-16-366). No other effluent sources are discharged to the outfall.

TA-16-280 is a physical inspection and metrology laboratory for HE and other weapon and non-weapon components, including depleted uranium products. Dimensional and other physical characteristics are measured. It also serves as a staging facility for test device components to be assembled in TA-16-410. No mechanical processing (e.g., machining) is performed; no explosive or radioactive scrap is produced.

HE, solvents, and uranium are the PCOCs in TA-16-280, but likelihood of their presence is small (LANL 1989, 15-16-362). Panowski and Salgado (1971, 15-16-038) classed TA-16-280 as discharging small to moderate amounts of material to the environment, but they did not specify what solvents were in use. Solvents may previously have been discharged to the sump, but are now drummed to prevent their reaching the waste system (LANL 1989, 15-16-363).

**260-Line - In-Line Assembly**

TA-16-265 and 267 function as an in-line assembly facility. They are located on the southwest of TA-16-260 as illustrated in Fig. 5-7.

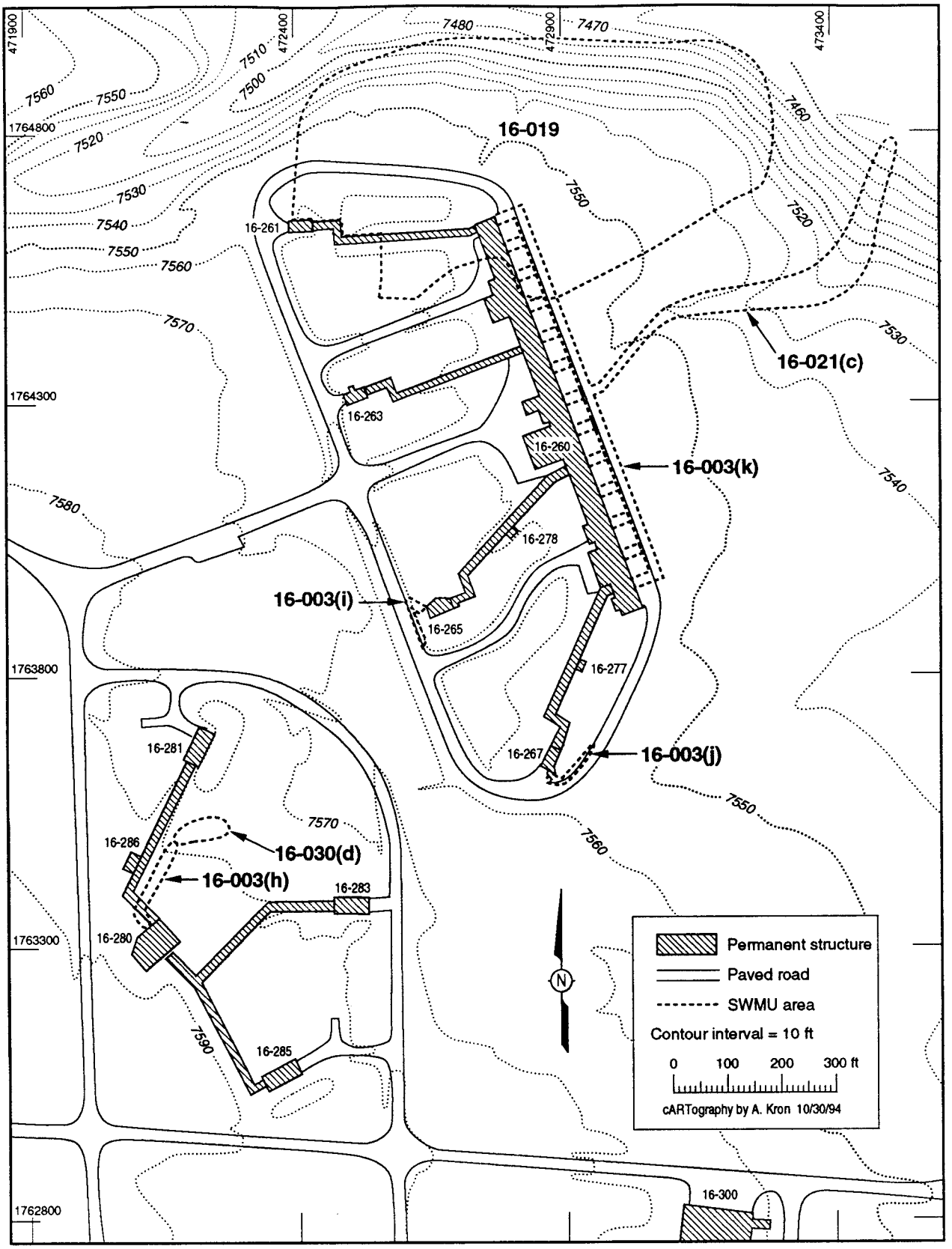


**Fig. 5-7. TA-16-260 and TA-16-280 groups.**

The buildings are used for in-process assembly of HE products machined in TA-16-260, such as gluing components together and building small subassemblies. In 1970, the use of HE was high, but the probability of HE in the sumps was nil (Wilder 1970, 15-16-282).

The buildings were rest houses, but were converted for in-line assembly work. Each has an HE sump, SWMU 16-003(i) and 16-003(j). In 1966, according to Engineering drawing ENG-C 34241, concrete drain lines were added to the sumps. The outfalls drained to the gutter adjacent to the road in front of the buildings, but the sumps are now plugged.

Potential wastes are HE and solvents. Panowski and Salgado (1971, 15-16-038) found that small to moderate amounts of hazardous materials may have been released to the environment but they did not specify solvents in use (Panowski and Salgado 1971, 15-16-038; LANL 1989, 15-16-362). TA-16-267 may have discharged uranium particulate matter.

**SWMU 16-003(i): TA-16-265.** SWMU 16-003(i) is an inactive HE sump associated with TA-16-265 (Fig. 5-7). The sump receives effluent from a sink and a drinking fountain as shown on Laboratory drawing 13Y-192117 (Palmer and Abercrombie 1991, 15-16-366).

The outfall, EPA 05A057, originates from the northwest corner of TA-16-265.

An H-Division report mentions the use of 'vythene' (1,1,1 trichloroethane) and chloromaleic anhydride in the building (H-Division 1955, 15-16-232).

**SWMU 16-003(j): TA-16-267.** SWMU 16-003(j) is an inactive HE sump associated with TA-16-267 (Fig. 5-7). According to Engineering drawing 13Y-192075, the sump receives effluent from a janitor sink (Palmer and Abercrombie 1991, 15-16-366).

The outfall, EPA 05A149, originates from the southeast corner of TA-16-267.

### The 300-Line - HE Casting, Inert Processing, Plastics

The 300-Line consists of process buildings TA-16-300, 302, 304, and 306, and their rest houses TA-16-301, 303, 305, and 307 as shown in Fig. 5-8.

The line was built in late 1951 and early 1952 for casting HE, such as TNT, Composition B, and baratol (Engineering drawing ENG-C 15725). The

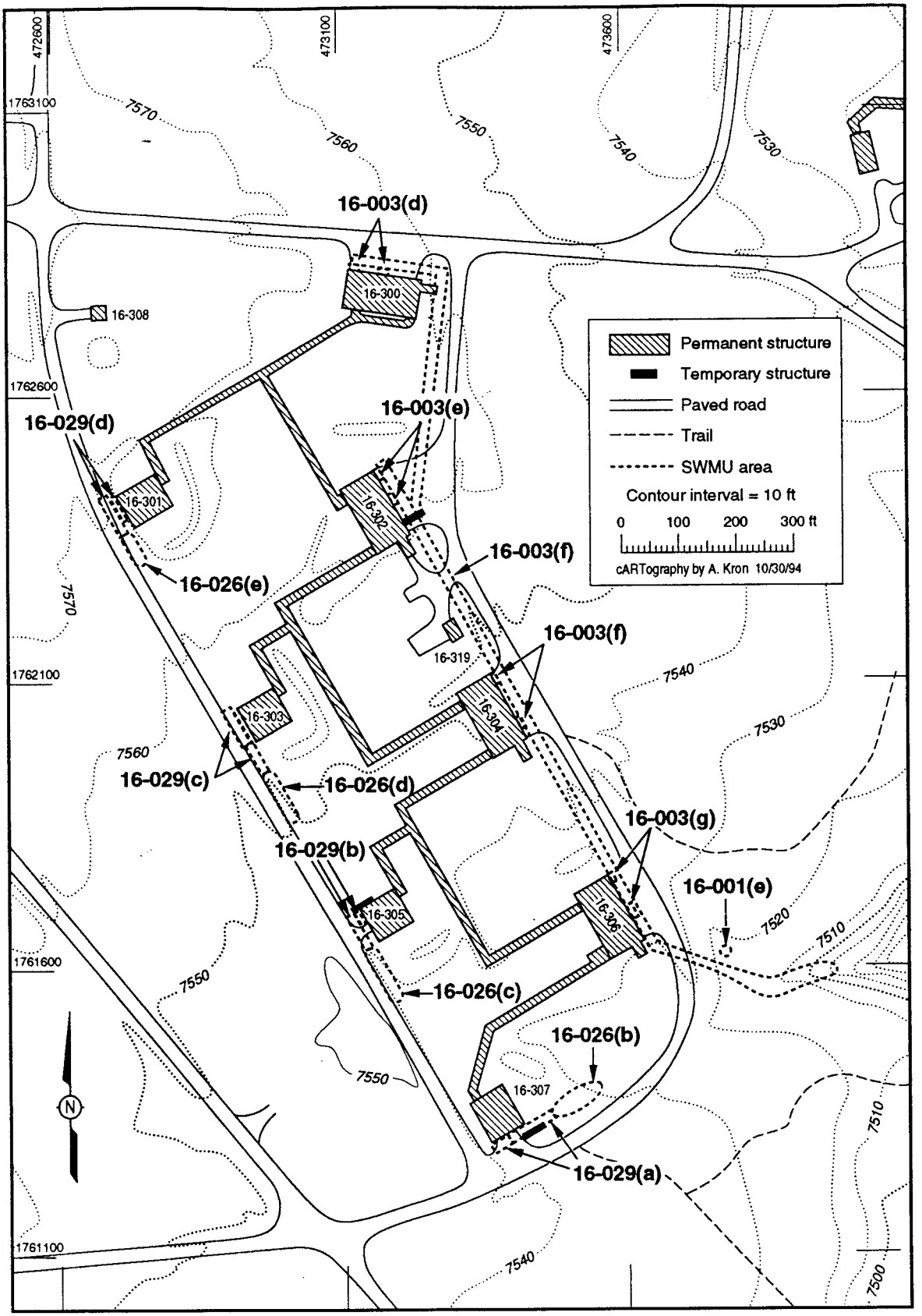


**Fig. 5-8. TA-16 300-Line.**

buildings were converted to other uses when cast explosives were replaced by plastic-bonded explosives, except TA-16-302, which remains a casting facility (Griffin 1992, 15-16-341). The TA-16-304 and 306 complex was converted to plastics development in 1958. TA-16-300 was converted to inert processing in 1962 or 1963 (Barr 1992, 15-16-329). Concern over explosives seeping into cracks in the floors of the processing bays and in the drainage troughs feeding the sumps in TA-16-300 and 302 has been reported (Dion 1963, 15-16-120; LANL 1989, 15-16-362).

TAs 16-300, 302, 304, and 306 have a common liquid waste trunk line on the northeast of the buildings as shown in Fig. 5-8. The outfall, EPA 05A058, discharges into a well-defined drainage across the road and southeast of TA-16-306.

Toluene 2,4-diisocyanate, anthracene, acetone, 1,1,1- trichloroethane, and methylene chloride are used in the various facilities in the 300-Line (LANL 1989, 15-16-362). Cyanuric acid is used extensively in TA-16-300 (Hickmott and Martin 1993, 15-16-448). TA-16-304 and 306 discharge plastics, oil, and solvents such as chlorothene, acetone, and methylene chloride (LANL 1989, 15-16-362; Panowski and Salgado 1971, 15-16-038). The SWMU Report states that methyl ethyl ketone solubles have been released from the process building sumps (LANL 1990, 0145).

Solvents are no longer discharged to the sumps or other drains in the 300-Line. The current practice is to drum the solvents before they reach the sumps. The solvents are then properly disposed of elsewhere.

**SWMU 16-003(d): TA-16-300.** SWMU 16-003(d) is two inactive HE sumps associated with TA-16-300 (Fig. 5-8). No HE is presently used and the probability of HE in the sumps is low (Wilder 1970, 15-16-282). Panowski stated that in 1970 pollution effluents from the building were effectively negligible (Panowski and Salgado 1971, 15-16-038).

TA-16-300 is a mock (inert) explosives preparation facility. Raw materials such as pentaerythritol (Pentek), barium nitrate, cyanuric acid, and nitrocellulose are blended into plastic-bonded molding powders. Currently there are no HE operations. Process and wash-down water is drained to the sumps.

An H-Division report mentions the use of octyl at the facility (H-Division 1955, 0762). Lynn Parkinson, former group leader of WX-3, has indicated that solvents were used (LANL 1989, 15-16-363).

**SWMU 16-003(e): TA-16-302.** SWMU 16-003(e) is two inactive HE sumps associated with TA-16-302 (Fig. 5-8). Wilder classified use of HE in TA-16-302 as very high, but probability of HE in the sumps as low (Wilder 1970, 15-16-282).

TA-16-302 is an HE casting facility. Explosives such as Composition B, baratol, and TNT are melted in steam-heated kettles and poured into molds. The castings are later machined to final shape. Molds, kettles, and other equipment are cleaned using steam and high-temperature wash water that drains into the sumps.

Panowski reported that TA-16-302 discharged small to moderate amounts of castable explosives and solvents to the environment (Panowski and Salgado 1971, 15-16-038; LANL 1989, 15-16-362). Panowski did not specify the solvents used in the facility. No plastic-bonded explosives are processed. In 1954, H-Division found low air concentrations of anthracene in the building and in TNT samples (H-Division 1954, 15-16-220).

**SWMU 16-003(f): TA-16-304.** SWMU 16-003(f) is two inactive HE sumps associated with TA-16-304 (Fig. 5-8). No HE is currently used and the probability of HE in the sumps is low (Wilder 1970, 15-16-282; LANL 1989, 15-16-362).

TA-16-304 functions as a plastics and plastic components development and production facility for the weapons program. Polycarbonate components are fabricated using injection molding machines. Other components are fabricated using hydraulic presses. Large, high-temperature ovens are used for drying molding powders and curing thermoset plastics. Solvents have been used in the facility. Panowski and Salgado (1971, 15-16-038) report that pollution effluents from the facility were effectively negligible, and did not report the nature of solvents in use at that time. Solvents are now drummed before they reach the sumps.

**SWMU 16-003(g): TA-16-306.** SWMU 16-003(g) is two inactive HE sumps associated with TA-16-306 (Fig. 5-8). No HE is currently used and the

probability of HE in the sumps is low (Wilder 1970, 15-16-282; LANL 1989, 15-16-362).

TA-16-306 functions as a plastic components development and production facility for the weapons program. Operations include molding of polysiloxane foam and polyurethane components, intrusion molding, and epoxy and laminate work. Ovens are used for curing thermoset plastics.

Panowski and Salgado reported that TA-16-306 was one of the larger users of solvents at S-Site (Panowski and Salgado 1971, 15-16-038; Salgado 1971, 15-16-012; LANL 1989, 15-16-362). These solvents included acetone, chlorothene, freon-PCA solvent, and methylene chloride. Methylene chloride was used as a spray-can propellant but its use has been discontinued. Use of all chlorinated solvents has been discontinued. In 1959, H Division found above-permissible levels of toluene diisocyanate within TA-16-306 (H-Division 1959, 0480).

Solvents are no longer discharged to the sumps. Solvents are now drummed before they reach the sumps.

**SWMU 16-001(e): Dry Well.** SWMU 16-001(e) is an inactive dry well adjacent to the outfall of the TA-16-300 process line. It was constructed in the early 1980s, but did not function properly because it drained to impermeable tuff. The well is corrugated metal pipe 4 ft in diameter and of unknown depth. A T-pipe exits the dry well.

The dry well is located about 100 ft east of TA-16-306 at the head of a small tributary to Water Canyon. A level area about 50 ft in diameter has been graded east of the dry well, which lies beneath a 10 ft bank cut. Outfall EPA 05A058 emerges from the bank about 15 ft south of the dry well. Effluent from the outfall has formed a stream that descends the gently sloping canyon. The dry well is currently filled with soil in which grasses and weeds grow.

Potentially hazardous materials are HE and the various types of solvents used in the process line (TA-16-300, 302, 304, and 306), as discussed above.

**The 300-Line Rest Houses**

The 300-Line is described above and illustrated in Fig. 5-8. The rest houses (TA-16-301, 303, 305, and 307) are located to the southwest of the process buildings. Each rest house has a pair of HE sumps. The effluent from each sump drained into the gutter adjacent to the roadway in front of the rest houses.

Except for TA-16-303, the buildings are no longer used for the storage of explosives. None of the sump outfalls require EPA permits and all have been plugged.

**SWMU 16-029(a) and SWMU 16-026(b): TA-16-307.** SWMU 16-029(a) is two inactive HE sumps associated with TA-16-307. SWMU 16-026(b) is the outfall from SWMU 16-029(a) and is located northeast of TA-16-307 (Fig. 5-8).

TA-16-307 is a rest house that serves TA-16-306. The rest house is used for storage of molds and other materials used in the plastics development facilities. At one time the building housed a solvent disassembly tank used for removing HE from test devices (LANL 1989, 15-16-362). This operation was the principal cause of HE contamination in the outfall drainage channel. Panowski and Salgado (1971, 15-16-038) report that TA-16-307 emitted small or moderate amounts of explosives or solvents of concern to the environment, but they did not specify the solvents of principal concern.

An H-Division report mentions the use of anthracene (H-Division 1955, 15-16-225). Panowski listed TA-16-307 as discharging low to moderate amounts of hazardous constituents to the environment (Panowski and Salgado 1971, 15-16-038; LANL 1989, 15-16-362).

**SWMU 16-029(b) and SWMU 16-026(c): TA-16-305.** SWMU 16-029(b) is two inactive HE sumps associated with TA-16-305, a rest house. SWMU 16-026(c) is the outfall from SWMU 16-029(b) and is located southwest of TA-16-305 (Fig. 5-8).

TA-16-305 is a rest house that serves TA-16-304 and 306, the plastics development and production facility. It is used for storage of chemicals used in plastics processing. Filament winding of developmental weapons components is also conducted in TA-16-305.

**SWMU 16-029(c) and SWMU 16-026(d): TA-16-303.** SWMU 16-029(c) is two inactive HE sumps associated with TA-16-303. SWMU 16-026(d) is the outfall from SWMU 16-029(c) and is located on the southwest of TA-16-303 (Fig. 5-8).

TA-16-303 is a rest house that serves TA-16-302, an HE casting facility. The rest house is used for storage of raw materials used in the casting process, and HE castings produced in the casting building (LANL 1989, 15-16-362).

**SWMU 16-029(d) and SWMU 16-026(e): TA-16-301.** SWMU 16-029(d) is two inactive HE sumps associated with TA-16-301. SWMU 16-026(e) is the outfall from SWMU 16-029(d) and is located southwest of TA-16-301 (Fig. 5-8). In 1970, use of HE in the building was high and the probability of HE in the outfall was moderate (Wilder 1970, 15-16-282).

At one time TA-16-301 was a rest house that served the mock HE processing operations in TA-16-300. The rest house was used for storage of raw materials used in the preparation of mock HE.

Currently, TA-16-301 is used as an environmental testing laboratory in which weapons and other components are subjected to extremes in temperature, pressure, and humidity. The nature of this work is such that no discharge of HE or radioactive materials occurs.

Solvents may have been stored at the facility in the past. Panowski classed TA-16-301 as discharging moderate to low amounts of hazardous constituents, but he did not specify the solvents (Panowski and Salgado 1971, 15-16-038; LANL 1989, 15-16-362).

**The 340-Line - HE Preparation**

The 340-Line consists of process buildings TA-16-340 and 342, and their rest houses TA-16-341, 343, and 345, as shown in Fig. 5-9. The line was built in 1951 and 1952. It is used for preparing plastic-bonded explosive powders. Currently, solvents are drummed to prevent their reaching the sumps.

**SWMU 16-003(n): TA-16-342.** SWMU 16-003(n) is an active HE sump associated with TA-16-342 (Fig. 5-9). Waste consists primarily of HE and solvents. Wilder classed use of HE as high but intermittent and the probability

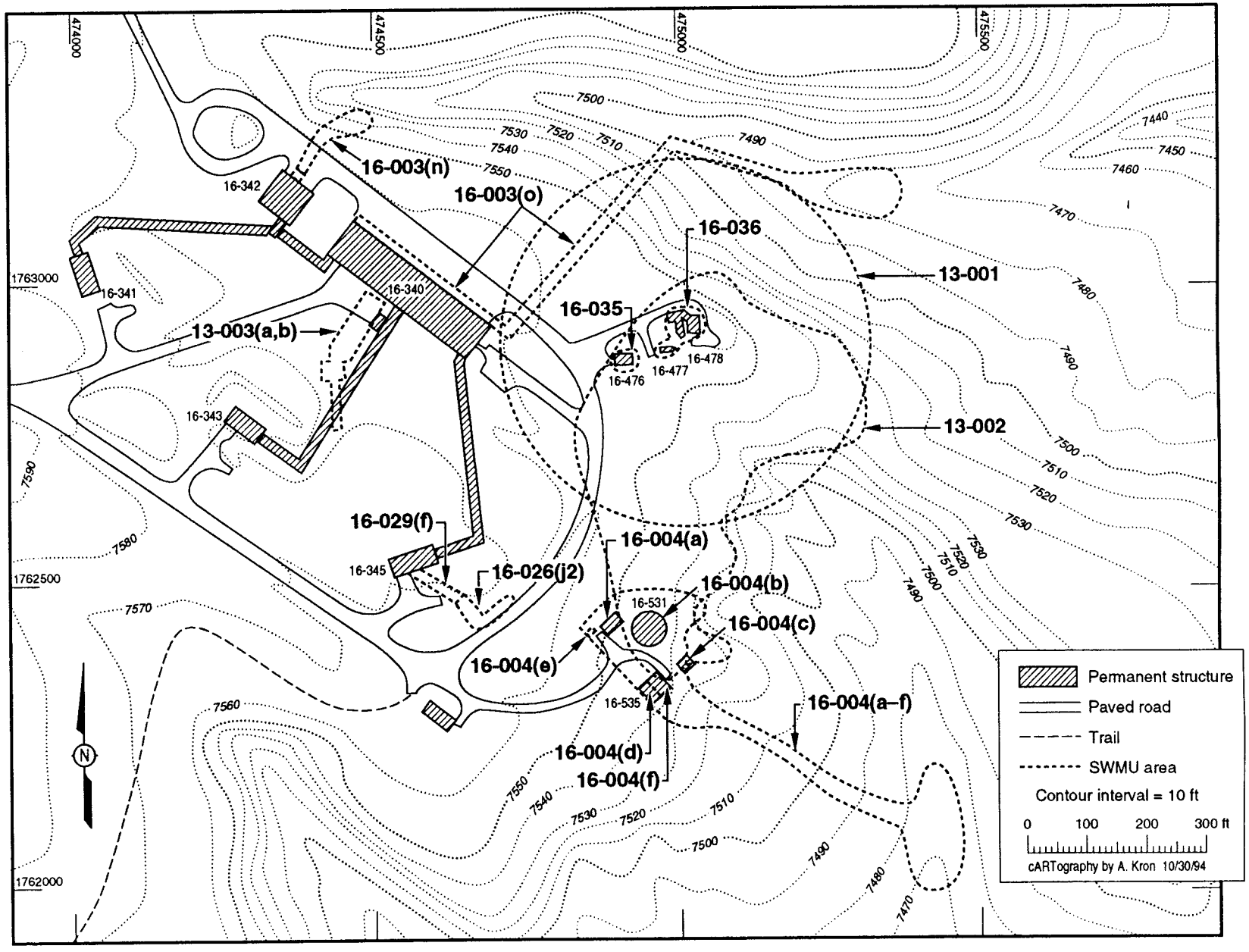


Fig. 5-9. TA-16-340-Line, waste water treatment plant, and TA-13 (P-Site).

of HE in the sump as low (Wilder 1970, 15-16-282). Panowski and Salgado determined that pollution effluents discharged from the building were effectively negligible, and did not identify any solvents used in the building (Panowski and Salgado 1971, 15-16-038).

The outfall, EPA 05A062, receives effluent from a HE sump on the northeast corner of TA-16-342, as shown in Laboratory drawing 13Y-192101 (Palmer and Abercrombie 1991, 15-16-366). The sump receives process and wash-down water following cleaning activities. The outfall discharges into a tributary of Cañon de Valle.

TA-16-342 is a facility for mixing and blending the constituents of plastic-bonded explosive formulations. Voelz, Laboratory H-DO, recorded that natural uranium had been used in the building; he did not specify quantities or frequency of use (Voelz 1979, 15-37-003; LANL 1989, 15-16-361).

**SWMU 16-003(o): TA-16-340.** SWMU 16-003(o) is six active HE sumps associated with TA-16-340 (Fig. 5-9). Waste consists primarily of HE and solvents. In 1970, Wilder classed the use of HE as moderate and the probability of HE in the sump as low (Wilder 1970, 15-16-282).

The outfall, EPA 05A054, discharges effluent from the six HE sumps on the northeast side of TA-16-340, sink drains, floor drains, equipment drains, and roof drains, as shown in Laboratory drawing 13Y-192074 (Palmer and Abercrombie 1991, 15-16-366). The effluent flows into a common drain line that discharges into a short tributary of Cañon de Valle. An attempt was made to eliminate volatile organic compounds from the outfall by installing a 250-ft-long weir-type discharge aerator that functioned as an air stripper. This structure caused outfall liquid to be disseminated over a larger area because of splashing.

TA-16-340 is a facility for producing plastic-bonded explosives. Most of the volatiles are distilled during the processing. In the past, any remaining solvents were discarded to the sump with the waste water. However, a solvent distillation treatment unit has been recently installed to trap residual solvents before discharge (LANL 1989, 15-16-361). Voelz, LANL H-DO, recorded that natural uranium had been used in the building; he did not

specify quantities or frequency of use (Voelz 1979, 15-37-003; LANL 1989, 15-16-361).

Panowski reported TA-16-340 as the largest user of solvents at TA-16. He classed the building as having emitted large quantities of explosives, solvents, gases, and other materials (Panowski and Salgado 1971, 15-16-038). The most volumetrically significant solvents used in TA-16-340 were acetone and n-butyl acetate.

The SWMU Report incorrectly identifies the outfall, EPA 05A054, as EPA 05A062 (LANL 1990, 0145).

**SWMU 16-029(f) and SWMU 16-026(j2): TA-16-345.** SWMU 16-029(f) is an active HE sump associated with TA-16-345 (Fig. 5-9). SWMU 16-026(j2) is the outfall from SWMU 16-029(f) and is located southeast of TA-16-345. Wilder stated that HE was stored in containers and the probability of HE in the sump was nil (Wilder 1970, 15-16-282). Panowski and Salgado classed the quantity of pollution effluent discharged from the building as effectively negligible (Panowski and Salgado 1971, 15-16-038).

The outfall receives effluent from the sump, as shown in Laboratory drawing 13Y-192180 (Palmer and Abercrombie 1991, 15-16-366). The exact discharge point is unknown. The EPA designation is unassigned (LANL 1989, 15-16-361).

TA-16-345 is a rest house that serves as an HE storage facility for TA-16-340. It has a single sump and associated drain lines. The sump has received wash-down water generated during cleaning activities. HE is the only known material stored in the building (LANL 1989, 15-16-361).

### 360 Building - HE Packaging

**SWMU 16-029(e) and SWMU 16-026(h2): TA-16-360.** TA-16-360 (Fig. 5-10) is packing and shipping facility for finished HE products. Explosive components are packaged for storage or for shipment to other users. In 1970, use of HE was low and probability of HE in the sumps was very low (Wilder 1970, 15-16-282). Hazardous wastes discharged from the building were effectively negligible (Panowski and Salgado 1971, 15-16-038).

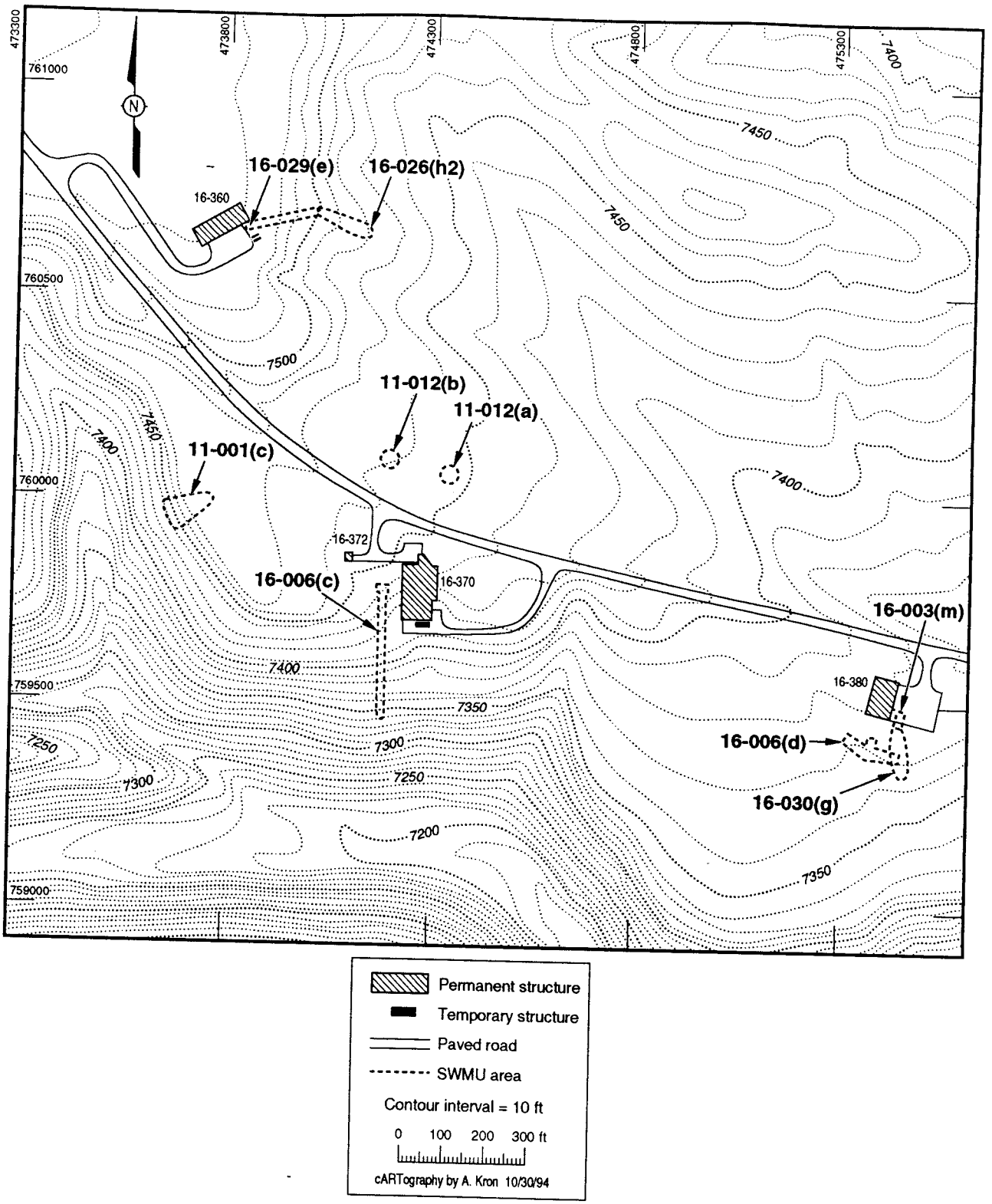


**Fig. 5-10. TA-16-360, TA-16-370, and TA-16-380 area.**

**SWMU 16-029(e).** SWMU 16-029(e) is an inactive HE sump associated with TA-16-360, as shown on Laboratory drawing 13Y-192111 (Palmer and Abercrombie 1991, 15-16-366).

**SWMU 16-026(h2).** SWMU 16-026(h2) is an outfall associated with the HE sump at TA-16-360. The sump and outfall most likely received wash water from past cleaning practices (LANL 1989, 15-16-361).

**380 Building - HE Inspection**

**SWMU 16-003(m) and SWMU 16-030(g): TA-16-380.** TA-16-380 (Fig. 5-10) functions as an inspection site for raw HE powder brought to TA-16. Wilder classed the use of HE as very high and the probability of HE in the sumps as moderate (Wilder 1970, 15-16-282).

**SWMU 16-003(m).** SWMU 16-003(m) is the inactive HE sump associated with TA-16-380. The sump receives wash-down water generated during cleaning activities (LANL 1989, 15-16-361). The waste consists primarily of HE.

**SWMU 16-030(g).** SWMU 16-030(g) is an outfall, EPA 05A052, associated with the HE sump at TA-16-380. It receives effluent from the sump, two roof drains, and a drop inlet as shown in Laboratory drawing 13Y-192091 (Palmer and Abercrombie 1991, 15-16-366). The drop inlet drains the parking area on the east of TA-16-380.

The SWMU Report (LANL 1990, 0145) lists two HE sumps, one of an unknown size, discharging to outfall EPA 05A057. The sump of unknown size is actually a parking lot drain that discharges to outfall EPA 05A052. It is shown on Laboratory drawing 13Y-192091 as a drop inlet (Palmer and Abercrombie 1991, 15-16-366).

#### 5.2.1.2 Conceptual Exposure Model for HE Sumps and Inactive Outfalls

The conceptual exposure model is presented in Fig. 4-9. Site-specific information on potential release sources, chemicals of concern, migration pathways, and potential receptors is presented below.

SALs in sediment, and another HE by-product, TNB, has been detected below SALs. In addition, barium, chromium, lead, and beryllium have been detected above SALs in soil or water in TA-16 drainages. Uranium in a water sample at TA-16-340 was above the SAL. Organics were present in several drainages below SALs and above SALs in sump water. These data do not suggest that any sumps, drains, or outfalls in the aggregate contain HE at explosive concentrations.

#### 5.2.1.2.2 Potential Pathways and Exposure Routes

Potential release of contaminants from the sumps, drain lines, and outfalls could occur as the result of leaks from the sump bottom or pipe joints into subsurface soil, and spillage and liquid disposal to the outfall onto surface soil and sediments in drainages. It is unlikely that any leakage from the sump bottoms has occurred since the installation of aluminum liners in the sumps in 1966. Once these contaminants have been released into the environment the major migration pathway is via surface water runoff which may carry contaminants beyond the original release site to accumulate in sedimentation areas in drainages. Potential subsurface contamination can be brought to the surface via excavation or erosion.

Current human receptors include on-site workers and recreational users. Chapter 4 contains a detailed discussion of the migration pathways, conversion mechanisms, human receptors, and exposure routes.

### 5.2.2 Remediation Decisions and Investigation Objectives

**Problem Statement (DQO Step 1)**

HE operations in the modern TA-16 complex have resulted in known releases of COCs into drainages associated with HE sumps at levels above SALs. The principal goal of Phase I of the RFI work plan for the sumps is to delineate the HE contamination in the drainages associated with the inactive sumps, in order to implement an effective VCA following submission of a VCA plan. We anticipate that this VCA will consist of excavation of contaminated soil, removal of HE by burning, and disposal of the residue in an appropriate landfill. A CMS is not expected to be required. A subsidiary goal is to investigate drainage extents of PCOCs, such as organics, that have not been shown to have been released from these SWMUs above SALs.

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In detail, the principal objective of Phase I of the RFI for this aggregate is to determine: 1) whether the levels of COCs are different from background, and if so, if they are above SALs; 2) the extent of HE contamination for those sump outfalls known to be contaminated based on existing data; and, 3) for those sump systems where contamination is found in the drainage whether a large plume of contamination is present beneath the sump. Sampling is necessary to determine, for these areas directly adjacent to the HE-contaminated areas, which will ultimately receive a VCA, whether contaminant concentrations warrant: 1) Phase II study and possible additional remediation, 2) a baseline risk assessment, or, 3) NFA based on Phase I sampling.

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**Decision Process (DQO Step 2)**

A Phase I study will be conducted to determine for each of the sumps and outfalls, which of the following actions should be recommended, subsequent to VCA of the HE-contaminated region:

1. Phase II study, if PCOCs are found above SALs and additional data are needed to further bound HE-contaminated areas or to perform a baseline risk assessment.

2. Baseline risk assessment, if PCOCs are found above SALs, and sufficient data exist to determine risks associated with the sump and outfall drainage

3. NFA, if no COCs are detected or they are below SALs

4. An expanded VCA, if it is deemed to be more cost-effective to merely expand the zone of VCA.

5. Deferred action on the sump and drain line.

6. An interim measure to reduce risks to construction workers potentially excavating in a sump region.

7. Corrective measures study, if risks are unacceptable and there is not an immediate and effective solution.

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Possible remediation alternatives for the outfalls and drainages include: 1) removal of HE-contaminated soil to a permitted landfill after removal of

HE at the TA-16 burning ground to eliminate any safety risk in transporting the soil off site; 2) *in-situ* degradation of HE by composting; or, 3) thermal, chemical, or biological treatment of HE-contaminated waste followed by replacement of clean soil. After remediation all sites will be resampled to confirm that cleanup was effective.

Figure 5-12 illustrates the decision process.

### 5.2.3 Data Needs and Data Quality Objectives

**Decision Inputs and Investigation Boundary (DQO Steps 3 and 4)**

In Phase I, the following questions will be addressed for each sump with an outfall.

1. Over what area do HE levels exceed SALs in the surface soils of the drainages associated with the outfalls?

2. Do the levels of barium or other metals exceed SALs in the surface soils of the drainages outside the HE-contaminated zone?

3. For the sumps that were involved in processes using radioactive materials, do levels of radionuclides exceed SALs?

4. Are HE, HE by-products, metal, or organic contaminants present at levels above SALs in the subsurface soils of the drainages or beneath the sumps draining to contaminated drainages?

21

The data required to answer the first question are HE screening data and concentrations of HE in the surface soils along the drainages associated with the sump outfalls. The data needed to answer the second question are the concentrations of metals in the surface soils of drainages outside the HE-contaminated zone. The data needed to check for radioactive contamination are the levels of radionuclides present in the surface soils of the drainages. Determination of organic contamination will require field screening for organics and subsurface data beneath the outfalls. Identifying

subsurface contamination beneath sumps with contaminated drainages will require analysis of samples from angled cores.

The decision process will be applied to the surface and subsurface soils of the outfalls and their associated drainages. It will also be applied to subsurface soils beneath sumps with contaminated outfalls. Sump drainages are generally well-defined; it is unlikely that contaminants have traveled upslope out of the drainage areas. Drainages will be considered for a maximum distance of 500 ft, because at TA-16-260, which is the most contaminated process-building drainage (see Subsection 5.3), existing data suggest minor HE transport beyond a distance of 500 ft from its outfall. Subsurface soils and tuffs at the outfalls will be considered down to a depth of 2.5 ft in bedrock during Phase I. Movement of HE and barium into the tuff will be evaluated using this vertical sampling domain. Based on previous studies in which metal contamination has been found within bedrock, it is expected that the highest concentrations of PCOCs in tuff will occur within 2.5 ft of the soil/bedrock interface (Nyhan et al. 1984, 0166; McLin 1989, 15-16-405).

21

Surface contaminants will be assumed to be concentrated in the natural sediment traps of the drainages. If organic contamination is present, it will be assumed to be concentrated in the near surface and subsurface soils immediately below an outfall or at the first sediment trap downstream from an outfall in those situations where an outfall daylights onto bare tuff. Subsurface contamination near and beneath the sumps is assumed to be most serious near the joint between a sump and its drain line based on information provided by site workers who were present during the 1960s cleanup of World War II era S-Site (Martin and Hickmott 1993, 15-16-497).

**Decision Logic (DQO Step 5)**

Existing data suggest that the drainages directly adjacent to many of the outfall points for these sumps are contaminated. Thus, we plan on implementing a VCA on those portions of the drainage that are shown to be contaminated based on the HE spot test results. The HE spot test indicates what portion of the drainage contains high concentrations of HE. If high concentrations of HE are indicated, then it is assumed that other COCs might exist in the same location. Most of the drainages in this aggregate are

Surface samples for HE and metals will be located using HE field screening techniques described above. A total of 5 laboratory surface samples will be planned in each drainage. The preferred sample size of 5 selected for the surface samples is associated with a probability of 0.9 if 40% is contaminated (see Subsection 4.5.1.1). Contaminant disposal processes in a drainage are likely to produce homogeneous contamination (i.e., 40%).

Sampling for volatile organics and other constituents will be conducted in the near surface and subsurface soils of the drainages directly beneath the outfalls, or at the first downstream sediment trap if an outfall daylights in bare tuff where the concentrations would be expected to be highest if organic contaminants were present. A second near surface/subsurface sample in each drainage will be taken at the second downstream sediment trap. Note that at TA-16-340, four subsurface cores will be taken, two at the outfall and two at the outfall of the discharge aerator. For each outfall, sample measurements will be obtained at three different depths to provide information on possible downward transport of contaminants. If contaminant levels are determined to be different from background, then the sample maxima will be compared to the SAL.

21

### 5.2.4 Sampling and Analysis Plans

All of the sumps discussed in this subsection have relatively similar operational histories and suites of contaminants, with HE being the principal PCOC; thus, a generic sampling plan applicable to all of the sumps and drainages is presented below. Figure 5-13 schematically illustrates this generic sampling plan. SOPs used in this sampling plan are delineated in Table 5-19. Numbers of samples in each SWMU are delineated in Table 5-20. Approximate downstream locations of field-screening points for each outfall are shown in Figs. 5-13 through 5-25. Field screening methods are described in Subsection 4.7; SOPs for these methods are in preparation.

#### 5.2.4.1 Engineering Surveys

Detailed engineering and geomorphologic surveys are needed to accurately map drainages from the HE outfalls in the field, as well as to lay out sampling points for HE spot tests, radiation surveys, and surface and near surface/subsurface sampling. The spacing of surveyed surface points is

## 5.3 HE Sumps and Active Outfall at TA-16-260, SWMUs 16-003(k), 16-021(c)

### 5.3.1 Background

This aggregate consists of 13 high explosive sumps, their drain lines, the outfall, and the well-defined drainage channel associated with TA-16-260 (Fig. 5-27; Tables 5-21, 5-22). The sumps have been designated SWMU 16-003(k) and the outfall as SWMU 16-021(c). The outfall is permitted as EPA 05A056. A general background discussion of sumps and their operating principles is given in Subsection 5.2.1.

The outfall receives effluent from the sumps, as shown on Laboratory drawing 13Y-1920756 (Palmer and Abercrombie 1991, 15-16-366). Each sump flows into a trunk line that discharges to the outfall. Sump S14, serving Bay 25 on the southeast end of TA-16-260, has been removed. The outlet of Sump S15 is plugged and the sump is no longer active.

TA-16-260 is an HE machining facility that processes large quantities of explosives. Machine turnings are routed to the sumps as waste. The drainage channel from the outfall is contaminated with explosive waste, including barium nitrate, the primary ingredient in the explosive baratol.

In 1966, the 10-ft wide loading dock on the rear (northeast) of TA-16-260 was removed. New sumps with water-tight aluminum liners were installed adjacent to the northeast wall of TA-16-260. HE-contaminated dirt under the old sumps was removed and replaced with clean, compacted earth. PCOCs are listed in Table 5-21.

#### 5.3.1.1 SWMU Description and History

**SWMU 16-003(k).** SWMU 16-003(k) is 13 HE sumps and drain lines associated with TA-16-260. Sump dimensions are 90 in. by 36 in. by 31 in. (1 each) and 176 in. by 36 in. by 31 in. (12 each). Unlike most active sumps located at TA-16, the majority of these sumps are located above ground level. Each sump is served by a primary cement trough (2 ft deep x 1.5 ft wide) that empties into a secondary cement trough (4 ft deep x 1.5 ft wide). This trough feeds into the main feeder trough (4 ft deep x 2 ft wide) that drains to the outfall. All of the cement troughs are capped by removable steel lids. The waste consists primarily of HE. In 1970, Wilder classed the

24a

In addition, a perimeter sampling approach will be applied that combines measurements from HE field screening and analytical samples. Field screening will be applied as described in Subsection 5.3.4 to determine the edge of HE-contaminated area. Based on the results of HE field screening on a grid, 14 analytical samples will be taken outside the HE-contaminated region, as delineated by field-screening. A 100-ft interval for these laboratory samples should provide adequate coverage of the soils bounding the central drainage. These laboratory samples will be used to check for barium and for HE occurring at levels above SALs but below the limit of detection of the HE spot test. Additional samples will be taken where radiation field screening results yielded above background levels in order to examine the possible presence of uranium.

24a
25

*Subsurface samples* : Although augering in highly HE-contaminated zones is hazardous, a limited number of subsurface samples are needed for waste management characterization, particularly to determine the presence or absence of RCRA-listed solvents in the outfall. Three laboratory samples will be selected from subsurface cores in the highly contaminated region of the outfall. The locations of those samples will be based on field screening by PID.

In addition, subsurface samples beneath the sumps and their feeder troughs are required to determine the distribution of contamination. At least 10 laboratory samples will be taken from 5 angled cores beneath the sumps and from 5 angled cores beneath the drainage troughs.

### 5.3.4 Sampling and Analysis Plans

The outfall from the sumps associated with machining building TA-16-260 are by far the most contaminated of any at S-Site (see Subsection 5.3.1.2.1).

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The HE sumps described in this subsection are all active. In addition, the drain line for these sumps is in use, although WX-3 will soon plug the outfall (Barr 1992, 15-16-329).

SOPs that control field activities in this sampling plan are listed in Table 5-26. Sample numbers and necessary analyses are shown in Table 5-27. Field screening methods are described in Subsection 4.7. SOPs for field screening are currently in preparation.

**TABLE 5-27**

**SUMMARY OF SITE SURVEYS, SAMPLING, AND ANALYSIS FOR TA-16-260**

| PRS | PRS TYPE | SAMPLED MEDIA | LABORATORY SAMPLES # | | | | | | FIELD SCREENING # | | | | | | | FIELD | | | | | | | LABORATORY ANALYSES # | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | STRUCTURE | | SURFACE | | SUBSURFACE | | | | | | | | A | | | | | B | | | C | | | | D | E | F | G | H | |
| | | | | FIELD DUP | | FIELD DUP | | FIELD DUP | GROSS ALPHA | GROSS GAMMA/BETA | ORGANIC VAPOR | HE SPOT TEST | GEOPHYSICS SURFACE | BARIUM - LIBS | GEOLOGICAL CHARACTERIZATION | GROSS ALPHA | GROSS GAMMA/BETA | HE | VOLATILE ORGANICS | XRF | SOIL MOISTURE | ALPHA SPECTROSCOPY | GAMMA SPECTROSCOPY | BETA SPECTROSCOPY | TOTAL URANIUM | ISOTOPIC PLUTONIUM | ISOTOPIC URANIUM | VOA (SW 8240) | SEMIVOLATILES (SW 8270) | METALS (SW 6010) | PCBs (SW 8080) | HIGH EXPLOSIVES (SW 8330) | CYANIDE |
| 16-003(k) | HE sump & trough | Sediments | | | | | 20 | | | | | 120 | | | | | | | | | | | | 20 | | | 20 | 20 | 20 | | 20 | 20 |
| 16-021(c) | Bounding samples | Sediments | | | 14 | | | | | 30 | | 155 | | | | | | | | | | | | 14 | | | | 14 | 14 | | 14 | 14 |
| 16-021(c) | Drainage center | Sediments | | | 17 | | 3 | | | | 33 | | | | | | | | | | | | | 20 | | | 3 | 20 | 20 | | 20 | 20 |

A, B, C, G = not applicable; D, E, H = full suite; F = 1082 suite. Note that TCLP analyses will be done on the center-drainage samples within 100 ft of the pond.
# The actual number of points will depend on the results of the field screening as it defines the lateral boundaries of the contaminated area.

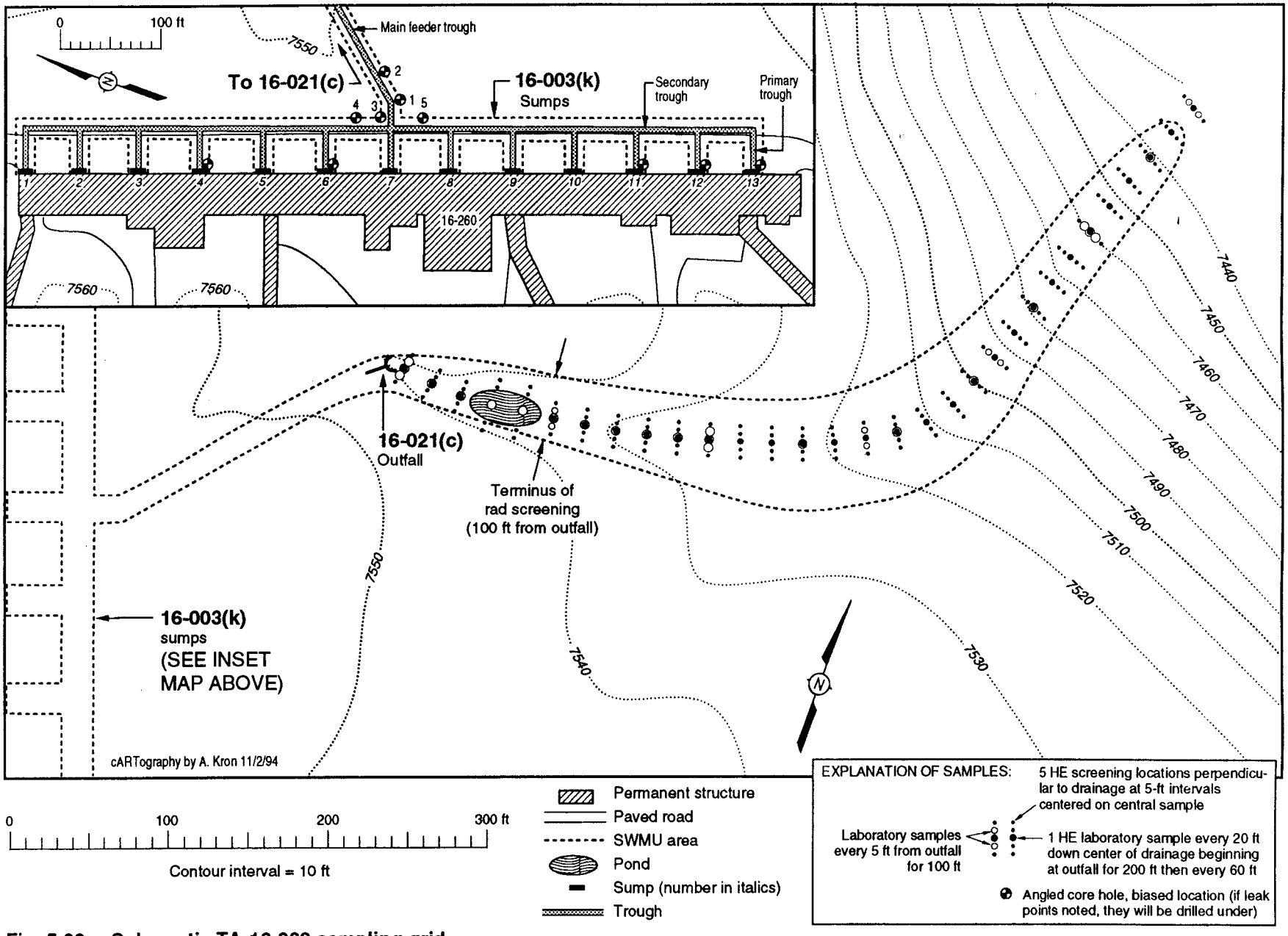


**Fig. 5-29. Schematic TA-16-260 sampling grid.**

Samples will be taken in the center of the drainage every 20 ft starting at the outfall and continuing for a distance of 100 ft from the HE pond (Fig. 5-25). Each of these samples will be augered to a depth of 2 ft or bedrock. The 0- to 6-in. interval of each of these cores will be submitted for laboratory analysis (Table 5-27). The remainder of each of these cores will be screened on 6-in. intervals for volatile organics by PID. Three deep-surface laboratory samples will be selected from these screened intervals based on positive readings on the PID. The samples exhibiting the highest readings will be selected. In the absence of positive readings, the three deep-subsurface samples will be randomly selected. These deep surface samples will be analyzed for volatiles, as well as the other COCs for this aggregate. Starting at a distance of 100 ft from the pond additional (0 to 6 in.) laboratory samples will be collected from the surface at 60-ft intervals downstream to Cañon de Valle.

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Subsurface sampling is needed beneath the active sumps and drainage troughs.

24a

Sumps 4, 6, 11, 12, and 13 (from the north end of the building) have been used extensively (Hyde 1994, 15-16-584) and are representative of all 13 sumps (Fig. 5-30). A single 45-degree angled core hole to a total depth of 4 ft, with a wellhead at a distance of 2 ft east of each of these sumps would yield a core that passed roughly 2 ft beneath the center of each sump (Fig. 5-30). Wellheads will be located so the cores pass adjacent to the sump-trough joint, a possible leak point. These cores will be screened at 6-in. intervals for HE by spot test. The deepest and shallowest positive sample for each sump will be submitted for laboratory analysis. In the absence of a positive reading for any sump, submit only the deepest sample from a core. We will not continue coring farther than beneath the center of the sump because we do not want to core into the building's foundation.

The subsurface beneath the feeder troughs to the 260 outfall will also be sampled using angled cores. A preliminary examination of roughly 10 locations on the feeder troughs revealed no obvious leak points or cracks. A more detailed survey that will include washing the interior of the troughs with water will further search for leak points or patched areas. If these are found, they will be sampled preferentially. In the absence of the discovery of leak points, the 5 trough samples will be located: 1) at a

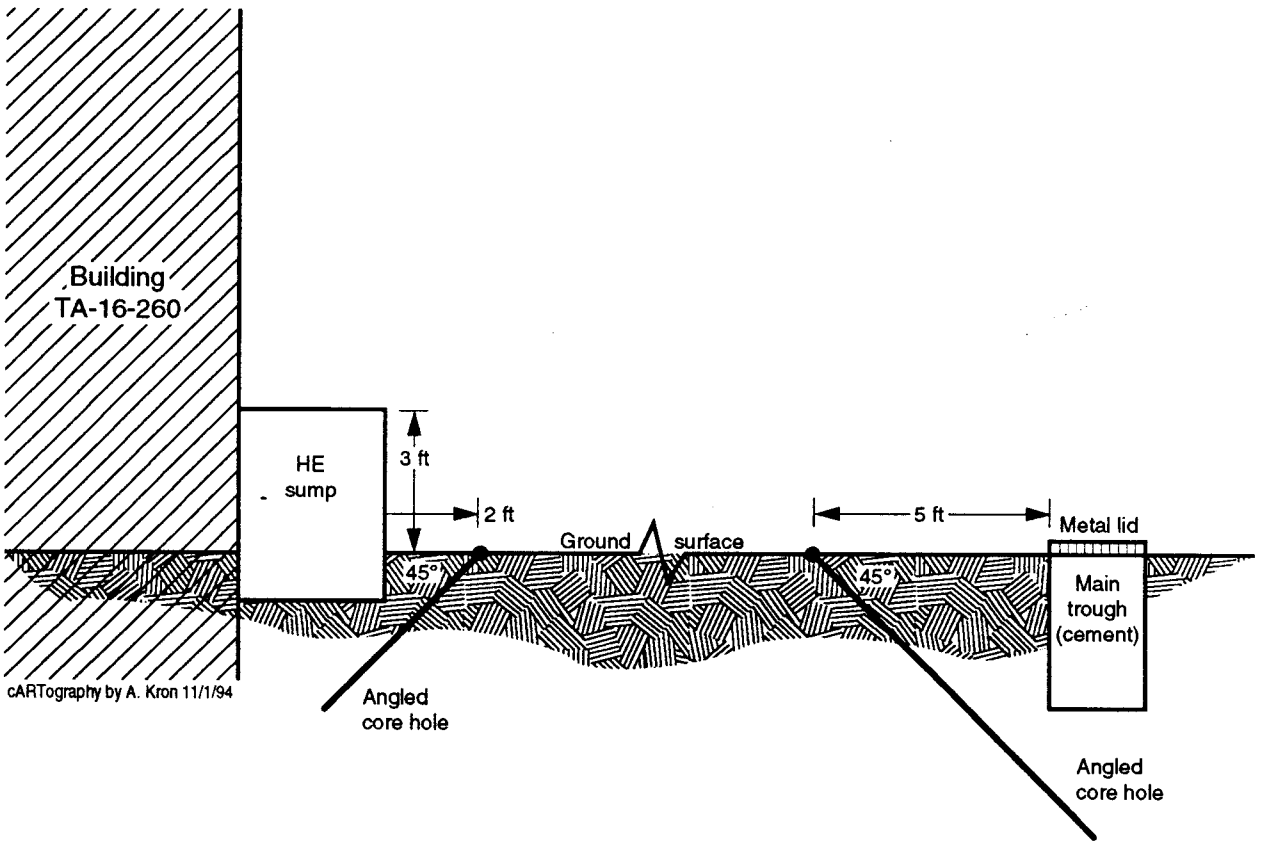


**Fig. 5-30. Schematic cross section showing angled coring approach under sumps and troughs**

distance of 20 ft down the main feeder trough; 2) at a distance of 40 ft down the main feeder trough; 3) at the joint between the main feeder trough and the 2 main secondary troughs; 4) at a distance 20 ft north of the main trough joint; and, 5) at a distance 20 ft south of that joint. Those locations are designated as 1 - 5 on Fig. 5-29.

Each of these 45-degree angled cores will have a wellhead roughly 5 ft from the trough and will pass roughly 1 to 2 ft beneath the center of the trough. The cores will be HE field screened on 6-in. intervals, and the shallowest and deepest positive intervals will be sent for laboratory analysis. In the absence of positive indicators only the deepest core interval will be submitted for laboratory analysis. If the deepest interval in any core yields a positive field screening reading, continue coring and laboratory sampling until no positive HE screening readings are found.

#### 5.3.4.3 Laboratory Analysis

Full laboratory analyses of samples will be at Level III using the following methods: uranium (LANL or DOE method), VOCs (SW-846 Method 8240), SVOCs (SW-846 Method 8270), metals (SW-846 Method 6010), and HE and its by-products (SW-846 Method 8330). TCLP analysis for metals will be performed on a subset of samples. SOPs used in this sampling plan are listed in Table 5-26. The metal of particular concern for this sampling plan is barium; HE of principal concern are HMX, RDX, TATB, and TNT; HE by-products of concern are HE degradation products and HE impurities such as DNT, DNB, and TNB (See Appendix D).

#### 5.3.4.4 Sample Quality Assurance

Field quality assurance samples will be collected according to the guidance provided in the latest revision of the IWP. Sampling parameters are summarized in Table 5-27, including a listing of appropriate QA/QC field duplicates planned to be collected during the course of the field investigations.

## 5.4 TA-11 and TA-16 Septic Systems Aggregate, SWMUs 11-005(a,b), SWMUs 13-003(a,b), and SWMUs 16-006(a,c,d,e)

### 5.4.1 Background

The following active septic systems, and one inactive system where the tank was probably removed, have been aggregated as a result of their common construction details, the character of the facilities that each serves or served (laboratory, process, office facilities), and the common sampling methods to be used. The inactive septic system [SWMUs 13-003(a,b)] includes a septic tank and drain field that were located in TA-13, now designated as part of TA-16. It should be stressed that all of these SWMUs were considered for deferred action including SWMU 13-003(a,b), which lies partially under an existing building. Our intent here, therefore, is to detect only significant and widely dispersed amounts of contaminants in these systems through a very nominal sampling approach prior to decommissioning and demolition (D&D). The concentration of potential contaminants in the septic drain field or outfall will be an indicator of the risk posed by the system. If contaminants are detected in the septic system, then further characterization or a VCA will be proposed prior to D&D.

#### 5.4.1.1 Description and History

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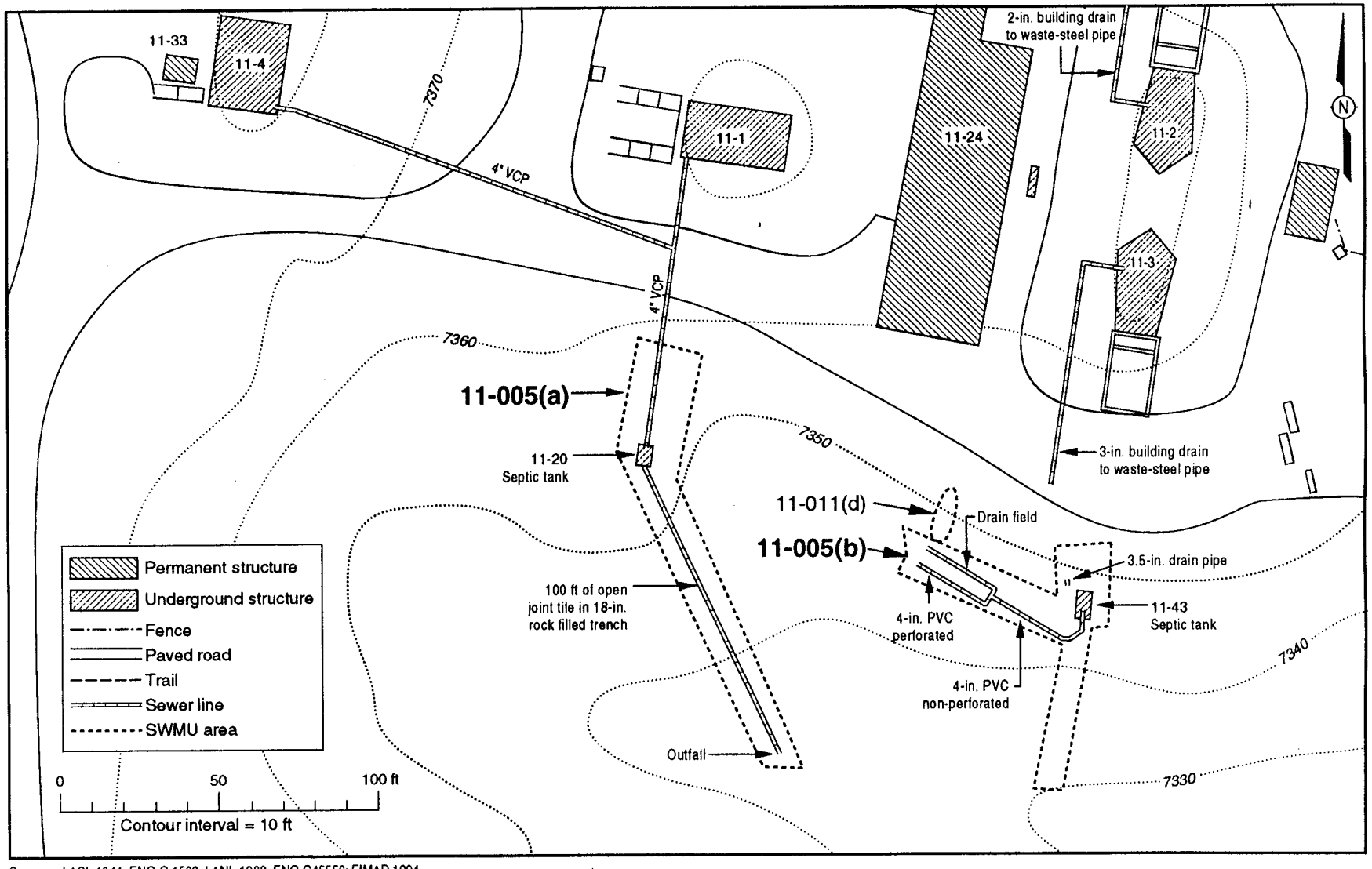
**SWMU 11-005(a): TA-11-20.** SWMU 11-005(a) is an active septic system to the south of TA-11-1 serving TA-11-4 and TA-11-1 since 1944 (Fig. 5-31). This septic system served the sinks and rest room facilities in TA-11-4 and a sink in TA-11-1. The TA-11-1 drain line is now capped and the only source from TA-11-4 is a rest room. As shown on Fig. 5-31, the septic system consists of vitreous clay drain lines from TA-11-4 and TA-11-1, a septic tank, and an open joint tile drain in an 18-in. rock-filled trench from the septic tank to the outfall. The discharge from the outfall is to a slightly sloped area of unconsolidated porous soil. Thus, potential contaminants from this outfall would be concentrated in the discharge area and/or under the open tile drain line.

TA-11-4, currently the control room for the vibration test facility located in TA-11-30, formerly housed a photoprocessing facility. TA-11-4 also contained a machine shop. A single 1950 K-Site safety inspection memo indicated tha




Sources: LASL 1944, ENG-C 1502; LANL 1988, ENG-C45556; FIMAD 1994
Modified by: cARTography by A. Kron 11/1/94

**Fig. 5-31. Locations of SWMUs 11-005(a) and 11-005(b).**

a mercury spill occurred in TA-11-4 (Ogle 1950, 15-11-011). The exact location, source, and extent of the spill are not known.

- TA-11-1, currently a storage area for electronic equipment, formerly served as a control room for buildings TA-11-2 and TA-11-3.

It should be noted that all HE formulation, casting, pressing, and machining was, and continues to be, performed at the main TA-16 HE area. Therefore, no HE or its detonation, burn, or decomposition by-products are expected in any TA-11 building, drain, septic system or associated outfall.

**SWMU 11-005(b): TA-11-43.** SWMU 11-005(b) is an active septic system constructed in 1963 that serves only the rest room facility added to the exterior of TA-11-3; only sanitary waste is expected from this rest room. As shown on Fig. 5-31, the septic system consists of a PVC drain line from TA-11-3 to a septic tank, a PVC drain line from the tank to an outfall, and a perforated PVC leach field to the west of the drain line. While no engineering as-built drawings have been found, site personnel recall that some drains in TA-11-24 were also connected to this septic tank. Formerly housing the air gun facility, TA-11-24 currently contains offices and a small machine shop. For a detailed description of the air gun facility see Subsection 6.2.1. Both the air gun and machine shop activities at TA-11-24 could have produced contaminants that entered this septic system.

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The outfall discharges to a slightly sloped area consisting of porous soil. Thus, potential contaminants from this outfall would be concentrated in the area of the discharge opening and/or the leach field.

**SWMU 13-003(a).** SWMU 13-003(a) is a decommissioned septic tank, TA-13-12, that served TA-13 (P-Site) during the 1940s and early 1950s (Fig. 5-32). This tank served P-1, an office and shop building associated with early implosion and initiator testing. It was then decommissioned and removed in 1951 (LANL 1990, 0145). Engineering drawing, ENG-C 1641 Sheet 1 of 7, shows the location of the septic tank at about 100 ft north of P-1, formerly designated TA-16-475. However, the entire area was leveled in the early 1950s when the 340 complex was built. Portions of the 340 complex were built on top of the original location of the septic tank. The location of the removed septic tank was northeast of TA-16-343. Specific

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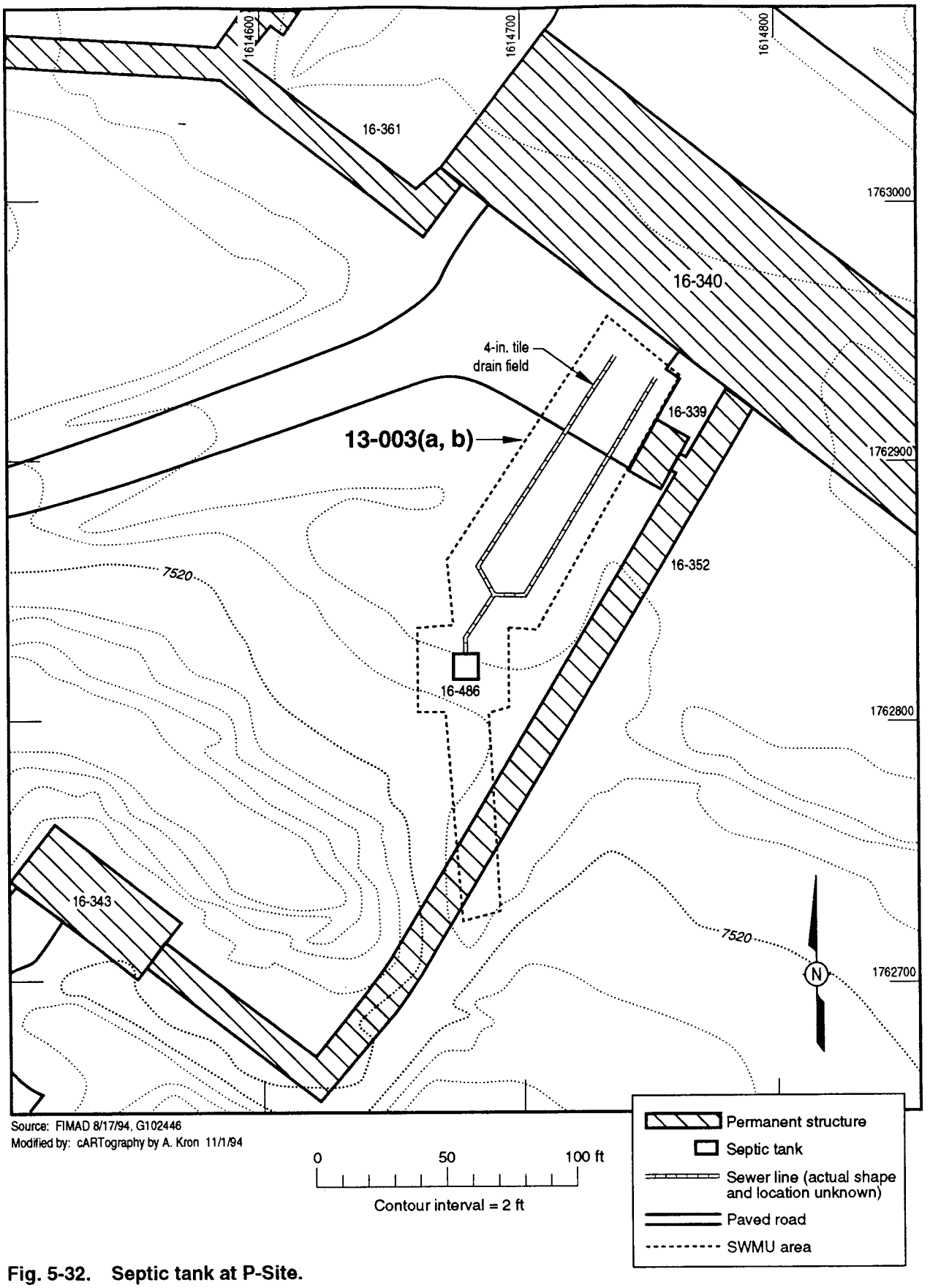


**Fig. 5-32. Septic tank at P-Site.**

details on the removal of this tank and possible contamination, as well as possible contamination from its drain field, are unavailable (LANL 1990, 0145). A report states that either HE or radionuclide contamination might be present in the subsurface soil of the adjacent area (Buckland 1948, 15-13-011). The types of liquid wastes discharged to this tank are unknown. Engineering drawing, ENG-C 1642 Sheet 2 of 7, shows that building P-1 had a toilet, lavatory, and small darkroom adjacent to the sewer hookup. Information on possible releases from the tank and its associated drain field, SWMU 13-003(b), is unavailable.

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**SWMU 13-003(b)** is the drain field associated with the septic tank (TA-13-12) (Fig. 5-32). According to construction drawings, ENG-C 1641 Sheet 1 of 7, the drain field is approximately 100 ft northeast of the septic tank. The drain field allowed the contents of the septic tank to discharge through 4-in. vitreous clay tile and leach into the soil beneath the drain lines. The Engineering drawing ENG-R 5111, Sheet 2 of 7, indicates the removal of the septic tank but does not indicate removal of the drain field.

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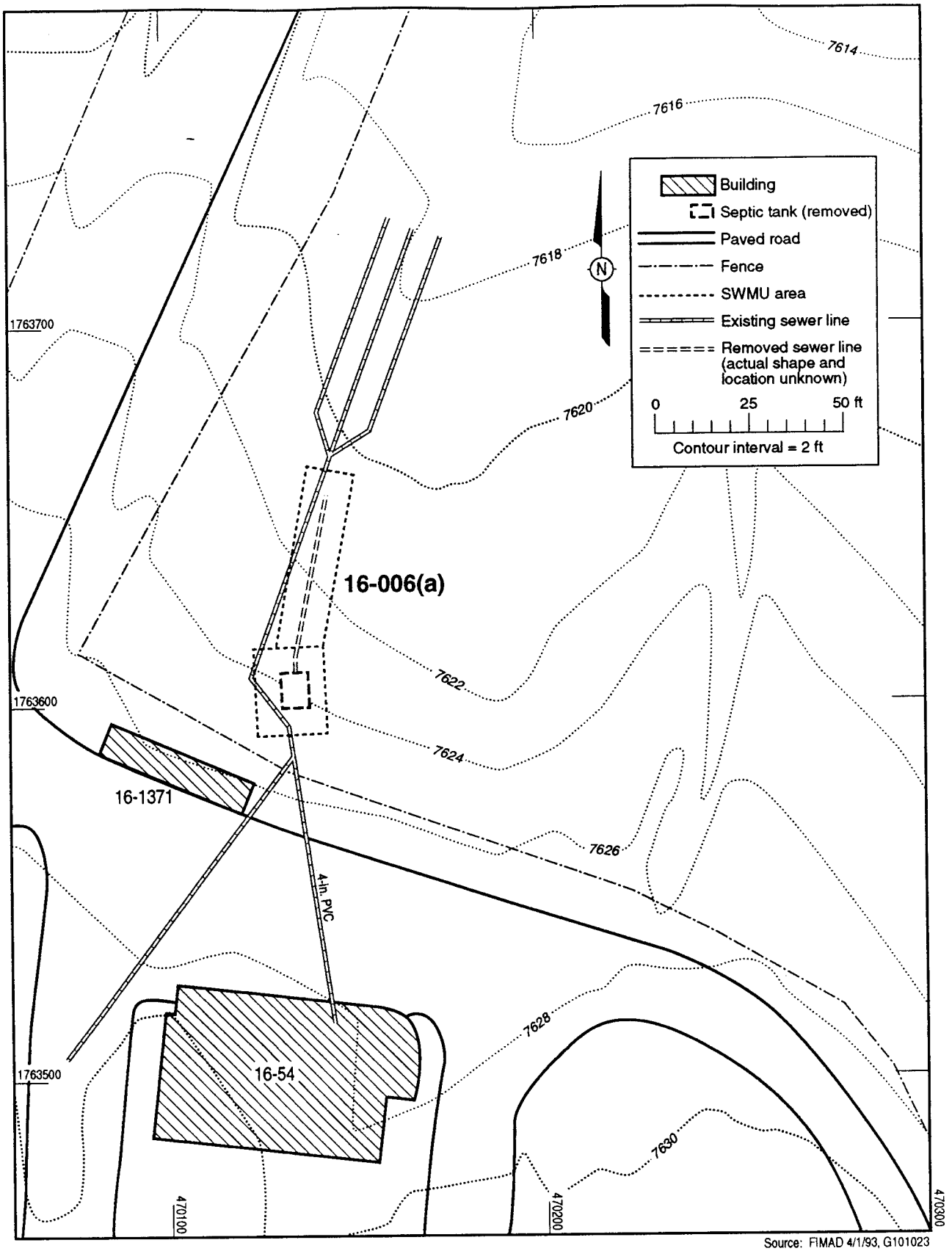
**SWMU 16-006(a)** was a 10 x 5 ft reinforced-concrete septic tank, TA-16-175, with a 500-gal. capacity (Fig. 5-33). There is a 4-in. diameter vitreous clay pipe from TA-16-54 to the septic tank. The septic tank was constructed in 1946 and replaced some time in 1988; the drain line was abandoned in place (drawing ENG-C 45512). The composition of the drain line is unknown. The original tank served TA-16-54, formerly a barium nitrate grinding facility. No drawings have been found that show what drains and fixtures the original septic tank served. The building was used as an environmental testing laboratory in the late 1950s but these activities were discontinued in 1988. The environmental laboratory contained various physical testing machines including a vibration table as well as shock-testing and drop-impact machines. Various weapons and non-weapons components, some of which may have contained hazardous materials, were tested at this facility. The OUPL believes it is possible that common organics used for lubrication and cleaning may have entered the septic system. An environmental survey of TA-16-175 (November 1988) detected volatiles, but did not detect EP toxic metals (LANL 1990, 0145).




Source: FIMAD 4/1/93, G101023
Modified by: cARTography by A. Kron 11/2/94

**Fig. 5-33 Septic tank at TA-16-54.**

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**SWMU 16-006(c)** is a 1 200-gal., reinforced-concrete septic tank, TA-16-371, with its associated drain field (LANL 1990, 0145) (Fig. 5-34). This system was installed in 1953. In a phone interview with Lynn Parkinson (WX-3), Weston personnel document in the CEARP Report that TA-16-370 originally functioned as a barium nitrate facility but was later converted to carbon steel, stainless steel, and aluminum metal forming in the late 1950s (DOE 1987, 0264; Palmer and Abercrombie 1991, 15-16-366). A 1971 memo indicates that at that time, trichloroethylene and acetylene were being used in the building served by this system. (Panowski and Salgado 1971, 15-16-038). The tank served six floor drains, three water closets, and two lavatories on the third floor (LANL 1991, WX Outfall Drawing 13Y-192147). These units are connected to a common line that empties into manhole TA-16-831, which then drains into the septic tank. A 4-in. vitreous-clay pipe drain line empties to daylight at the canyon rim approximately 260 ft south of the septic tank. The outfall drains to a soil/cobble surface for a few feet before going into the canyon.

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**SWMU 16-006(d)** is a 540-gal., reinforced-concrete septic tank with associated drain lines, distribution box, and tile drain field; it was constructed in 1952 (LANL 1990, 0145) (Fig. 5-35). This system serves TA-16-380, a high explosives inspection building. The tank serves five floor drains, two lavatories, two water closets, and one deep sink on the first floor (LANL 1991, WX Outfall Drawing 13Y-192091).

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**SWMU 16-006(e)** is a 385-gal. steel septic tank that was constructed in 1963. It has an associated drain field and outfall which serves TA-16-389, a control shelter at the burning ground (Fig. 5-36). The septic tank serves a water closet, lavatory, and a floor drain (Engineering drawing ENG-C 23442, Sheet 2 of 4). Large quantities of HE and barium are processed through this area. Drawing ENG-C 23442 indicates that the outfall is associated with the overflow line from the tank.

#### 5.4.1.2 Conceptual Exposure Model

The conceptual exposure model for this aggregate is presented in Chapter 4, Fig. 4-7. Subsection 5.4.1.2.1 presents the potential sources of contamination and PCOCs. PRS-specific information on migration pathways and potential receptors is discussed in Subsection 5.4.1.2.2.

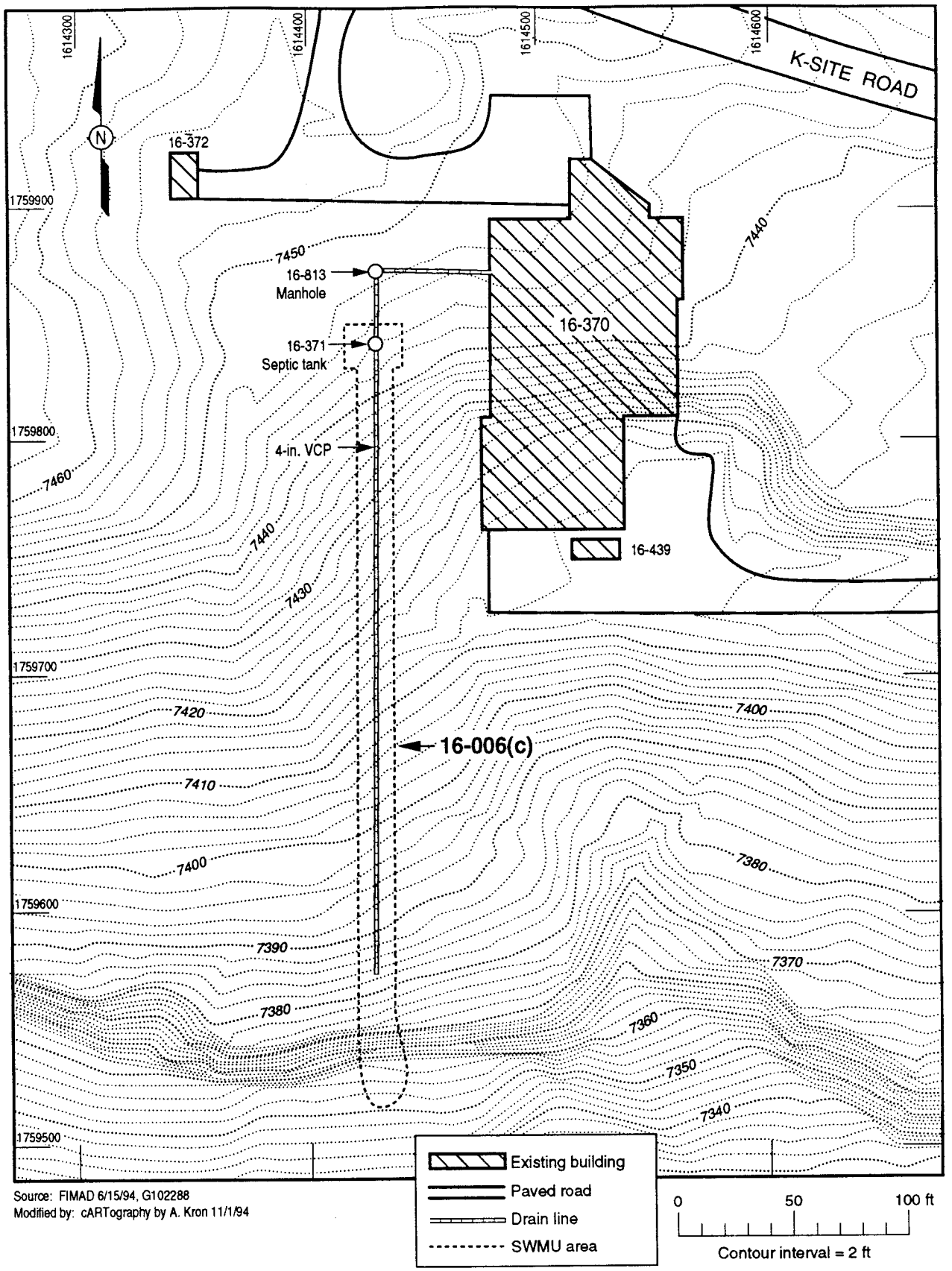



**Fig. 5-34. Location of SWMU 16-006(c).**

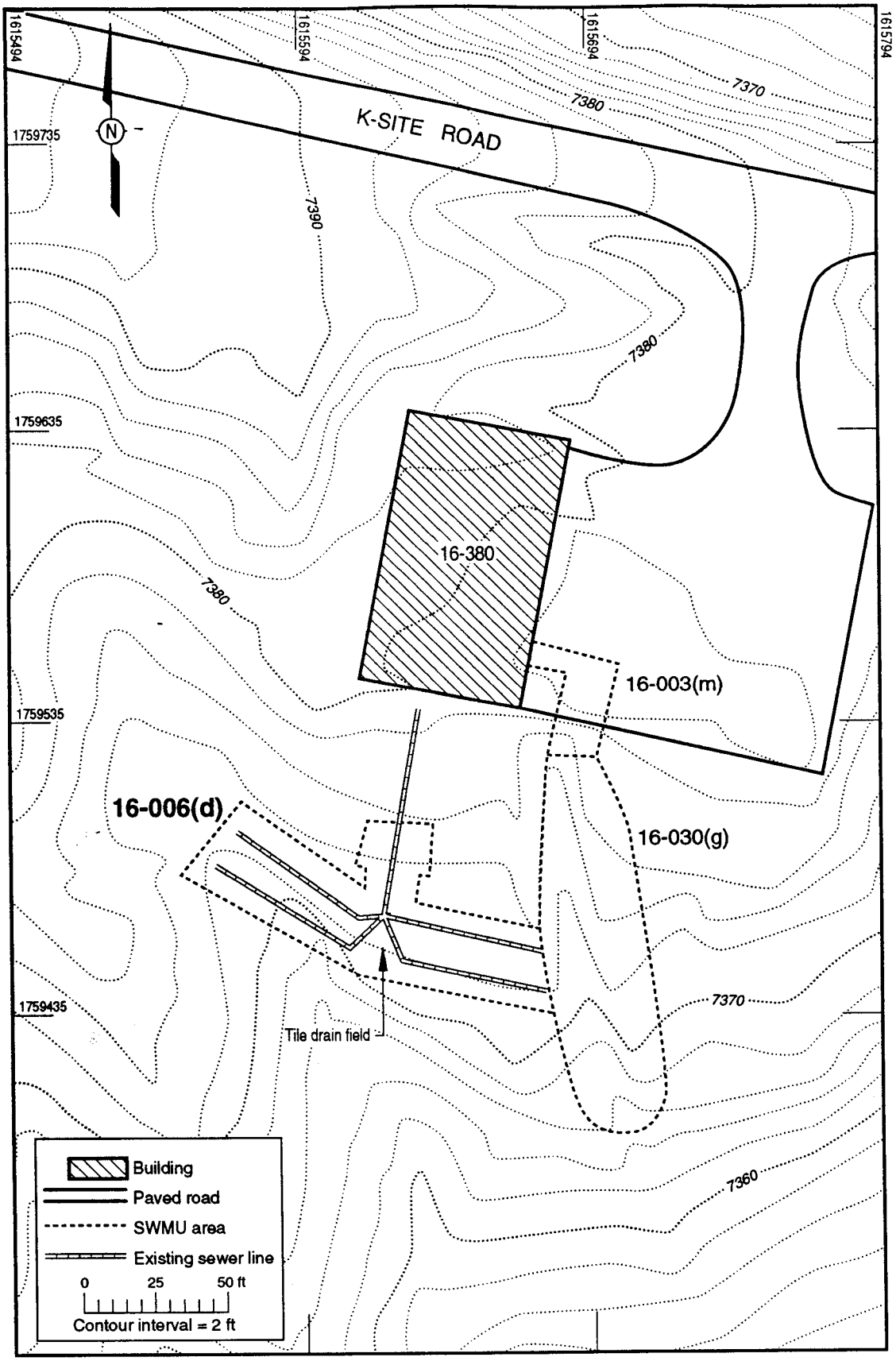
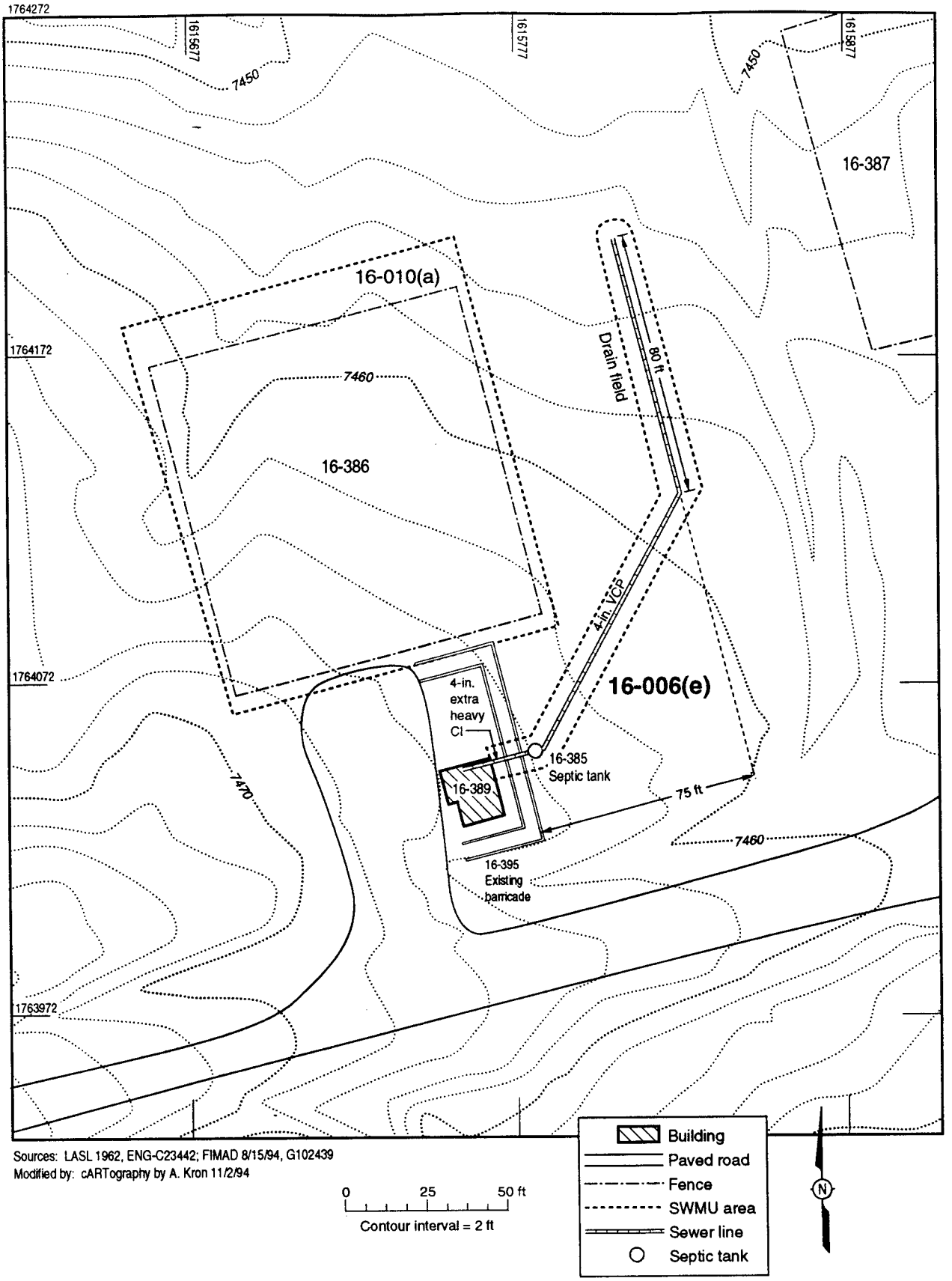



**Fig. 5-35. Location of SWMU 16-006(d).**




Sources: LASL 1962, ENG-C23442; FIMAD 8/15/94, G102439
Modified by: cARTography by A. Kron 11/2/94

**Fig. 5-36. Detail of SWMU 16-006(e).**

soil may be contaminated around the outfalls from tank or drain field overflow. Once contaminants are released into the environment they can potentially migrate into the surrounding soils.

### 5.4.2 Remediation Decisions and Investigation Objectives

**Problem Statement (DQO Step 1)**

Historical activities at TA-11 and TA-16 may have resulted in release of PCOCs into septic systems. The main problem is to quantify the concentration of PCOCs in these systems. Based on the design of the septic systems, it is expected that the highest concentrations of PCOCs will occur in the drain fields or outfalls. All of these septic systems are currently active with the exception of SWMUs 13-003(a,b). The septic tank [SWMU 13-003(a)] was removed when TA-16-340 was built in 1951, but the drain field [SWMU 13-003(b)] was left in place. Thus, it is not practical to sample the soil surrounding the septic tank, but the drain field and/or outfall for each septic system can be sampled.

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**Decision Process (DQO Step 2)**

The Phase I environmental data will lead us to one of four actions: 1) propose NFA for the septic system, 2) conduct a baseline risk assessment, 3) perform a VCA, or, 4) collect additional data in a Phase II environmental survey to better quantify the risk or understand the cost consequences of a VCA. Data that represent the drain fields and outfalls will be the primary determinant for selecting an action. The SAL will be used as a trigger value for the NFA option. Additionally, if any PCOC concentration is measured above SAL, then a Phase II survey will be conducted that will collect subsurface soil samples around the septic tank.

### 5.4.3 Data Needs and Data Quality Objectives

**Decision Inputs (DQO Step 3)**

Data on PCOCs for the soils and tuff associated with the septic tank drain fields and outfalls are needed to evaluate whether concentrations are different from background or below SALs. Concentrations of potential contaminants will be measured by a method in which the detection limit is less than the SAL (see Table 5-28 for a list of PCOCs).

mobile laboratory and the highest two values will be sent for full laboratory analysis.

- PCOCs released through the drain field outfall sampling are not expected to travel far from the end of the pipe. Little flow went through these lines to the outfalls, and there are no other drivers for contaminant movement (no outfall is in a storm water runoff drainage). Three boreholes will be taken for each outfall: one proximal to the outfall, and two downstream in sediment traps (or other parts of the drainage where sediment may collect). One subsurface sample at the soil-tuff interface will also be taken at each outfall. Certain constituents, such as volatiles, would not be detected on surface samples.

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### 5.4.4 Sampling and Analysis Plan

SOPs that control field activities in this sampling plan are listed in Table 5-29. Sample numbers and required analysis are shown on Table 5-30.

**TABLE 5-29**

**STANDARD OPERATING PROCEDURES FOR FIELD ACTIVITIES**

| LANL-ER-SOP | TITLE | NOTES |
|---|---|---|
| 01.02, R0 | Sample Containers and Preservation | Applies to all laboratory analytical samples |
| 01.04, R1 | Sample Control and Field Documentation | Applies to all laboratory analytical samples |
| 06.11, R0 | Stainless Steel Surface Soil Sampler | Applies to surface soil sampling |
| 04.01, R0 | Drilling Methods and Drill Site Management | Applies to core drilling |
| 12.01, R0 | Field Logging, Handling, and Documentation of Borehole Materials | All core samples, soil and lithologic logging |

#### 5.4.4.1 Engineering Surveys

The SWMUs in the septic system aggregate will be field surveyed, which will consist of site engineering (geodetic) mapping and geomorphologic mapping. Site mapping is required to accurately record the location of the SWMUs. In the field, the engineering survey will locate, stake, and document the location of the SWMUs. Sample locations will be registered on a base map, scale 1:7 200. If during the course of sampling any sample points must be

**TABLE 5-30**

**SUMMARY OF SITE SURVEYS, SAMPLING, AND ANALYSIS FOR SEPTIC SYSTEMS AGGREGATE**

| | | | LABORATORY SAMPLES | | | | | | | | FIELD SCREENING # | | | | | | | FIELD LAB. | | | | | | LABORATORY ANALYSES | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | STRUCTURE | | SURFACE | | SUB-SURFACE | | | | | | | | | | A | | | | | B | | | | C | | | | D | E | F | G | H | |
| PRS | PRS TYPE | SAMPLED MEDIA | | FIELD DUP | | FIELD DUP | CORES | SAMPLES PER CORE | TOTAL | FIELD DUP | GROSS ALPHA | GROSS GAMMA/BETA | ORGANIC VAPOR | HE SPOT TEST | GEOPHYSICS SURFACE | BARIUM LIBS | GEOLOGICAL CHARACTERIZATION | GROSS ALPHA | GROS S GAMMA/BETA | TRITIUM | VOLATILE ORGANICS | XRF | SOIL MOISTURE | ALPHA SPECTROSCOPY | GAMMA SPECTROSCOPY | BETA SPECTROSCOPY | TOTAL URANIUM | ISOTOPIC PLUTONIUM | ISOTOPIC URANIUM | VOA (SW 8240) | SEMIVOLATILES (SW 8270) | METALS (SW 6010) | PCBs (SW 8080) | HIGH EXPLOSIVES (SW 8330) | CYANIDE |
| 11-005(a) | Septic system | Soil/tuff | | | 2 | | 3 | 2 | 6 | | | 10 | 10 | 10 | X | 10 | | | | | 10 | 10 | | | 8 | | | | | 6 | 8 | 8 | | 8 | 8 |
| 11-005(b) | Septic system | Soil/tuff | | | 2 | | 3 | 2 | 6 | | | 10 | 10 | 10 | X | 10 | | | | | 10 | 10 | | | 8 | | | | | 6 | 8 | 8 | | 8 | |
| 13-003(a,b) | Drain field | Soil/tuff | | | | | 3 | 2 | 6 | 1 | | 15 | 15 | 15 | X | 15 | | | | | 15 | 15 | | | 6 | | 6 | | | 6 | 6 | 6 | | 6 | 6 |
| 16-006(a) | Septic system | Soil/tuff | | | | | 2 | 2 | 4 | | | 10 | 10 | | X | 10 | | | | | 10 | 10 | | | 4 | | | | | 4 | 4 | 4 | | | |
| 16-006(c) | Septic system | Soil/tuff | | | 2 | 1 | 3 | 2 | 6 | 1 | | 10 | 10 | | X | 10 | | | | | 10 | 10 | | | 8 | | | | | 6 | 8 | 8 | | | |
| 16-006(d) | Septic system | Soil/tuff | | | | | 3 | 2 | 6 | | | 15 | 15 | 15 | X | 15 | | | | | 15 | 15 | | | 6 | | | | | 6 | 6 | 6 | | 6 | 6 |
| 16-006(e) | Septic system | Soil/tuff | | | 2 | | 3 | 2 | 6 | 1 | | 10 | 10 | 10 | X | 10 | | | | | 10 | 10 | | | 8 | | | | | 6 | 8 | 8 | | 8 | 8 |

# The number of field-screening samples for subsurface will depend on the depth to bedrock.
A, C, G = not applicable; D, E, H = full suite; D volatile samples in subsurface samples only; F = silver, mercury, barium.

relocated, the new position will be surveyed and the revised locations will be indicated on the map. The engineering survey will be performed by a licensed professional under the supervision of the field team leader.

Geomorphologic mapping will provide an accurate picture of where outfall sediment sampling locations should be placed. The geomorphologic survey will consist of the mapping of the first-order stream channels downslope of any identified drain outfall. The geomorphologic mapping will verify the existence of the suspected outfalls and will facilitate the selection of outfall sediment sample collection points for all outfalls.

#### 5.4.4.2 Geophysical Surveys/Potholing

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If necessary, geophysical surveys and/or potholing will be conducted to precisely determine the boundaries of the septic tanks, distribution boxes, or drain lines. The Geosciences Technical Team will provide guidance as to the appropriate geophysical methods. Potholing consists of digging shallow trenches perpendicular to the suspected locations of drain lines and drain fields in order to verify the locations of those lines. Once located, the sites will be surveyed in and permanently marked in the field and the data registered on the base map scale 1:7 200.

#### 5.4.4.3 Sampling

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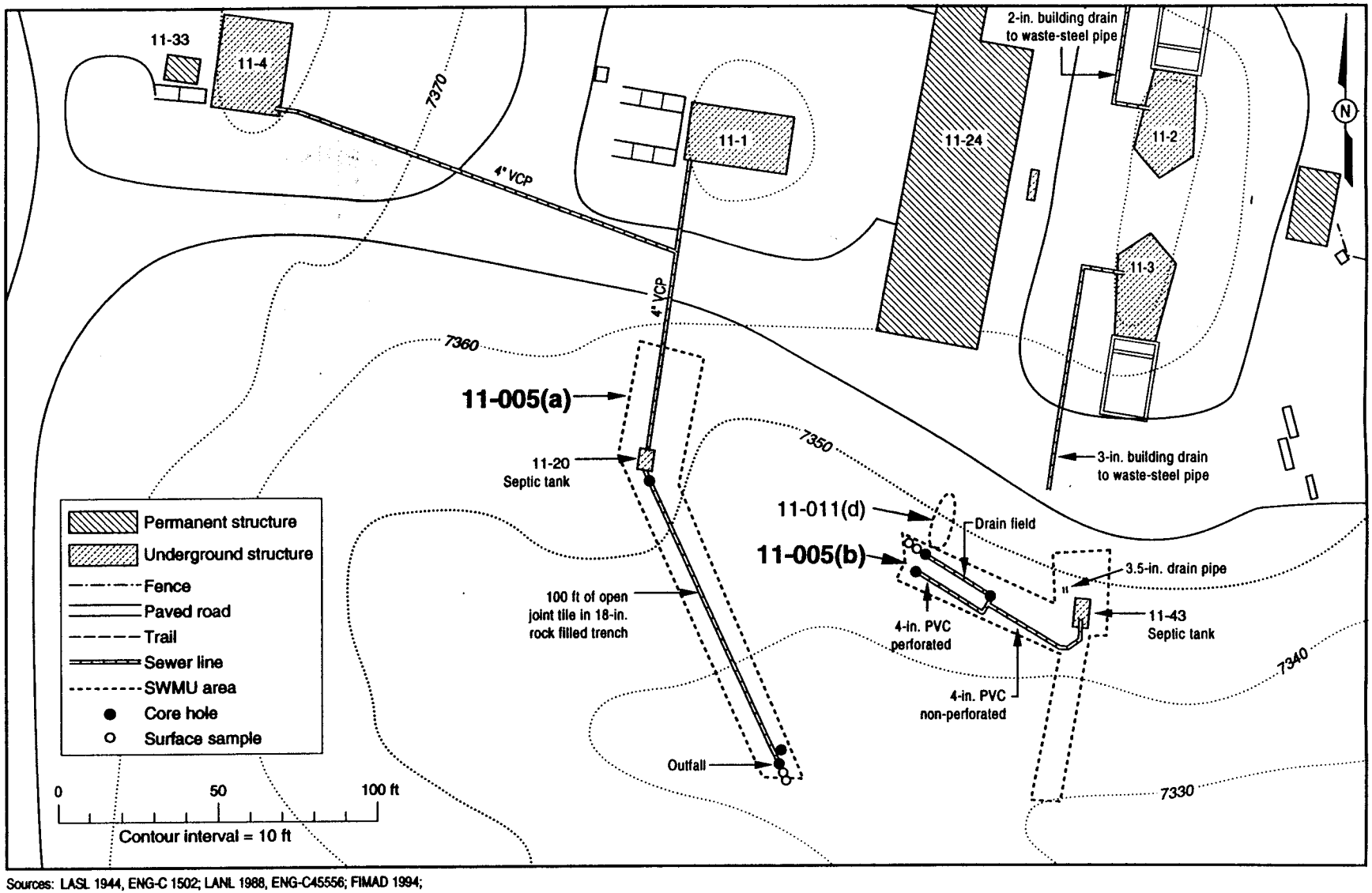
**Drain fields.** All drain fields/drain pipes will be sampled by drilling two vertical core holes, one installed at the proximal end and one at the distal end of the drain field (Figs. 5-38 to 5-43). These core holes will be advanced at least 2.5 ft into bedrock. At SWMUs 13-003(b) and 16-006(d), three cores will be taken.

Each core will be field screened at 0.5 ft intervals for HE by swipe, radioactivity by field instrument for detection of low-energy radiation (FIDLER), volatiles by PID, and metals by x-ray fluorescence (XRF) or laser-induced breakdown spectroscopy (LIBS). This screening will be performed to guide the selection of samples submitted for laboratory analysis. Field screening methods are described in Subsection 4.7 of this work plan.

The two highest field screening readings compared to soil SALs will dictate the selection of two analytical samples for each core. If the screening of the




Sources: LASL 1944, ENG-C 1502; LANL 1988, ENG-C45556; FIMAD 1994;
Modified by: cARTography by A. Kron 11/2/94

**Fig. 5-38. Sampling locations fo SWMUs 11-005(a) and 11-005(b).**

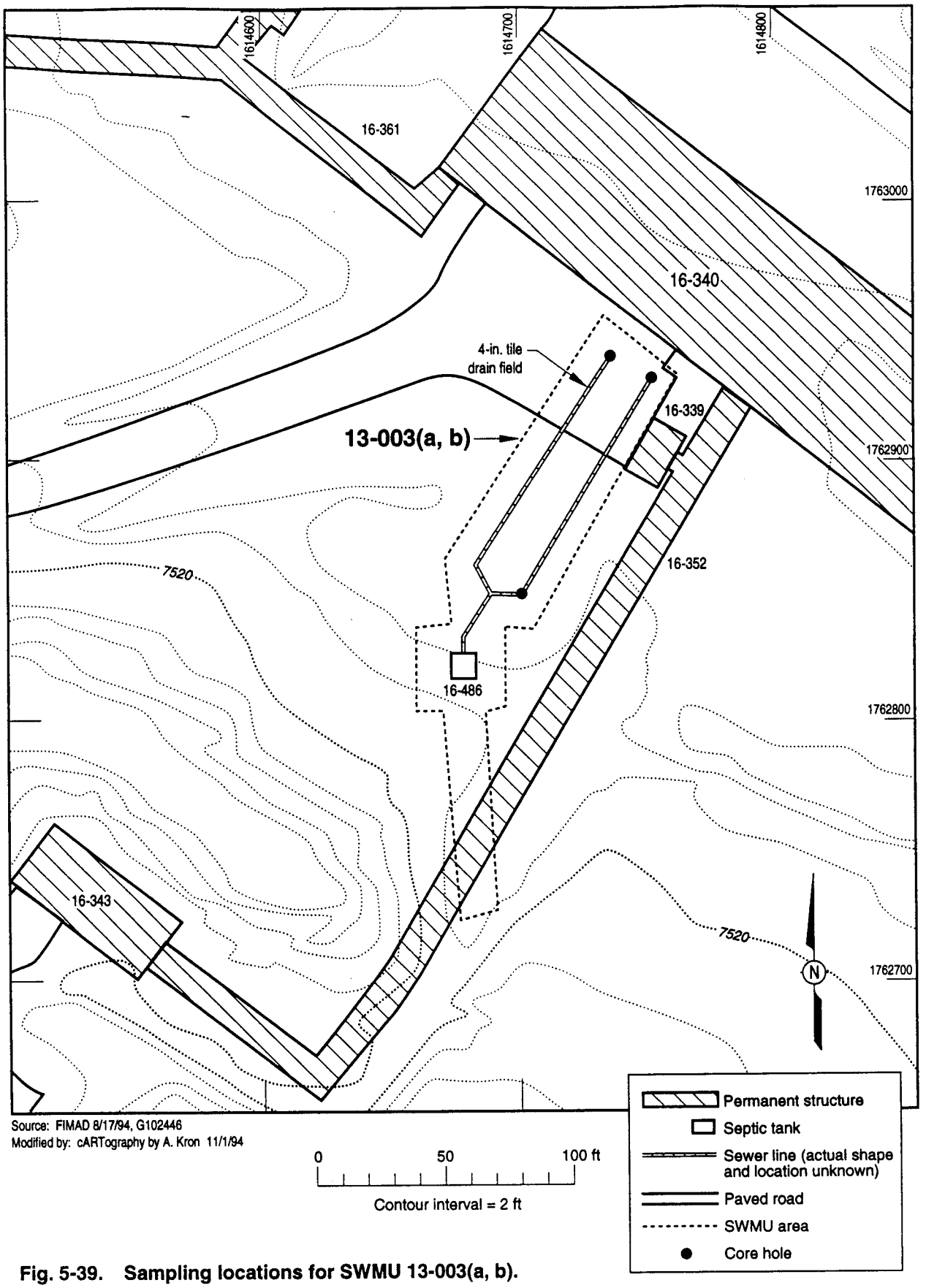
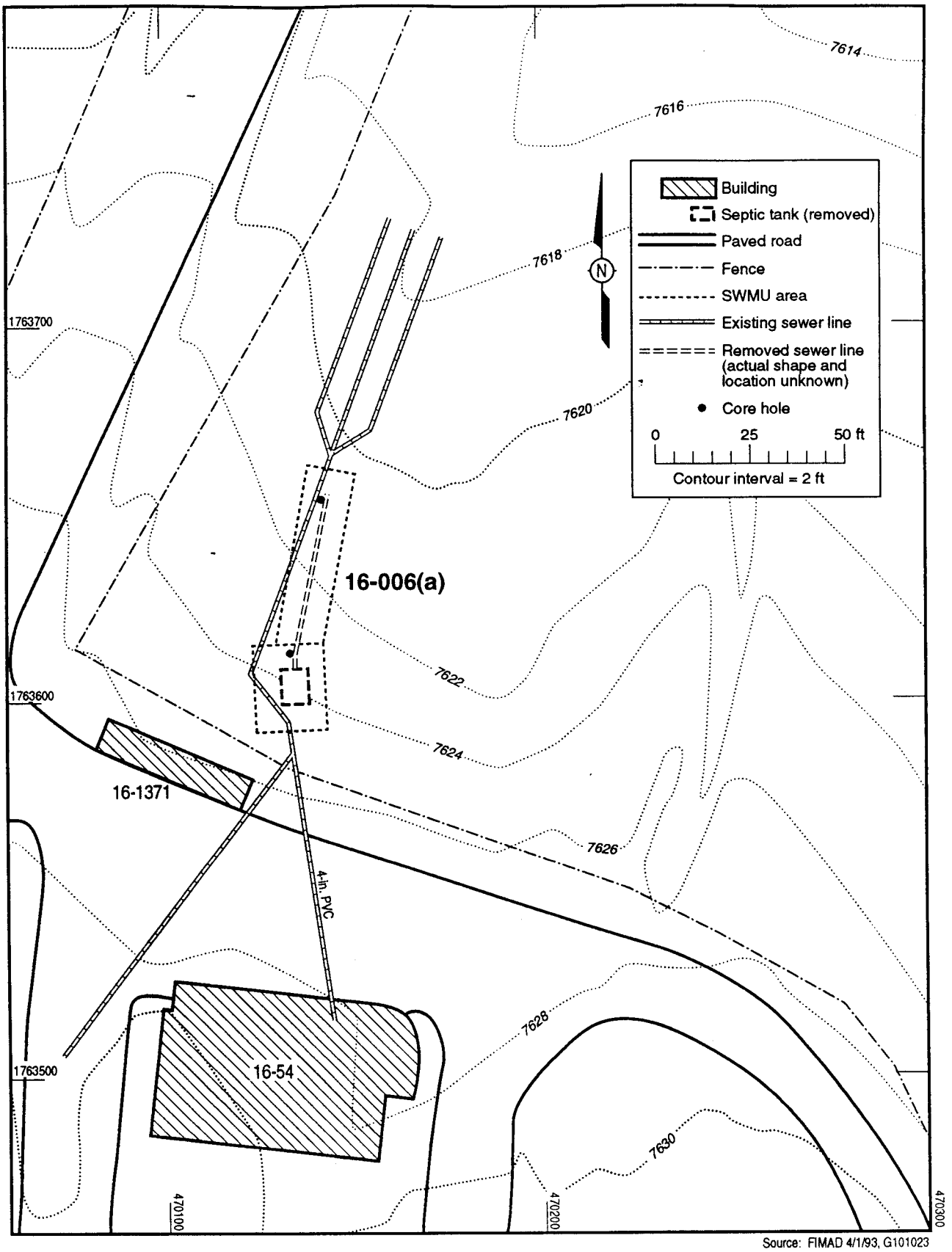
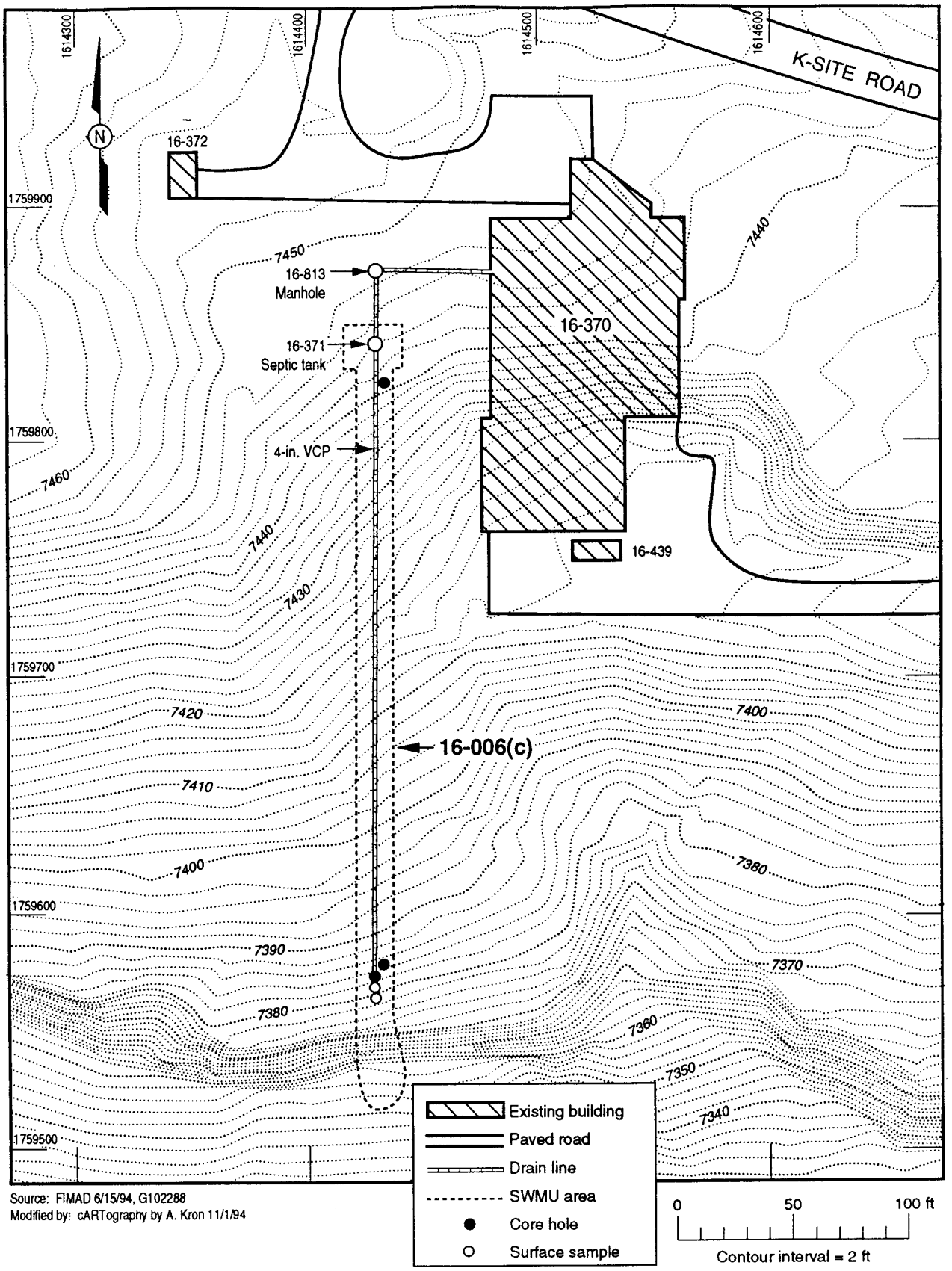



**Fig. 5-39. Sampling locations for SWMU 13-003(a, b).**



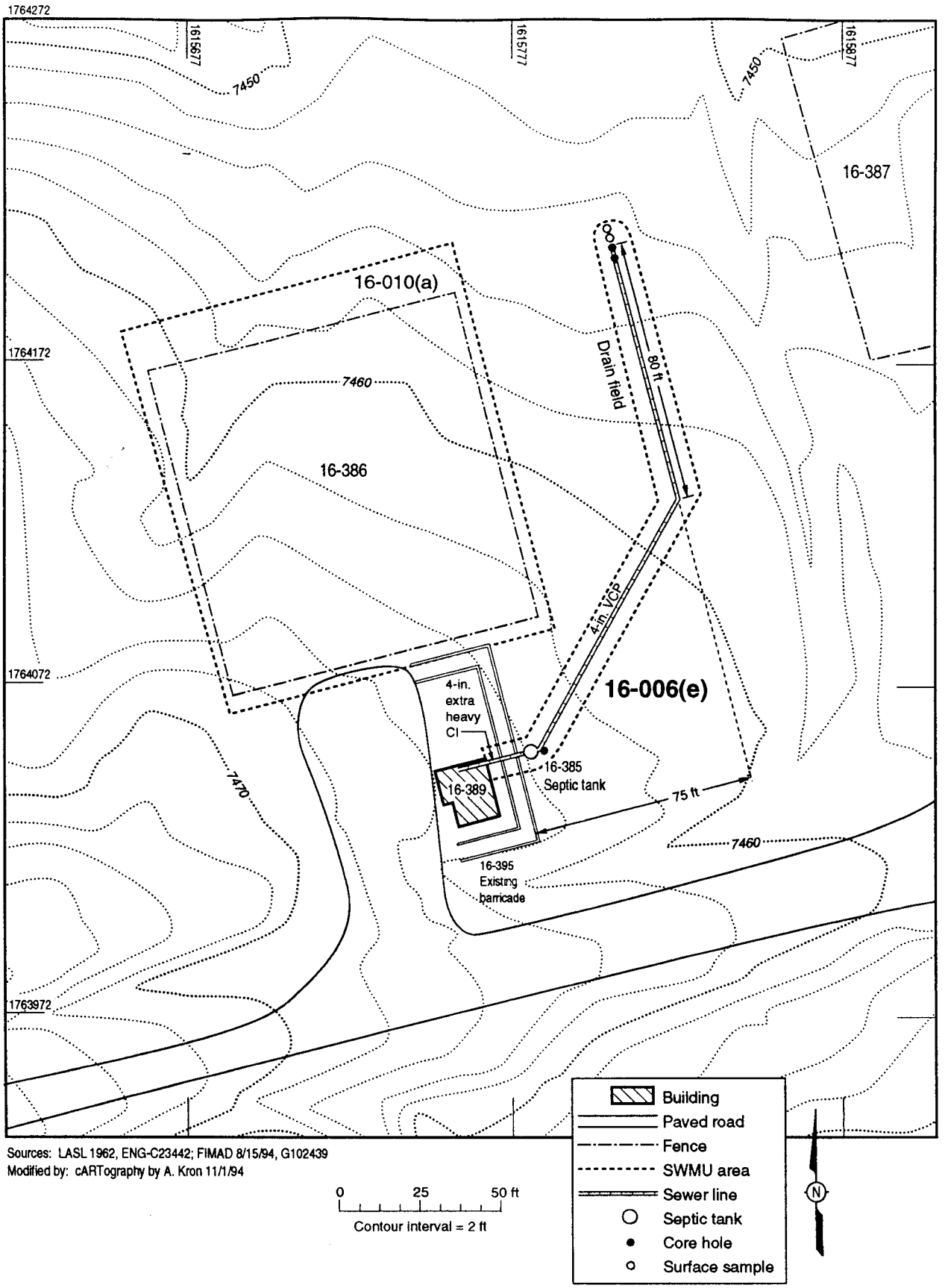

Source: FIMAD 4/1/93, G101023
Modified by: cARTography by A. Kron 11/2/94

**Fig. 5-40. Sampling locations for SWMU 16-006(a).**




Source: FIMAD 6/15/94, G102288
Modified by: cARTography by A. Kron 11/1/94

**Fig. 5-41. Sampling locations for SWMU 16-006(c).**




Sources: LASL 1962, ENG-C23442; FIMAD 8/15/94, G102439
Modified by: cARTography by A. Kron 11/1/94

**Fig. 5-42. Sampling locations for SWMU 16-006(e).**

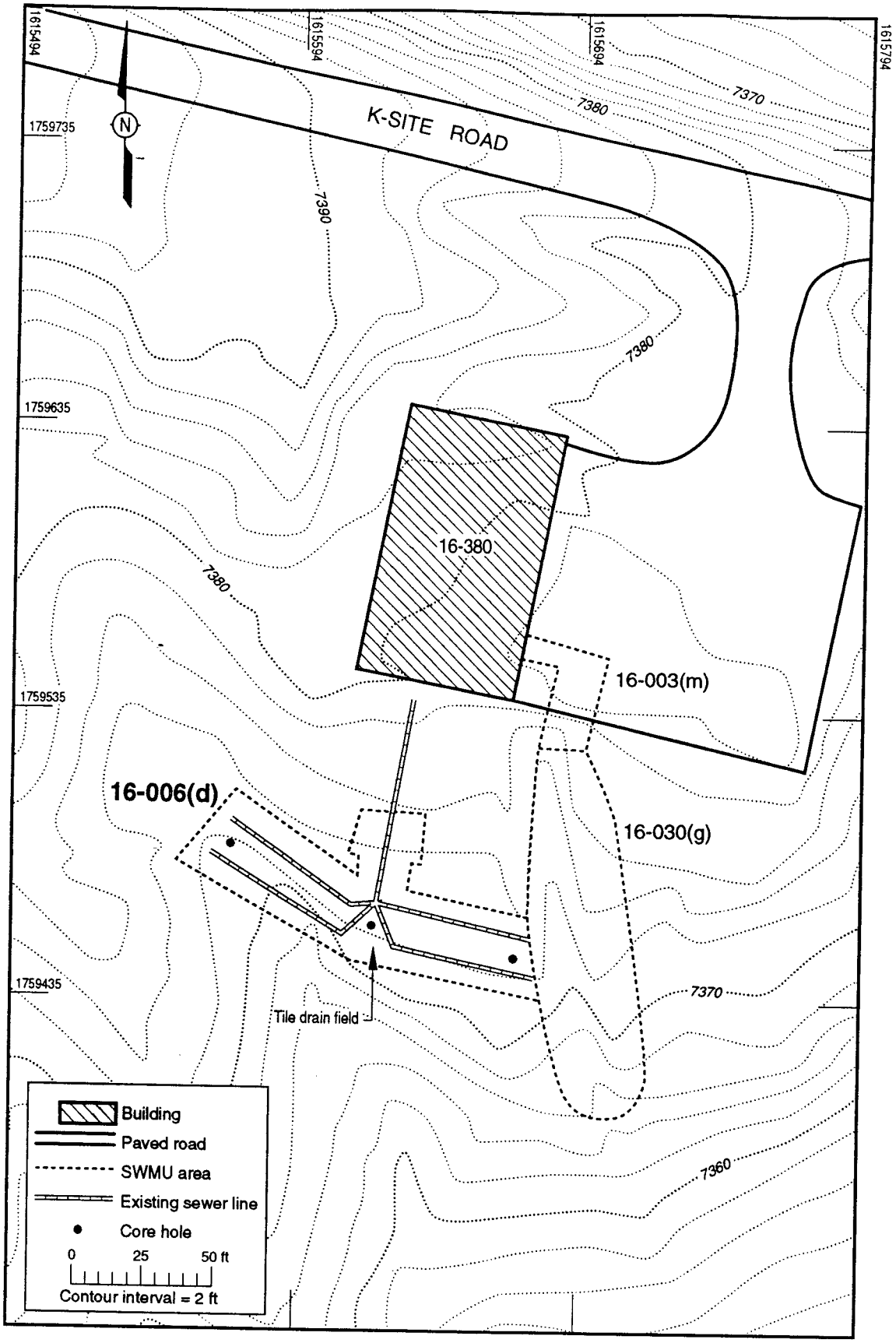



**Fig. 5-43. Sampling locations for SWMU 16-006(d).**

core results in negative results, then analytical samples will be removed from the cores 0.5 ft straddling the soil-bedrock interface and 0.5 ft at the interval adjacent to the drain lines.

**Outfalls.** Three sediment/soil samples will be collected at each outfall (Figs. 5-38, -41, -42). At SWMUs 11-005(a), 11-005(b), and 16-006(c) the first sample will be taken immediately below the outfall, the second and third samples will be taken at a distance of 2.5 ft and 5 ft down the drainage from the outfall. The core at the outfall will extend to the soil-tuff interface and will include two samples, one from 0 to 6 in. and the other at the soil-tuff interface. The two downstream samples will be 0 to 6 in. At SWMU 16-006(e) the overburden that has hidden the drain line will first be excavated to expose the outfall. The excavation will be only as deep as needed to access the soil level immediately beneath the outfall and will extend at this depth laterally down the drainage for a distance of 5 ft. The exposed soil layer will be the starting position for the collection of 6-in. deep sediment/soil samples. As for the other outfall SWMUs in this aggregate, a total of three soil samples equally distributed from the outfall to 5 ft down the drainage will be gathered.

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All three surface samples and the soil-tuff interface sample for each outfall will be submitted for full laboratory analysis as shown in Table 5-30.

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#### 5.4.4.4 Laboratory Analysis

Laboratory analyses of samples will be at Level III for radionuclides (LANL or DOE method), metals (SW-846 Method 6010), VOCs (SW-846 Method 8240), SVOCs (SW-846 Method 8270), and HE (SW-846 Method 8330). The principal radionuclides of concern are uranium isotopes, the principal VOCs are hydrocarbon solvents, and the metals of concern are barium, mercury, and silver. Cyanide is also of concern.

#### 5.4.4.5 Sample Quality Assurance

Field quality assurance samples will be collected according to the guidance provided in the latest revision of the IWP (LANL 1992, 0768). Any QA/QC duplicate samples that are to be collected during the course of the field investigation are outlined in Table 5-30.

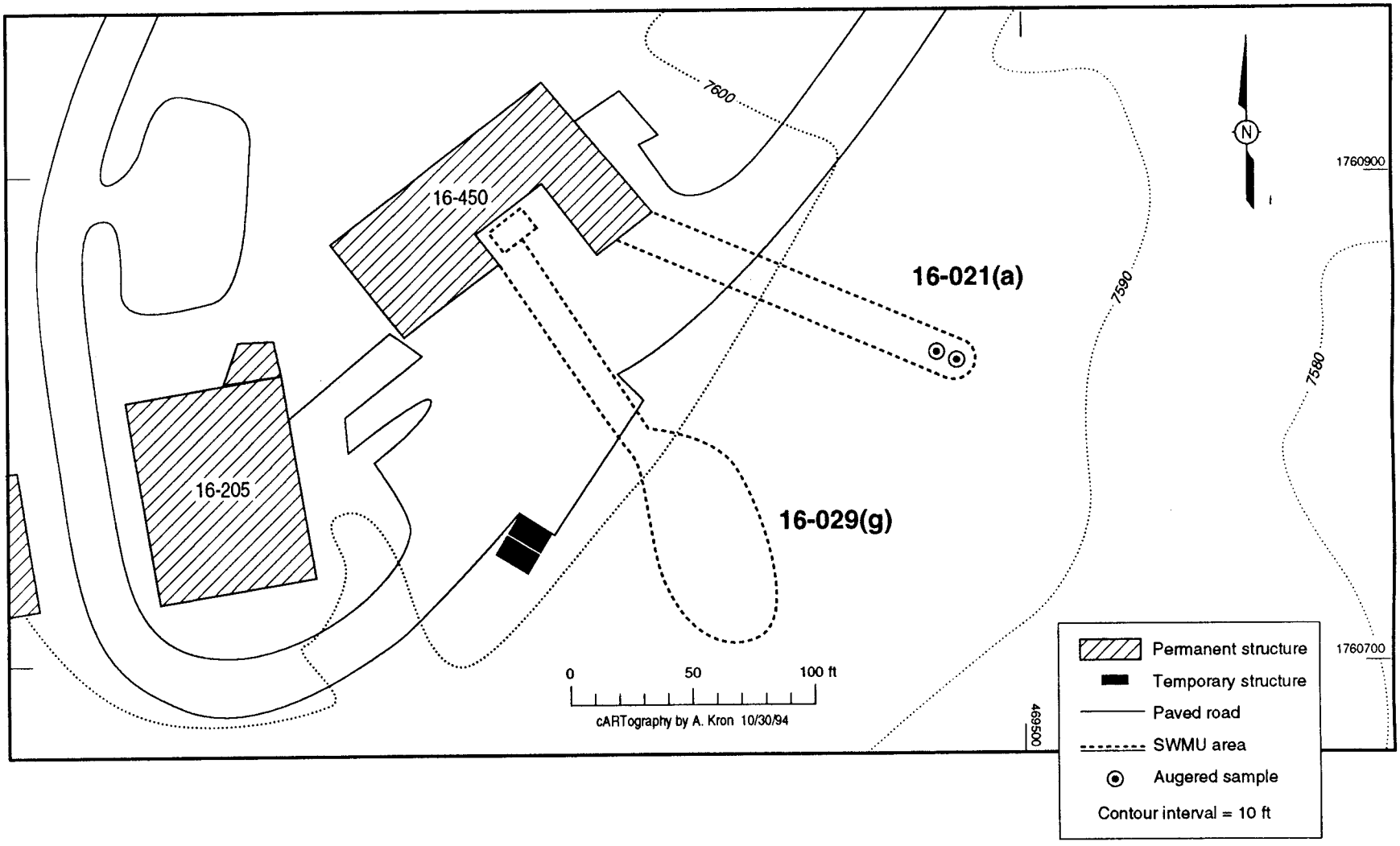


**Fig. 5-44. Schematic sampling plan for materials testing facility.**

is considered to be next to the waste outfall mouth. Soil and sediment will be taken in the Phase I investigation at the outfall. Note that the drainage downstream from this operational release outfall will be sampled as part of the sampling plan for SWMU 16-029(g) (see Fig. 5-25).

**Decision Logic (DQO Step 5)**

The maximum concentration identified in the soil samples will be used to compare to background and SALs for metals, cyanide, semivolatiles, and solvents.

If all potential contaminant concentrations in all samples overlap background, then NFA can be proposed. If the concentration of each potential contaminant in all samples is below the SAL, then NFA or DA can be proposed. If the sample concentrations exceed the SALs, a Phase II investigation must be performed.

**Design Criteria (DQO Step 6)**

The soil and sediment sample will be biased (i.e., located at an outfall mouth which is a diffuse area with no well-defined drainage) and will reflect the area most likely to contain PCOCs. For this reason, reconnaissance sampling will be used for the soil surrounding the outfall. A second sample will be taken 5 ft downgradient to evaluate if a historic release has been flushed out of the outfall area.

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### 5.5.4 Sampling and Analysis Plan

SOPs that control field activities in this sampling plan are listed in Table 5-32. Sample numbers and required analyses are shown on Table 5-33.

#### 5.5.4.1 Engineering Surveys

SWMU 16-021(a) will be field surveyed, which will consist of site engineering mapping. Site mapping is required to accurately record the location of the SWMU. In the field, the engineering survey will locate, stake, and document the location of the SWMU. Sample locations will be registered on a base map, scale 1:7 200. If during the course of sampling any sample points must be relocated, the new position will be surveyed and the revised locations will

**TABLE 5-32**

**STANDARD OPERATING PROCEDURES FOR FIELD ACTIVITIES**

| LANL-ER-SOP | TITLE | NOTES |
|---|---|---|
| 01.02, R0 | Sample Containers and Preservation | Applies to all laboratory analytical samples |
| 01.04, R1 | Sample Control and Field Documentation | Applies to all laboratory analytical samples |
| 06.10, R0 | Hand Auger and Thin-Wall Tube Sampler | Applies to augered soil samples |

be indicated on the map. The engineering survey will be performed by a licensed professional under the supervision of the field team leader.

#### 5.5.4.2 Sampling

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One hand-augered sample hole will be bored at SWMU 16-021(a) and will be located at the mouth of the waste outfall (Fig. 5-44). A second core will be sampled 5 ft southeast of the mouth of the outfall pipe (Fig. 5-44). Each hole will be cored to the soil-tuff interface.

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A sufficient volume of soil will be removed from the upper 6 in. of each core to yield 500 ml. These 500 ml analytical surface samples will be submitted for laboratory analysis for semivolatiles, metals, and cyanide. If more than 6 in. of sediment is present at either location, a second laboratory sample will be taken from the 6 in. interval at the bottom of each core. The deeper analytical samples will be analyzed for volatiles, semivolatiles, metals, and cyanide.

#### 5.5.4.3 Laboratory Analysis

Laboratory analyses of samples will be full metals suite (SW-846 Method 6010), VOCs (SW-846 Method 8240), and semivolatiles (SW-846 Method 8270).

#### 5.5.4.4 Sample Quality Assurance

Field quality assurance samples will be collected according to the guidance provided in the latest revision of the IWP (LANL 1992, 0768). Any QA/QC duplicate samples planned to be collected during the course of the field investigation are outlined in Table 5-33.

**TABLE 5-33**

**SUMMARY OF SITE SURVEYS, SAMPLING, AND ANALYSIS FOR MATERIALS TESTING LABORATORY**

| | | LABORATORY SAMPLES# | | | | | | | FIELD SCREENING | | | | | | | FIELD LAB | | | | | | LABORATORY ANALYSES# | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | STRUCTURE | | SURFACE | | SUBSURFACE | | | | | | | | A | | | | | B | | | | C | | | | D | E | F | G | H | |
| PRS | PRS TYPE | SAMPLED MEDIA | | FIELD DUP | | FIELD DUP | | FIELD DUP | GROSS ALPHA | GROSS GAMMA/BETA | ORGANIC VAPOR | HE SPOT TEST | GEOPHYSICS SURFACE | BARIUM - LIBS | GEOLOGICAL CHARACTERIZATION | GROSS ALPHA | GROSS GAMMA/BETA | TRITIUM | VOLATILE ORGANICS | XRF | SOIL MOISTURE | ALPHA SPECTROSCOPY | GAMMA SPECTROSCOPY | BETA SPECTROSCOPY | TOTAL URANIUM | ISOTOPIC PLUTONIUM | ISOTOPIC URANIUM | VOA (SW 8240) | SEMIVOLATILES (SW 8270) | METALS (SW 6010) | ASBESTOS | HIGH EXPLOSIVES (SW 8330) | CYANIDE |
| 16-021(a) | Outfall | Sediment | | | 2# | | | | | | | | | | | | | | | | | | | | | | | 2 | 2 | 2 | | | 2 |

A,B,C,G,H = not applicable; D = full suite; E = full suite (includes total petroleum hydrocarbons); F = 1082 suite
# Additional samples will be taken at the soil-tuff interface if the cores extend below 6 in.

## 5.6 Photoprocessing Facility, SWMU 16-020

### 5.6.1 Background

The photoprocessing facility consists of SWMU 16-020, which is associated with TA-16-222, an x-ray film-processing laboratory. SWMU 16-020 is an active, permitted operational release area where untreated, spent photographic chemicals (e.g., silver thiosulfate) have been released to the soils and stream sediments.

#### 5.6.1.1 Description and History

Currently, permitted, treated photoprocessing wastes are discharged to a surface discharge point on the south side of TA-16-222, approximately 10 ft below building grade. A small stream channel slopes gently for approximately 295 ft to a confluence with the main channel of Cañon de Valle (Fig. 5-45).

In general, the volume of waste discharged during a single operation is insufficient to maintain surface flow more than 230 to 262 ft downstream before infiltrating into the sediments and underlying alluvium (Kasunic et al. 1985, 0134).

For a period of 20 years, SWMU 16-020 received significant quantities of silver, > 12 g/L, as silver thiosulfate complexes in untreated, spent x-ray fixing solutions. In 1979, the facility began to recover the silver before discharging the waste. The current release is governed by NPDES Permit EPA 06A073.

#### 5.6.1.2 Conceptual Exposure Model

The relevant conceptual exposure model is presented in Fig. 4-3. Site-specific information on potential release sources, chemicals of concern, migration pathways, and potential receptors is presented below.

##### 5.6.1.2.1 Nature and Extent of Contamination

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The principal source of chemical release to the environment is untreated spent photofixing bath solutions. Table 5-34 summarizes the PCOCs for this aggregate. Chemicals reported to have been used include: silver thiosulfate, sodium thiosulfate or "hypo", sulfuric acid, boric acid, and cyanide (Kasunic et al. 1985, 0134). It is unknown if volatile or semivolatile organics were

used in photoprocessing; however, a 1955 encyclopedia lists organic reducing agents such as phenols and amines as used by commercial film developers (Kingslake 1955, 15-16-0579). Based on relative toxicity, the PCOCs for evaluating human health effects from environmental exposure are silver and cyanide. The outfall water from TA-16-222 was analyzed several times during the late 1970s as part of the NPDES application process. Silver ranged from 2.16 to 7.30 mg/L and cyanide ranged from <0.004 to 2.080 mg/L (Keenan 1977, 15-16-441). The silver SAL in water is 0.050 ppm and the cyanide SAL in water is 0.2 ppm.

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A site transport study included an examination of the vertical distribution of silver in soils and the downstream distribution of silver in sediments, soils, and plants (Kasunic 1982, 15-16-343; Kasunic et al. 1985, 0134). Silver analysis of sediments and soils defined the vertical and horizontal extent of silver in the stream (Tables 5-35 and 5-36). The silver content of the sediments and the soils decreased with increasing distance from the mouth of the waste outfall. Sediment silver concentrations ranged from 14 500 ppm at the outfall to 4 ppm at 1 378 ft, decreasing fairly linearly. The silver SAL in soil is 400 ppm. Sharp drops in the silver concentration occurred at 295 ft, where the waste outfall converges with Cañon de Valle, and at 984 ft, where a side canyon converges with Cañon de Valle. Silver concentration in the soils followed a much more erratic pattern, but silver concentration was typically lower in the soil than in the associated sediment. Subsurface soil analyses at 33 and 66 ft from the mouth of the outfall indicated that subsurface concentrations decreased with increasing distance from the mouth of the outfall and with increasing depth from the surface. At 33 ft, silver concentrations ranged from 1 400 ppm at the surface to 182 ppm at the 3-ft depth (Kasunic et al. 1985, 0134).

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Silver thiosulfate is highly mobile in the soil environment and is extremely stable and mobile in neutral or alkaline conditions. The factors determining silver mobility are the amount of oxygen and reducing substances in the soil and the drainage condition of the soil.

The soils in SWMU 16-020 are sodium saturated from photoprocessing activities and this reduces soil porosity and drainage. Under a high evaporative demand, the surface soil will tend to dry. Under a low evaporative

## TABLE 5-35

## SILVER CONTENT OF SAMPLES COLLECTED IN CAÑON DE VALLE AND CONTROL CANYON[a]

| LOCATION FROM OUTFALL (ft) | WATER (ppb) | SEDIMENT (ppm) | SOIL (ppm) | GRASS (ppm) | SHRUB OAK (ppm) | PONDEROSA PINE (ppm) | DOUGLAS-FIR (ppm) |
|---|---|---|---|---|---|---|---|
| Control | -0 ± 0.5 | 0.48 ± 0.29<br>2.60 ± 0.70 | 1.60 ± 0.40<br>2.00 ± 1.00 | 0.29 ± 0.11<br>0.52 ± 0.08 | 0.22 ± 0.13<br>0.96 ± 0.09 | | |
| 0 | 0.7 ± 0.5 | 14 500 ± 1 100 | | 12 ± 1 | | | |
| 33 | 0.7 ± 0.5 | 22 300 ±1 800 | 14 000 ± 1 100 | 8.80 ± 0.85 | | | |
| 66 | -0 ± 0.5 | 22 400 ± 1 800 | 1 860 ± 150 | 8.00 ± 0.90 | | 4.80 ± 0.50 | |
| 99 | -0 ± 0.5 | 10 500 ± 800 | 654 ± 52 | 5.80 ± 0.60 | | 2.10 ± 0.20 | |
| 198 | 6.7 ± 0.5 | 13 700 ± 1 100 | 3 520 ± 280 | 3.00 ± 0.30 | 3.60 ± 0.40 | 1.10 ± 0.20 | |
| 297[b] | | 14 100 ± 1 100 | 278 ± 23 | 1.70 ± 0.30 | | 0.53 ± 0.18 | |
| 297 | | 1 280 ± 100 | 686 ± 56 | 9.40 ± 0.80 | | | |
| 396 | | 4 660 ± 380 | 2 160 ± 170 | 4.00 ± 0.40 | 9.10 ± 0.80 | 1.40 ± 0.20 | |
| 495 | | 542 ± 44 | 78 ± 6 | 2.30 ± 0.30 | | | |
| 594 | | 600 ± 48 | 19 ± 2 | 2.20 ± 0.20 | 1.90 ± 0.30 | | |
| 693[c] | | 81 ± 7 | 97 ± 8 | 1.20 ± 0.10 | 4.10 ±0.40 | | |
| 792 | | 51 ± 4 | 20 ± 2 | 1.30 ± 0.10 | 2.30 ± 0.30 | | |
| 891 | | 109 ± 9 | 15 ± 1 | 0.95 ± 0.09 | 1.40 ± 0.20 | 1.40 ±0.10 | |
| 990[d] | 0.9 ± 0.5 | 4.80 ± 0.90 | 14 ± 1 | 1.10 ± 0.10 | 1.80 ± 0.40 | 0.40 ± 0.15 | |
| 1 089 | 1.8 ± 0.5 | 12 ± 1 | 21 ± 2 | 0.53 ± 0.10 | 0.79 ± 0.10 | 0.29 ± 0.11 | 0.46 ± 0.15 |
| 1 188 | | 9.60 ± 1.10 | 1.60 ± 0.70 | 0.60 ± 0.15 | 0.16 ± 0.08 | | 0.24 ± 0.11 |
| 1 287 | | 7.60 ± 0.90 | 8.00 ± 0.90 | 2.30 ± 0.20 | 0.86 ± 0.09 | | 0.38 ± 0.11 |
| 1 386 | | 9.70 ± 1.10 | 12 ± 2 | 0.47 ± 0.15 | 0.82 ± 0.08 | 0.39 ± 0.11 | |
| 1 485 | | 3.80 ± 0.80 | 0.76 ± 0.38 | 0.40 ± 0.15 | 1.10 ± 0.10 | | |

[a] Kasunic 1982, 15-16-343.
[b] Waste outflow converges with main stream channel of Cañon de Valle at approximately 297 ft.
[c] Land and soil type changes at approximately 644 ft.
[d] Side canyon converges with Cañon de Valle at approximately 990 ft.

**TABLE 5-36**

**SILVER CONTENT IN SOIL[a]**

| DEPTH FROM SURFACE (in.) | SOIL 33 ft FROM OUTFALL (ppm) | SOIL 66 ft FROM OUTFALL (ppm) |
|---|---|---|
| 0-6 | 14 000 ± 1 100 (0.8) | 1 860 ± 150 (1.2) |
| 6-12 | 4 480 ± 285 | 824 ± 66 |
| 12-18 | 1 250 ± 75 | |
| 18-24 | 770 ± 50 | |
| 24-30 | 138 ± 9 | |
| 30-36 | 182 ± 12 | |

[a]Kasunic 1982, 15-16-343

demand, water will tend to remain at the surface in high sodium soils. Subsurface soil will have a reduced oxygen level and a higher pH, which increases silver thiosulfate mobility. Under a high oxidation potential, such as at the soil surface, the ultimate sink for silver from the spent fixing bath solution may be the clay fraction in the soil.

#### 5.6.1.2.2 Potential Pathways and Exposure Routes

Based on Kasunic's fieldwork, the number of ways and the manner in which silver may be mobilized or transported downgradient is believed to be limited. Most of the site is under a low evaporative demand; the soils remain wet and the swollen clays are not readily eroded. Therefore, silver and cyanide are most likely transported via subsurface water (Kasunic et al. 1985, 0134). Silver released from SWMU 16-020 may have also migrated downgradient via snowmelt and storm water runoff. Silver has accumulated in sedimentation areas and subsequently may have infiltrated into subsurface water and soils. During Kasunic's investigation, silver above its SAL was found 492 ft downstream from the outfall. Thus, surface water runoff due to snowmelt and thunderstorms is not expected to transport PCOCs off site, which is approximately 7 miles downstream.

SWMU 16-020 is located within a highly industrialized area, and land use in the foreseeable future is likely to continue to be industrial. In the future, the site may eventually be decommissioned and released for recreational use. The exposure potential related to on-site maintenance workers is limited to incidental soil ingestion and dermal exposure. Chapter 4 of this RFI work

### 5.6.4 Sampling and Analysis Plan

SOPs that control field activities in this sampling plan are listed in Table 5-37. Sample numbers and required analysis are shown on Table 5-38.

**TABLE 5-37**

**STANDARD OPERATING PROCEDURES FOR FIELD ACTIVITIES**

| LANL-ER-SOP | TITLE | NOTES |
|---|---|---|
| 01.02, R0 | Sample Containers and Preservation | Applies to all laboratory analytical samples |
| 01.04, R1 | Sample Control and Field Documentation | Applies to all laboratory analytical samples |
| 06.10, R0 | Hand Auger and Thin-Wall Tube Sampler | Applies to augered soil/sediment samples |
| 06.11, R0 | Stainless Steel Surface Soil Sampler | All 0 to 6 in. surface samples |

#### 5.6.4.1 Engineering Surveys

SWMU 16-020 will be field surveyed, which will consist of site engineering and geomorphic mapping. Site mapping is required to accurately record the location of the SWMU and its associated drainage. In the field, the engineering survey will locate, stake, and document the location of the SWMU. Sample locations will be registered on a base map, scale 1:7 200. If during the course of sampling any sample points must be relocated, the new position will be surveyed and the revised locations will be indicated on the map. The engineering survey will be performed by a licensed professional under the supervision of the field team leader.

#### 5.6.4.2 Sampling

Seven hand-augered sample holes will be bored at SWMU 16-020 and will be positioned at biased points within the stream center, which is the location where the highest concentrations of silver have been observed. These points will be the outfall and at 25, 50, 75, 100, 492, and 738 ft downstream (Fig. 5-47). The holes will be bored to the depth of 5 ft. 34

For the core samples at 0, 25, 50, 75, and 100 ft, 6-in. laboratory samples will be collected at 0 to 6 in., 3 ft, and 5 ft. For the core samples at 492 and 738 ft, analytical samples will be collected from the 0.5 ft immediately above 34

**TABLE 5-38**

**SUMMARY OF SITE SURVEYS, SAMPLING, AND ANALYSIS FOR PHOTO-PROCESSING FACILITY AGGREGATE**

| PRS | PRS TYPE | SAMPLED MEDIA | LABORATORY SAMPLES | | | | | | | | FIELD SCREENING | | | | | | | FIELD | | | | | | | LABORATORY ANALYSES | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | STRUCTURE | | SURFACE | | SUBSURFACE | | | | | | | | | | A | | | | | | B | | | | C | | | | D | E | F | G | H | |
| | | | | FIELD DUP | | FIELD DUP | NO. OF CORES | NO. OF SAMPLES PER CORE | TOTAL | FIELD DUP | GROSS ALPHA | GROSS GAMMA/BETA | ORGANIC VAPOR | HE SPOT TEST | GEOPHYSICS SURFACE | BARIUM - LIBS | GEOLOGICAL CHARACTERIZATION | GROSS ALPHA | GROSS GAMMA/BETA | TRITIUM | VOLATILE ORGANICS | XRF | SOIL MOISTURE | ALPHA SPECTROSCOPY | GAMMA SPECTROSCOPY | BETA SPECTROSCOPY | TOTAL URANIUM | ISOTOPIC PLUTONIUM | ISOTOPIC URANIUM | VOA (SW 8240) | SEMIVOLATILES (SW 8270) | METALS (SW 6010) | PCBs (SW 8080) | HIGH EXPLOSIVES (SW 8330) | CYANIDE |
| 16-020 | Outfall | Soil/tuff | | | 6 | 1 | 5 | 3 | 15 | 1 | | | | | | | | | | | | | | | | | | | | | 15 | 21 | 21 | | | 21 |
| 16-020 | Outfall | Soil/tuff | | | | | 2 | 2 | 4 | 1 | | | | | | | 2 | | | | | | 4 | | | | | | | | 4 | 4 | 4 | | | 4 |

A = lithologic logging; B,C, G, H = not applicable; F = silver.

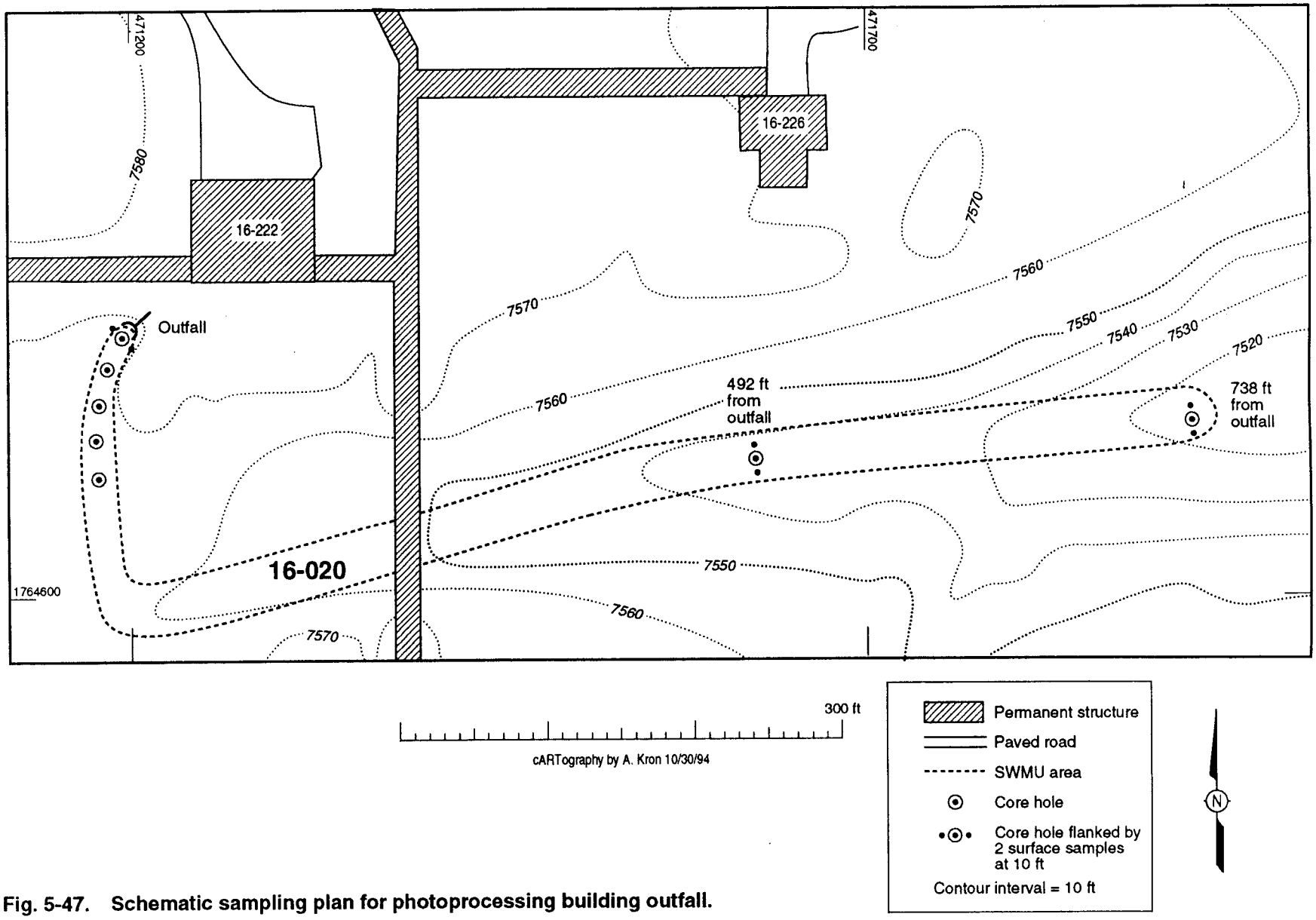



**Fig. 5-47. Schematic sampling plan for photoprocessing building outfall.**

the clay-rich layer and from the 0.5 ft immediately above the soil-tuff interface.

34

A set of two surface soil samples (0 to 6 in.) will be collected adjacent to the three hand-augered sample holes at 0, 492, and 738 ft. One surface soil sample will be collected at the high-water line upslope from the center of the stream bed and one will be collected at the high-water line downslope of the center of the stream bed.

#### 5.6.4.3 Laboratory Analysis

35

Laboratory analyses of samples will be at Level III for metals (silver by SW-846 Method 6010), volatile organics (SW-846 Method 8240), and semivolatile organics (SW-846 Method 8270) and for cyanide. Selected core samples will be analyzed for water content (saturation).

#### 5.6.4.4 Sample Quality Assurance

Field quality assurance samples will be collected according to the guidance provided in the latest revision of the IWP. Any QA/QC duplicate samples planned to be collected during the course of the field investigation are outlined in Table 5-38.

**TABLE 5-44**

**SUMMARY OF SITE SURVEYS, SAMPLING, AND ANALYSIS FOR SANITARY WASTE TREATMENT PLANT AGGREGATE**

| PRS | PRS TYPE | SAMPLED MEDIA | LABORATORY SAMPLES # | | | | | | | | FIELD SCREENING | | | | | | | FIELD LABORATORY | | | | | | LABORATORY ANALYSES # | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | STRUCTURE | | SURFACE | | SUBSURFACE | | | | | | | | | | A | | | | | B | | | | C | | | | | D | E | F | G | H | |
| | | | | FIELD DUP | | FIELD DUP | NO. OF CORES | NO. OF SAMPLES | TOTAL | FIELD DUP | GROSS ALPHA | GROSS GAMMA/BETA | ORGANIC VAPOR | HE SPOT TEST | METALS - LIBS | BARIUM - LIBS | GEOLOGICAL CHARACTERIZATION | GROSS ALPHA | GROSS GAMMA/BETA | TRITIUM | VOLATILE ORGANICS | XRF | SOIL MOISTURE | ALPHA SPECTROSCOPY | GAMMA SPECTROSCOPY | BETA SPECTROSCOPY | TOTAL URANIUM | ISOTOPIC PLUTONIUM | ISOTOPIC URANIUM | VOA (SW 8240) | SEMIVOLATILES (SW 8270) | METALS (SW 6010) | PCBs (SW 8080) | HIGH EXPLOSIVES (SW 8330) | CYANIDE |
| 16-004(a) | Imhoff tank | Soil | | | 8 | | 1 | 1 | 1 | | | 9 | 9 | 9 | | | | 4 | 4 | | 4 | 9 | | | 9 | | | 9 | 9 | 9 | 9 | 9 | | 9 | |
| 16-004(a) | Imhoff tank | Concrete | 1 | | | | | | | | | | | | | | | | | | | | | | 1 | | | 1 | 1 | 1 | 1 | 1 | | 1 | |
| 16-004(b) | Trickling filter | Soil | | | 4 | | 1 | 1 | 1 | 1 | | 5 | 5 | 5 | | | | | | | | 5 | | | 5 | | | 5 | 5 | 5 | 5 | 5 | | 5 | |
| 16-004(c) | Final tank | Soil | | | 4 | | 1 | 1 | 1 | | | 5 | 5 | 5 | | | | | | | | 5 | | | 5 | | | 5 | 5 | 5 | 5 | 5 | | 5 | |
| 16-004(d) | Sludge bed | Soil | | | 4 | 1 | 1 | 1 | 1 | | | 5 | 5 | 5 | | | | | | | | 5 | | | 5 | | | 5 | 5 | 5 | 5 | 5 | | 5 | |
| 16-004(f) | Sludge bed | Soil | | | 4 | | 1 | 1 | 1 | | | 5 | 5 | 5 | | | | | | | | 5 | | | 5 | | | 5 | 5 | 5 | 5 | 5 | | 5 | |
| 16-004(c) | Outfall stream | Soil | | | 6 | | | | | | | 6 | 6 | 6 | | | x | 6 | 6 | | 6 | 6 | | | 6 | | | 6 | 6 | 6 | 6 | 6 | | 6 | |
| 16-004(c) | Sedimentation area | Sediment | | | | | 24 | | 9 | 1 | 72* | 72* | 72* | 72* | 72* | | x | 72* | 72* | | 72* | 72* | | | 9 | | | 9 | 9 | 9 | 9 | 9 | | 9 | |

A = lithologic logging; C, G = not applicable; B, D, E, H = full suite; F = 1082 suite.
* = This is the field screening of all cores to determine the nine laboratory samples.
# These numbers represent the minimum number of samples for each SWMU. Additional samples may be taken based on field screening results.

SWMUs. Sample locations will be registered on a base map, scale 1:7 200. If during the course of sampling, any sample points must be relocated, the new position will be surveyed and the revised locations will be indicated on the map. The engineering survey will be performed by a licensed professional under the supervision of the field team leader.

The geomorphologic survey will consist of mapping the first-order stream channels downslope of any identified drain outfall. There are two identified at this time; one from the Imhoff tank, and the other from the final tank (EPA SSS03S). There are also two overflow lines that drain the sludge beds. This mapping will facilitate the selection of outfall sediment and sedimentation area sample collection points. This mapping will establish a sampling grid in the sedimentation area. The surface drainage mapping will include the sediment catchment sites adjacent to any identified outfall.

#### 5.7.4.2 Sampling

38a

Two cored soil samples (0 to 24 in. or the soil-tuff interface) will be collected within 5 ft of all treatment plant structures. One surface sample on the upgradient and one on the downgradient side will be collected. Each of these cores will be sampled for laboratory analyses at 0 to 6 in. and at 2 ft or the soil-tuff interface. Structures include the Imhoff tank, trickling filter, final tank, and the two sludge beds. All sampling locations are shown on Fig. 5-50.

38a

38a

Three cored soil samples (0 to 24 in. or the soil-tuff interface) will be collected in the drainage below the drying bed outfall, equally distributed between the outfall and the start of the sedimentation area. Each of these cores will be sampled for laboratory analyses at 0 to 6 in. and at 2 ft or the soil-tuff interface. These samples, as well as the two cored surface soil samples collected at the Imhoff tank outfall, will be field screened and analyzed in the field laboratory to formulate an indicator constituent for the cores that are to be drilled in the sedimentation area. The two samples collected at the Imhoff tank outfall will be at the mouth of the outfall and 30 ft down the drainage.

38a

One core hole will be drilled into and through the center of the Imhoff tank to three-quarters of the thickness of the concrete structure. The entire core

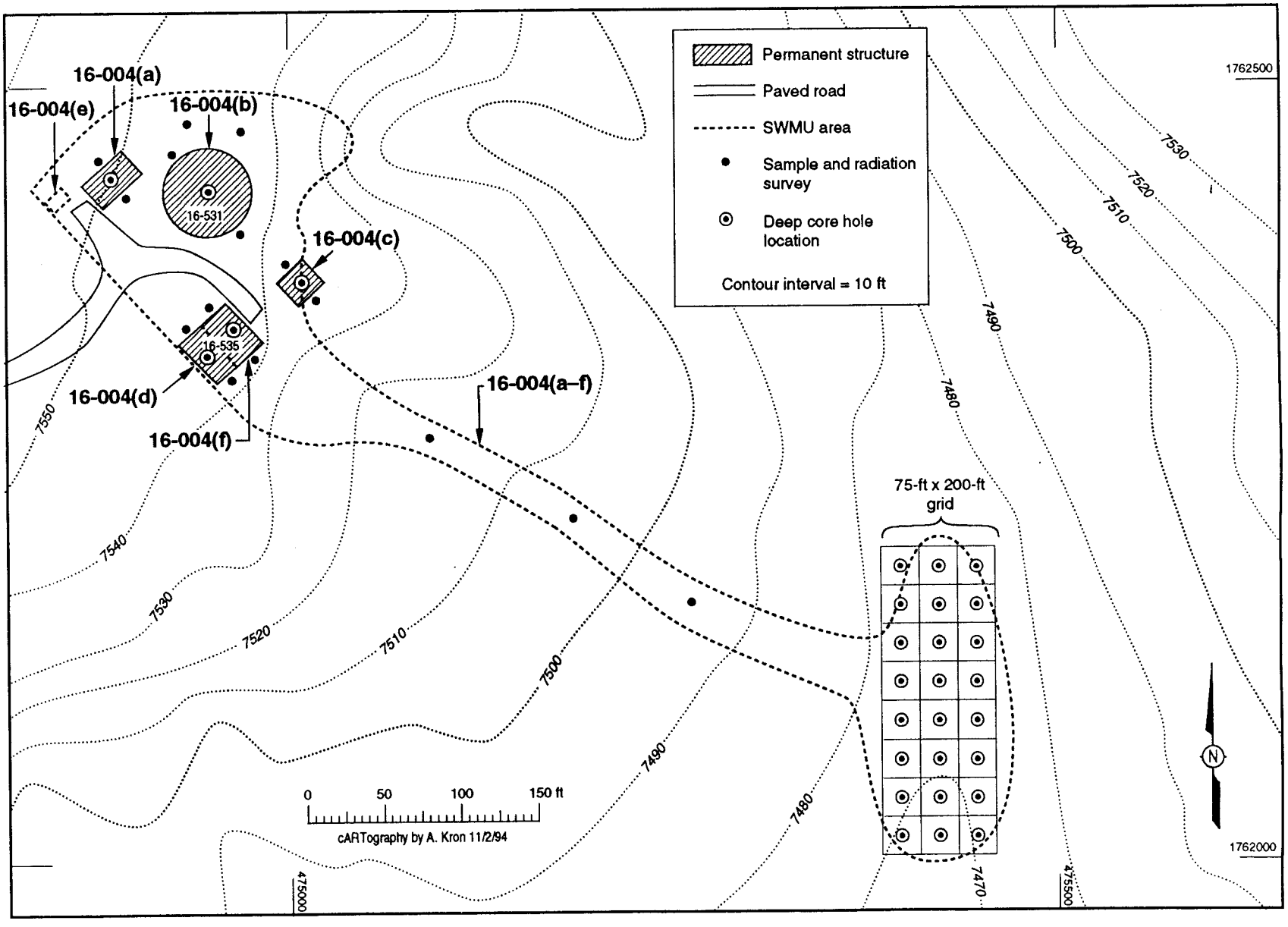



Fig. 5-50. Schematic sampling plan for sanitary waste treatment aggregate.

38b

sample will be sent to the laboratory for analysis of the full suite of PCOCs. Cement sampling will use ER-SOP 6.28, R0, Chip Sampling of Porous Surfaces, which is used by the ER D and D Program.

A 200 by 75 ft, 24-station sampling grid will be established in the sedimentation area; each grid square measuring 25 ft (Table 5-45). Hand-augered core holes will be bored in the center of each grid square. The cores will be bored to a depth of 3 ft or tuff. Field screening and field laboratory analysis will be carried out on all 24 cores at depths intervals of 0 to 6 in., 15 to 21 in., and 30 to 36 in. Field screening will consist of metals by XRF or LIBS, HE by swipe test, VOC by PID, and radionuclides by gross beta/gamma. If field screening results in the detection of a PCOC relative to SALs or background, then the analytical samples with the nine highest readings will be submitted for full laboratory analysis. If the field screening yields negative results (all samples in background range), then analytical samples for both VOC and non-VOC PCOCs will be taken from the same

**TABLE 5-45**

**SAMPLING POINTS IF FIELD SCREENING YIELDS NEGATIVE RESULTS**

N

| | | |
|---|---|---|
| 1 | 2 | 3 |
| 4 | 5 | 6 |
| 7 | 8 | 9 |
| 10 | 11 | 12 |
| 13 | 14 | 15 |
| 16 | 17 | 18 |
| 19 | 20 | 21 |
| 22 | 23 | 24 |

Screening and sampling grid

| SAMPLING STATION | VOC SAMPLE LOCATION | NON-VOC SAMPLE LOCATION |
|---|---|---|
| 7 | 18 in. | 0 in. |
| 15 | 36 in. | 18 in. |
| 14 | 18 in. | 36 in. |
| 10 | 36 in. | 0 in. |
| 16 | 18 in. | 18 in. |
| 17 | 36 in. | 36 in. |
| 23 | 18 in. | 0 in. |
| 5 | 36 in. | 18 in. |
| 9 | 18 in. | 36 in. |

Sampling points for VOC and non-VOC where field screening finds no indicator analytes

cores according to Table 5-45. It is unlikely that this field-randomization approach will have to be used.

38c

A five-foot core sample will be taken beneath each unit at the waste water treatment plant. Siting of these cores will depend on if the units have been removed prior to Phase I sampling. If the units remain in place, then each will be drained and cleaned in order to examine the interior for structural flaws and cracks. If the units have been removed, each will be examined during removal and structural flaws and cracks will be noted. The site of the core for each unit will be at the location of the greatest density of cracks or flaws, based on the judgment of the field team. In the absence of visible flaws, the core will be sited near the center of each unit. Each 5-ft core will be divided into 6-in. intervals; every second 6-in. interval will be screened for volatiles by positive PID, metals by XRF, and HE by spot-test. Any interval that exhibits a positive reading, defined as a PID or HE reading or an XRF reading above SALs, will be submitted for laboratory analysis. In the absence of positive readings, one lab sample from the first 6-in. interval of each core will be taken.

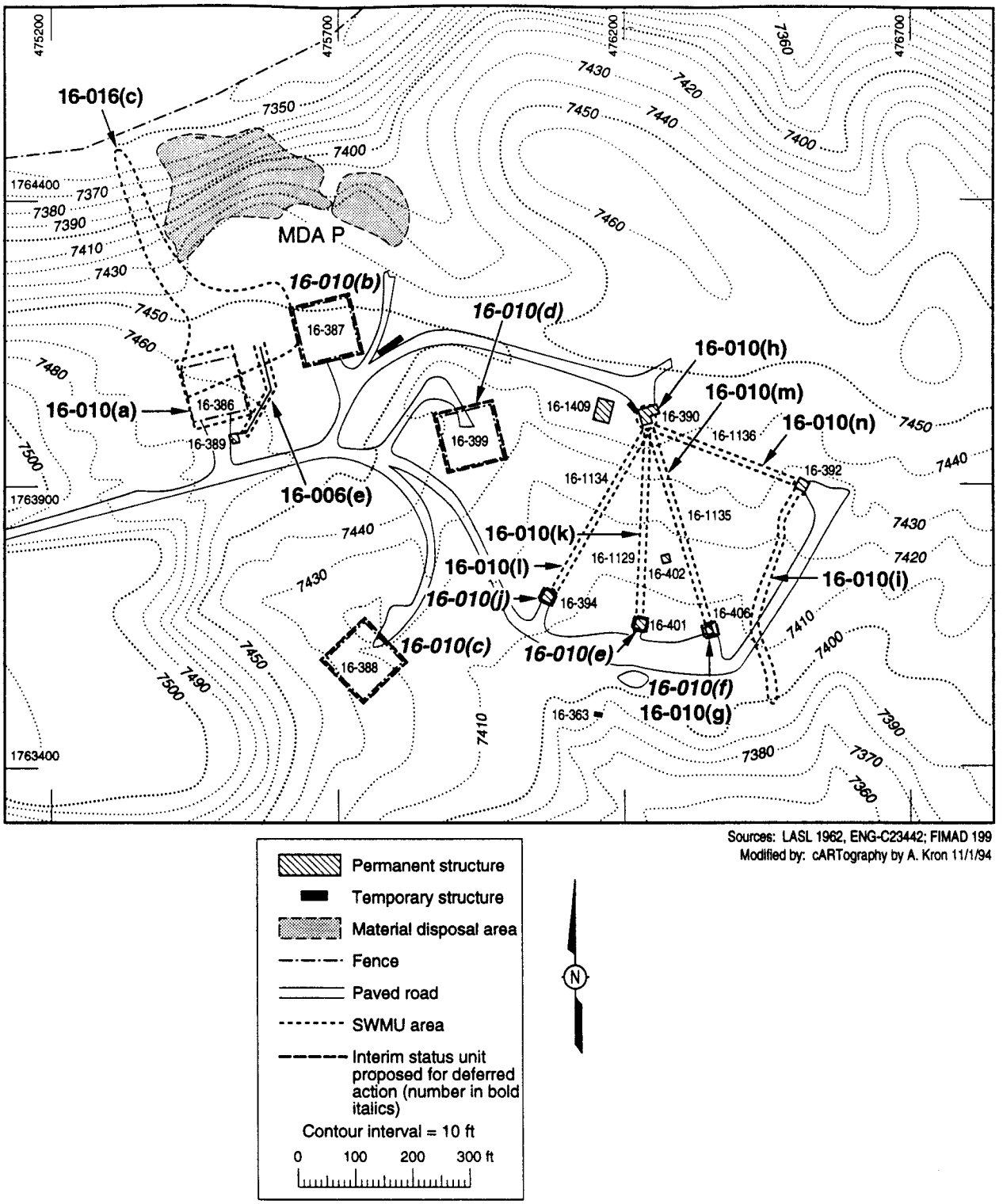
36

#### 5.7.4.3 Laboratory Analysis

Laboratory analyses of samples will be at Level III for radionuclides (LANL or DOE method), metals (SW-846 Method 6010), VOCs (SW-846 Method 8240), SVOCs (SW-846 Method 8270) and HE (SW-846 Method 8330). The principal radionuclides of concern are uranium and plutonium isotopes, the principal VOCs are hydrocarbon solvents, and the full analytical suite of OU 1082 metals.

#### 5.7.4.4 Sample Quality Assurance

Field quality assurance samples will be collected according to the guidance provided in the latest revision of the IWP (LANL 1992, 0768). Any QA/QC duplicate samples planned to be collected during the course of the field investigation are outlined in Table 5-44.




Sources: LASL 1962, ENG-C23442; FIMAD 199
Modified by: cARTography by A. Kron 11/1/94

**Fig. 5-51. TA-16 burning ground map.**

SWMU-specific information for SWMUs covered in this subsection is given below.

**SWMU 16-010(a).** TA-16-386, SWMU 16-010(a), is an inactive flash pad now used for storage. This structure is located 35 ft north of TA-16-389 (LANL 1990, 0145). This structure was designated as a barium nitrate storage site. A large pile of barium nitrate was stored at this location during the late 1960s [see SWMU 16-016(c)]. This barium nitrate pile is shown on a 1959 photo.

**SWMU 16-010(h).** TA-16-390, SWMU 16-010(h), is a decommissioned basket wash facility. HE residues from basket filters from sumps site-wide were emptied into a floor drain located on the south end of the building. Currently a single floor drain remains; three plugged drains are visible beneath this existing drain. An operator in the building controlled a manifold that diverted the wash water to one of four troughs, TA-16-1129, -1134, -1135, or -1136, which then carried the effluent to one of four filtering units, TA-16-401, -394, -406, or -392 respectively (LANL 1990, 0145). Three troughs were originally connected to the building, and in 1961, an additional trough, TA-16-1136 was installed. In 1966, operations at the basket wash facility ceased when the use of filter baskets was discontinued. Several iron-stained holes are visible on the eastern end of the south-facing exterior wall of TA-16-390.

44c

44c

**SWMU 16-010(i).** TA-16-392, SWMU 16-010(i), is a currently inactive burning pad, which received wash water from the basket wash facility. Former filter bed, TA-16-392, received suspected uranium-contaminated wash water from filter baskets being cleaned at TA-16-390. In 1988 the bed was modified to a burn pad for the purpose of burning suspected uranium-contaminated objects (Barr 1992, 15-16-371); the trough, TA-16-1136, that once fed this bed was dismantled at that time (LANL 1990, 0145).

**SWMU 16-010(k).** TA-16-1129, SWMU 16-010(k), is a steel trough with a V-shaped cross section that once carried wash water from the basket wash facility to pressure filter tank TA-16-401. This structure is open at the top, elevated approximately 3 ft from the ground on a steel framework, and approximately 370 ft long. Structure TA-16-1129 was built in 1951 (LANL 1990, 0145).

during the summer of 1992 (Brown et al. 1992, 15-16-389). Six soil samples were collected from the western drainage flowing northward through SWMU 16-016(c) and three were collected from the drainage due south of the site of the decommissioned Hypalon pond, 16-008(b). Sample locations are shown on Fig. 5-52 and results are listed in Table 5-47. Barium concentrations ranged from 1 700 ppm to 6 253 ppm in the drainage from SWMU 16-016(c) and from 941 ppm to 1 420 ppm in the southern drainage. The barium concentrations in the northern drainage rise to their highest values downstream from the former barium nitrate storage pile, but upstream from MDA P. This result suggests that barium derived from the pile has slowly been transported down the drainage since removal of the barium nitrate pile in the early 1970s.

40a

**TABLE 5-47**

**SOIL SAMPLING RESULTS**

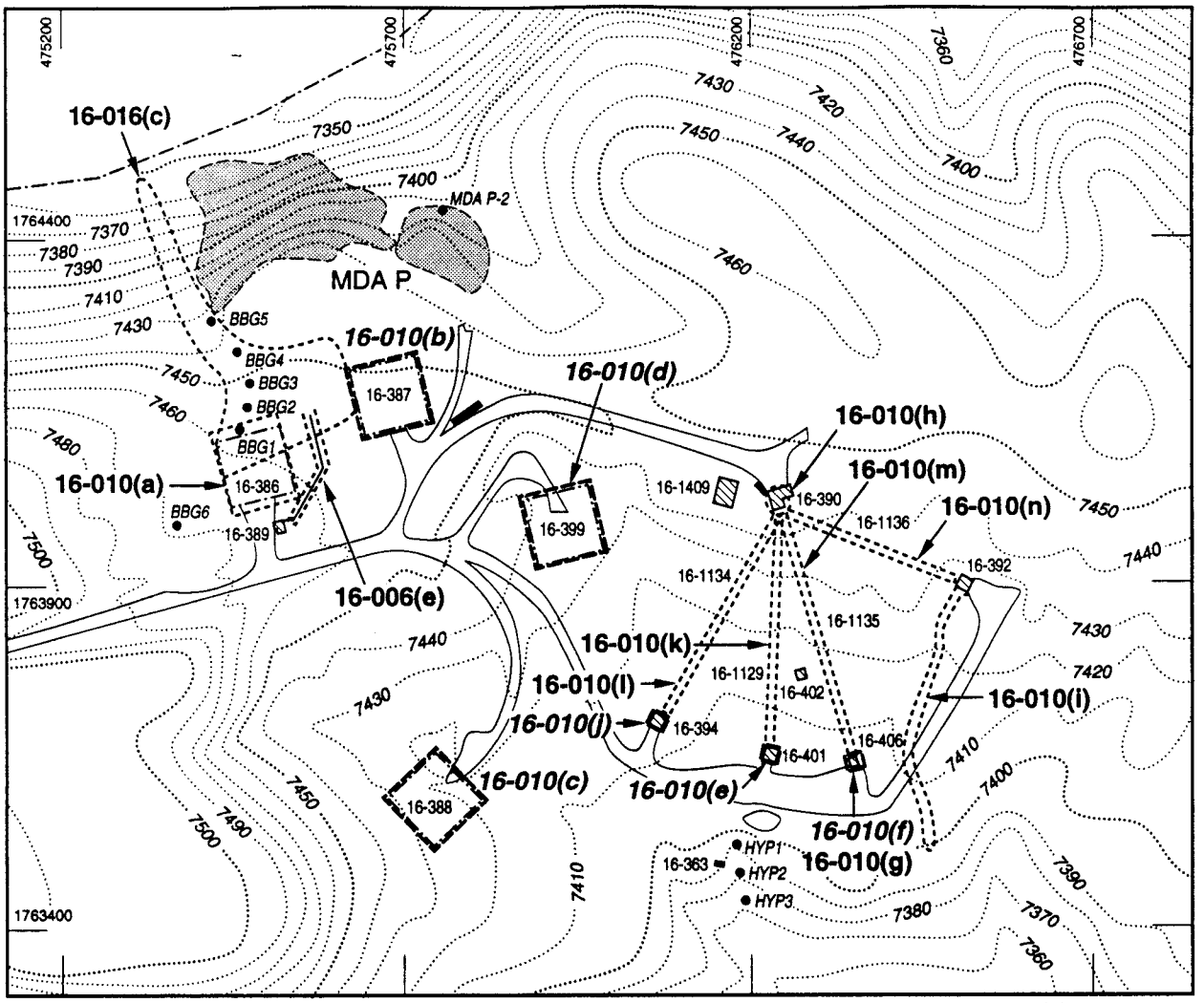
40a
40b

| SAMPLE | CHROMIUM ppm | NICKEL ppm | ZINC ppm | BARIUM ppm |
|---|---|---|---|---|
| BBG-1 | 8 | 15 | 157 | 1750 |
| BBG-2 | 10 | 16 | 102 | 2351 |
| BBG-3 | 8 | 16 | 70 | 2658 |
| BBG-4 | 7 | 16 | 61 | 6253 |
| BBG-5 | 8 | 14 | 58 | 2823 |
| BBG-6 | 14 | 13 | 39 | 620 |
| MDA-P-2 | 3 | 19 | 80 | 10026 |
| HYP-1 | 7 | 15 | 61 | 1430 |
| HYP-2 | 6 | 14 | 73 | 941 |
| HYP-3 | 7 | 16 | 73 | 1180 |

All data by x-ray fluorescence. These data represent the total barium in each sample.

The existing data above SALs at the burning ground are from a single soil HE analysis requested by V. Raper. This sample was obtained at the intersection of the first pipe culvert near TA-16-406, it contained 23.7 wt % HE (Baytos 1984, 15-16-269. SALs for TNT (40 ppm), HMX (4 000 ppm), and RDX (64 ppm) are exceeded. One barium in soil value of 6 253 ppm (Brown et al. 1992, 15-16-389) in the drainage from the barium nitrate pile is above the soil SAL of 5 600 ppm.

40b




Sources: LASL 1962, ENG-C23442; FIMAD 199
Modified by: cARTography by A. Kron 11/1/94

0 100 200 300 ft

Contour interval = 10 ft

- Permanent structure
- Temporary structure
- Material disposal area
- Fence
- Paved road
- SWMU area
- Interim status unit proposed for deferred action (number in bold italics)
- Sampling location

**Fig. 5-52. Sampling locations from Brown et al. 1992 (15-16-389).**

#### 5.8.1.2.2 Potential Pathways and Exposure Routes

This aggregate consists of potential surface and subsurface contamination as a result of solid and liquid surface disposal, burning, spills, leaks, and waste burial. In the northeast corner of TA-16, three principal drainages run south, northwest, and northeast of the PRSs. These drainages discharge into a tributary of Cañon de Valle. The primary migration pathway at this site is surface water runoff resulting in the potential accumulation in sedimentation areas in these major drainages. Potential subsurface contamination could be brought to the surface via excavation or erosion.

Currently, human receptors are limited to on-site workers. Chapter 4 contains a detailed discussion of the migration pathways, conversion mechanisms, human receptors, and exposure routes.

### 5.8.2 Remediation Decisions and Investigation Objectives

**Problem Statement (DQO Step 1)**

Much of the burning ground is an active site, operating under interim status for open burn/open detonation. Those SWMUs discussed in this section are portions of the burning ground that are inactive, and hence could be proposed for NFA or VCA without fear of recontamination. The inactive SWMUs at the burning ground can further be subdivided based on the potential contaminants that may have been released at the sites: 1) SWMUs 16-010(a) and 16-016(c) were potentially contaminated with barium due to leaching of barium nitrate from a barium nitrate storage pile, and 2) the other SWMUs are all associated with former HE disposal activities at the basket wash facility [SWMU 16-010(h)] and its associated troughs and inactive burning pads.

41

The primary PCOC at SWMU 16-010(a), SWMU 16-016(c), and in their associated drainage is barium. Existing data suggest that at least portions of the drainage are contaminated above SALs for barium. The objective of Phase I for this area will be to determine the nature and extent of contamination in order to perform a baseline risk assessment. A subsidiary problem is to determine if other PCOCs are associated with these SWMUs.

For the remaining SWMUs at the burning ground, the objective of Phase I will be to perform screening assessment to determine whether any PCOCs

Assumptions made include: 1) that HE and barium concentrations will be highest directly adjacent to those structures involved in HE disposal or material storage; 2) that the drainages serve as the primary mechanism for transport of PCOCs from the burning ground and may concentrate contaminants in their sediment traps; and, 3) HE and barium are the constituents most likely to present a health risk at the burning ground. So, field screening for these constituents will help define the location of any highly contaminated zone.

42

**Decision Logic (DQO Step 5)**

Following Phase I investigation of the areas associated with the former barium nitrate pile, perform a baseline risk assessment. For these areas, recommend Phase II study if additional information on nature and extent of contamination is required. If baseline risk assessment suggests that remediation is necessary and a clear remediation alternative exists that would not interfere with operations, recommend VCA. If risk is shown to be negligible, recommend NFA.

For the remaining group of SWMUs, perform screening assessment for the combined group of SWMUs. If contaminant levels are not different from background, or if the sample maxima do not exceed SALs, propose NFA for the group. Otherwise, if sufficient data exist, perform a baseline risk assessment for the group as a whole to determine whether the group can be recommended for NFA. If the group as a whole cannot be recommended for NFA based on either the screening assessment or the baseline risk assessment, then recommend additional Phase II study to determine nature and extent of contamination at those sites where screening assessment indicates potential contamination. Screening data at the individual SWMUs may be used in the analysis phase to establish information on the variability and distributions of contaminant levels at the individual SWMUs. This information will also be helpful in designing Phase II data collection.

**Design Criteria (DQO Step 6)**

**SWMUs 16-010(a) and 16-016(c), barium nitrate pile:** The goal of sampling at the site of the former barium nitrate pile is to determine the nature and extent of contamination in order to perform a baseline risk assessment.

**TABLE 5-49**

**SUMMARY OF SITE SURVEYS, SAMPLING AND ANALYSIS FOR BURNING GROUND**

| PRS | PRS TYPE | SAMPLED MEDIA | LABORATORY SAMPLES # | | | | | | FIELD SCREENING | | | | | | | FIELD LAB | | | | | | LABORATORY ANALYSES # | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | STRUCTURE | | SURFACE | | SUBSURFACE | | | | | | | | A | | | | | B | | | | C | | | | D | E | F | G | H | |
| | | | | FIELD DUP | | FIELD DUP | | FIELD DUP | GROSS ALPHA | GROSS GAMMA/BETA | ORGANIC VAPOR | HE SPOT TEST | GEOPHYSICS SURFACE | BARIUM - LIBS | GEOLOGICAL CHARACTERIZATION | GROSS ALPHA | GROSS GAMMA/BETA | TRITIUM | VOLATILE ORGANICS | XRF | SOIL MOISTURE | ALPHA SPECTROSCOPY | GAMMA SPECTROSCOPY | BETA SPECTROSCOPY | TOTAL URANIUM | ISOTOPIC PLUTONIUM | ISOTOPIC URANIUM | VOA (SW 8240) | SEMIVOLATILES (SW 8270) | METALS (SW 6010) | PCBs (SW 8080) | HIGH EXPLOSIVES (SW 8330) | CYANIDE |
| 16-010(a) | Storage (ex-flash pad) | Soil | | | 3 | | 6 | | | 30 | | 30 | | 30 | | | | | | | | | | | | | | | 9 | 9 | | 9 | 9 |
| 16-010(h) | Basket wash | Soil | | | 3 | 1 | 3 | | | 5 | | 5 | | 5 | | | | | | | | | | 6 | | | | | 6 | 6 | | 6 | 6 |
| 16-010(i) | Burning pad | In | | | 3 | | 4 | 1 | | 10 | 4 | 10 | 10 | | | | | | | | | | | 7 | | | 4 | | 7 | 7 | | 7 | 7 |
| 16-010(i) | Drainage | Soil | | | 4 | | * | | | | | | | | | | | | | | | | | 4 | | | | | 4 | 4 | | 4 | 4 |
| 16-010(k) | Steel trough | Soil | | | 3 | 1 | * | | | 10 | | 10 | | 10 | | | | | | | | | | | | | | | | 3 | | 3 | 3 |
| 16-010(l) | Steel trough | Soil | | | 3 | | * | 1* | | 16 | | 16 | | 16 | | | | | | | | | | | | | | | | 3 | | 3 | 3 |
| 16-001(m) | Steel trough | Soil | | | 3 | | * | | | 10 | | 10 | | 10 | | | | | | | | | | | | | | | | 3 | | 3 | 3 |
| 16-010(n) | Trough | Soil | | | 3 | | * | | | 10 | | 10 | | 10 | | | | | | | | | | 3 | | | | | | 3 | | 3 | 3 |
| 16-016(c) | Barium nitrate pile | Soil | | | 15 | 1 | 3 | | | 32 | | 32 | | 32 | | | | | | | | | | | | | | | 18 | 18 | | 18 | 18 |
| | South drainage | Soil | | | 5 | | 3 | | | 10 | | 10 | | 10 | | | | | | | | | | 8 | | | | | 8 | 8 | | 8 | 8 |

*=Seven subsurface samples will be chosen from within this group of SWMUs.
A, B, C, G = not applicable; D = full suite; D = subsurface samples only; E = full suite; F = 1082 suite.
# = This is the minimum number of laboratory samples that could be taken. Additional samples may be taken based on field screening results. Analytes for any additional sample within a SWMU will be identical to those already indicated for that SWMU.
An additional seven collocated samples will be chosen from within this group of samples for subsurface sampling.

For purposes of future baseline risk assessment calculations two SWMU groups are defined: 1) one group consists of the two SWMUs associated witht he barium nitrate pile, SWMU 16-010(a) and SWMU 16-016(c) and its drainage; 2) the other group consits of the six SWMUs associated with HE disposal at the basket wash facility, SWMUs 16-010(h), 16-010(i), 16-010(k), 16-010(l), 16-010(m), and 16-010(n) and their primary drainages.

**SWMU 16-010(a).** At the former flash pad, field screenng will be initiated on a stratified random sampling grid wihtin the 215 ft x 180 ft area. Stratified random sampling is described in Subsection 4.5.2. Intervals between nodes of the grid will be approximately 20 ft (see Fig. 5-54). Phase I surface samples selected for laboratory analysis will be biased for the three maximum barium values resulting from field screening. Up to ten additional samples will be taken where staining is visible or where positive HE or above-background radiation concentrations are indicated by the field screening. At each location selected for laboratory analysis, 3 laboratory samples will be collected, one at 0 to 6 in., one at 2 ft, and one at 5 ft.

44ai

**SWMU 16-016(c).** As explained in Subsection 5.8.1.1 the storage of barium nitrate was very likely within SWMU 16-010(a) rather than northeast of TA-16-386. However, in order to verify that no contamination exists above SALs at this location, four surface soil samples will be screened at this location. The general screening locations are shown on Fig. 5-54.

A stain-biased soil sample will be taken approximately 25 ft due east of the northeast corner post of the fence at SWMU 16-010(a). A blackened stain was observed at this location during field observations. Phase I samples selected for laboratory analysis in this area will be biased for the two maximum values resulting from field screening as well as the stain-biased sample.

The drainage from these units will be field screened with three points, spaced at 10 ft intervals and centered on the drainage, on a transect located every 30 ft extending 210 ft from the fence at SWMU 16-010(a). Five samples from this portion of the drainage will be sent for full laboratory analysis based on the highest field screening values for barium. If any of the barium field screening values are above SALs, then a subsurface sample will be taken at a depth of 2 ft. If a sample from 2-ft depth contains barium

44bii

44bii

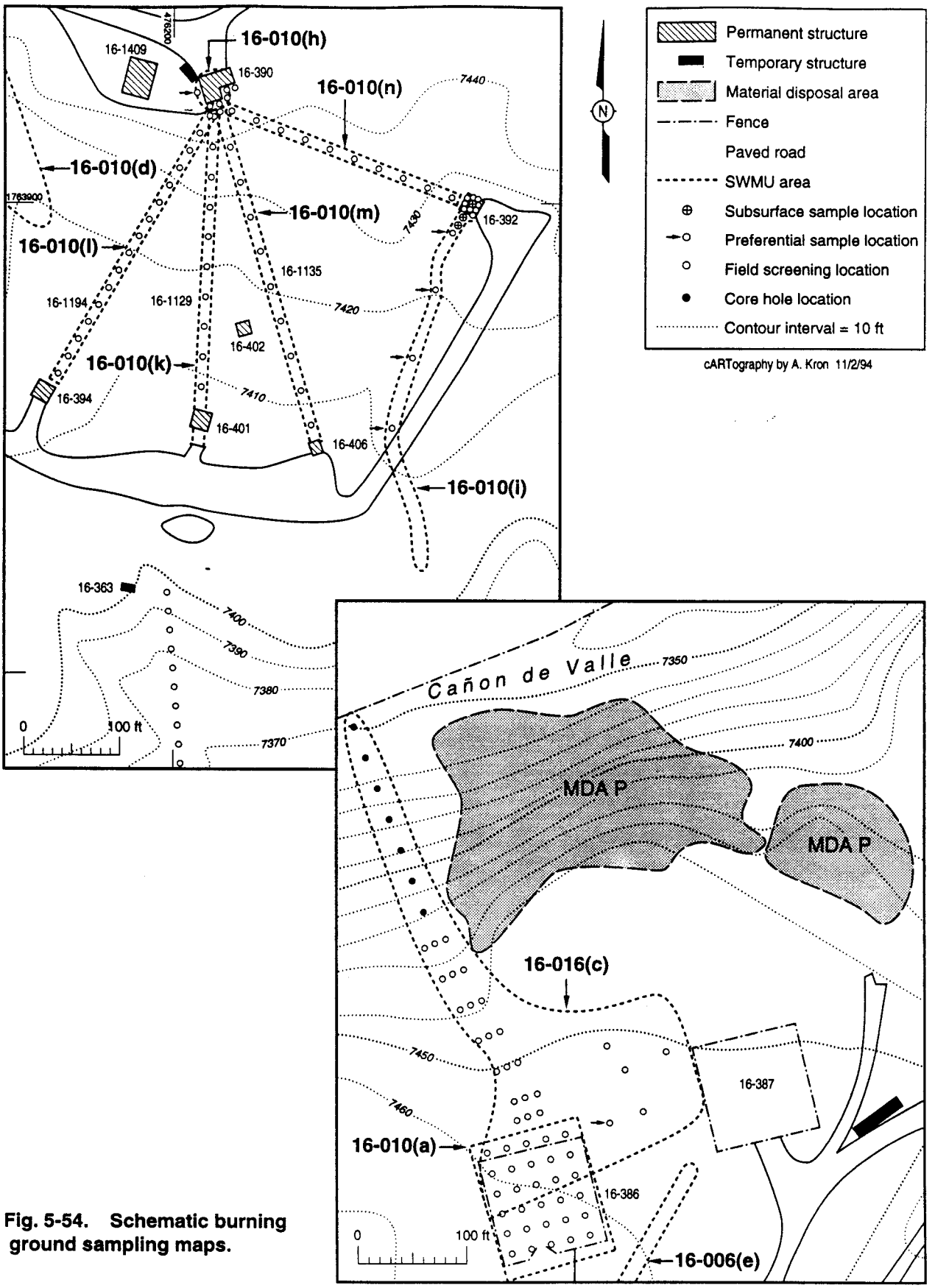



**Fig. 5-54. Schematic burning ground sampling maps.**

above SALs based on field screening, then a sample will be taken at a depth of 5 ft. Up to ten additional surface samples will be taken where staining is visible or where positive HE or above-background radiation concentrations are indicated by the field screening.

44biii

From 210 ft to Cañon de Valle a 0 to 6 in. laboratory sample will be collected every 30 ft in the center of the drainage. These samples will be field screened for barium and the three highest barium values will also have laboratory samples collected at a depth of 2 ft.

**SWMU 16-010(h).** At the former basket wash facility, five evenly-spaced (approximately 6 ft) points will be field screened on the south side of the building following removal of concrete to expose the soil (Fig. 5-54). The westernmost sampling point will be biased directly beneath the floor drain. The fourth sampling point from the west will be biased beneath the stained holes in the south wall of the building. Two Phase I laboratory surface samples (0 to 6 in.) will be collected, biased to barium values over SALs or positive HE on screening tests. In the absence of such indicators, the westernmost point and that beneath the stained holes will be selected. In addition, one sample will be collected from the soil adjacent to the sloping cement pad from which contamination may have washed. At each of these three locations a subsurface sample will also be taken at a depth of 3 ft, or the soil-tuff interface if it is shallower.

44c

44c

44c

**SWMU 16-010(i).** On the surface of the sand in the filter bed, ten randomly chosen samples will be field screened. Phase I laboratory surface samples will be biased for two above-background radiation field-screened values. In the absence of anomalous radiation values, the two samples will be field-randomized. Since water entered at the center of the filter bed from the trough, a sample will be taken at the center of the filter bed.

At the three selected locations, core sample will be taken to a depth of 3 ft or bedrock. Field screening of the core will dictate the interval of the core to be analyzed.

As Engineering drawing ENG-C 1106 shows, this unit discharged to a drainage pipe, buried approximately 14 in. below the surface. A sample will be taken directly below the end of the drainage pipe, now exposed, one

sample 12 in. upgradient, and one sample 12 in. downgradient. The upgradient and downgradient subsurface samples will be taken 14 to 16 in. below the surface. An additional sample will be taken to a depth of 6 in. beneath the sample taken directly below the end of the drainage pipe.

Additional surface soil samples will be taken in the drainage leading away from this unit. Four samples will be taken, the first sample 2 ft from the unit where any effluent might have first encountered soil. Three more samples will be taken every 50 ft. At all of these locations, 0 to 6 in. of soil will be collected. See Fig. 5-54 for sample locations.

**SWMU 16-010(l).** Field inspection of the ground below this trough indicates numerous stain-biased sample locations. From south to north, staining is observed at the 3rd, 7th, 10th, 14th, and 18th anchors. The anchors are approximately 10 ft apart. The trough is compromised at the 13th and 23rd anchors. At these locations and at every joint in the trough from the 23rd anchor to 10 ft from the basket wash facility, soil beneath the trough will be field screened. Full laboratory analysis will be performed on up to ten samples with positive HE field screening values. If three or fewer samples have positive HE values, then up to three samples will be biased for maximum values for barium from field screening. At all of these locations, 0 to 6 in. of soil will be collected.

**SWMUs 16-010(k) and 16-010(m).** Field inspection shows no stain-biased sample locations at these units. At these two troughs, field screening will commence on the soil directly below the troughs. Ten roughly evenly spaced samples will be field screened, starting 20 ft from the basket wash facility and terminating at the filter beds (see Fig. 5-54). Full laboratory analysis will be performed on up to 10 samples that yield positive HE values. If fewer than three samples have positive HE, then select the remaining samples (up to three) based on maximum screened locations for barium. At all of these locations, 0 to 6 in. of soil will be collected.

**SWMU 16-010(n).** A field inspection of this area shows no points for stain-biased sampling, ten roughly evenly-spaced surface soil samples will be field screened. These field-screened samples will commence 20 ft from the basket wash facility and terminate adjacent to the filter bed. Full laboratory analysis will be performed on up to ten samples that yield positive HE

values. If fewer than three samples have positive HE, then select the remaining samples (up to three) based on maximum screened locations for barium. At these locations, soil will be collected from 0 to 6 in.

**South drainage.** The south drainage for much of the burning ground will be field screened at ten randomly selected sediment catchments between the outfall from the former Hypalon pond and the downstream end of the sedimentation area, including locations at 130 ft and 165 ft from the road (see Fig. 5-54). Five sediment traps will be selected based on the highest barium field screening values. Any samples with positive HE field screening readings will also be sampled for laboratory analysis. A likely sample location is at the bottom of the canyon where the drainage flattens and runoff velocity is greatly decreased. At all of these locations, 0 to 6 in. of soil will be collected.

44e

At the three sediment traps with the highest barium readings based on field screening, a subsurface sample will be taken at the soil-tuff interface, if this interfaces is at a depth greater than 6 in.

**Subsurface samples.** Seven subsurface sampling points will be augered (6 to 18 in. or bedrock), collocated with the surface samples described for SWMUs 16-010(i,k,l,m,n). These will be biased to surface points with positive HE screening results. If fewer than seven points yield positive HE screening data, then choose the augered points randomly. If more than seven points yield positive HE screening results, choose those farthest downslope from the basket wash facility.

#### 5.8.4.3 Laboratory Analysis

Full laboratory analyses of samples will be at Level III by the following methods: radionuclides (LANL or DOE method), SVOCs such as HE burn products (SW-846 Method 8270), metals (SW-846 Method 6010), and HE (SW-846 Method 8330). Particular contaminants of concern for this aggregate are barium and HE, including RDX, HMX, TNT, and HE by-products (DNT, DNB, etc.).

**Decision Process (DQO Step 2)**

Initial goals for the Phase I studies are: 1) verification/elimination of specific PCOCs for these areas, and 2) providing sufficient Phase I data so that Phase II studies can be implemented in an efficient and cost-effective manner.

**Cañon de Valle – surface.** If screening assessment confirms contaminant levels different from background and above SALs at Cañon de Valle, the results of Phase I study will be used to perform a baseline risk assessment to determine whether a VCA should be performed, such as installation of a barrier to prevent off-site migration of COCs.

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**Cañon de Valle – deep-surface/subsurface.** No data exist that indicate contamination of the deep-surface/subsurface in Cañon de Valle. Thus, the goal of Phase I for the deep-surface/subsurface is to evaluate whether PCOCs are different from background and exceed SALs or whether multiple contaminants may pose a health risk. If PCOCs are not different, NFA the deep-surface/subsurface. If PCOCs without background exceed SALs, then incorporate the deep-surface/subsurface data into the baseline risk assessment and institute a Phase II study to further define nature and extent of deep-surface/subsurface contamination. A subsidiary question in the deep-surface/subsurface at Cañon de Valle is the possible existence of an alluvial aquifer. If soil moisture measurements indicate a continuous alluvial aquifer in the canyon, then incorporate this information into risk assessment models. EPA guidance suggests use of residential scenario in regions in which alluvial aquifers can be pumped with sufficient yield to serve as a water supply.

Possible remediation alternatives for Cañon de Valle include some combination of: 1) full removal of contaminated soils with long-term disposal in a permitted landfill; and 2) implementation of barriers to inhibit off-site migration. The decision flow logic for Cañon de Valle is shown in Fig. 5-56.

### 5.9.3 Data Needs and Data Quality Objectives

**Decision Inputs and Investigation Boundary (DQO Steps 3 and 4)**

Assumptions made for the canyon include: 1) that PCOCs are concentrated in the central channel of the canyon; and 2) that there is a barium and HE

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contamination problem in the canyon, but the risk to human health remains to be quantified.

Questions to be addressed during Phase I are: 1) Are HE, HE by-products, barium, or other metals present at levels that would present a risk to humans, in Cañon de Valle?; 2) What is the nature and extent of migration of contaminants in Cañon de Valle?; and, 3) Is an alluvial aquifer present within Cañon de Valle? Data needed to address these questions are:

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1) concentrations of PCOCs in surface and deep-surface/subsurface soils and water; and 2) soil moisture measurements on deep-surface/subsurface soils, particularly directly above the soil/tuff interface.

The domain of interest is the surface and deep-surface/subsurface soils and water in Cañon de Valle in those areas most likely to be impacted by TA-16 operations. Cañon de Valle will be sampled from the effluent point of the MDA R drainages down the canyon for approximately 6 000 ft. This distance allows evaluation of contaminant contribution from three principal SWMUs that may impact Cañon de Valle: MDA R, the TA-16-260 outfall, and MDA P, but avoids contaminant contributions from TA-14, which is located downstream from the TA-16 operation area on the north of Cañon de Valle. If data from this section of Cañon de Valle suggest that TA-16 contamination is being transported down Cañon de Valle beyond the furthest downstream point investigated, then additional data from further down Cañon de Valle will be collected in Phase II. In addition, other portions of Cañon de Valle will be investigated by the Canyons OU.

**Decision Logic (DQO Step 5)**

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**Cañon de Valle – surface.** Based on the results of the Phase I study of Cañon de Valle, perform a preliminary baseline risk assessment. Use the results of this baseline risk assessment to decide between the following options: 1) propose Phase II study to obtain additional information on the nature and extent of contamination and transport of contaminants if the baseline risk assessment suggests significant levels of risk (greater than $10^{-6}$), but additional data may further bound the risk; 2) proceed to VCA if significant (between $10^{-4}$ and $10^{-6}$) risk is demonstrated, and a clear remediation alternative exists for the canyon; 3) propose NFA if the risk is minimal (less than $10^{-6}$). If Phase I data suggest that the rate of potential

contaminant migration in Cañon de Valle is high, installation of a barrier to prevent off-site migration may be recommended as an interim action.

**Cañon de Valle – deep-surface/subsurface.** Soil concentrations for deep-surface/subsurface samples will be used to compare to background and SALs for metals (particularly barium), HE, and other PCOCs. If the concentrations of PCOCs are at or below background and SALs, then propose NFA for the deep-surface/subsurface. If more than one PCOC is above background but below SALs, then perform multiple contaminant screening to evaluate whether any PCOCs are of concern in combination with other constituents. In either case, PCOC and soil moisture data will be incorporated into the proposed baseline risk assessment for the surface soils.

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The decisions described in the previous two sections for Cañon de Valle will be based on sample means of soil and water samples from sediment traps in Cañon de Valle.

**Design Criteria (DQO Step 6)**

The purpose of surface sampling Cañon de Valle is to obtain information about contaminant extent, migration, and transport, so the samples will be located to provide approximately uniform coverage of the region of interest. A total of 40 laboratory samples [30 0 to 6 in. and 10 deep-surface/subsurface samples (6 to 12 in. or 12 to 18 in. or soil-tuff interface)] from Cañon de Valle will be submitted for laboratory analysis. The purpose of surface sampling Cañon de Valle is to obtain information about contaminant migration and transport. The samples will be located to provide approximately uniform coverage of the region of interest. Geomorphologic mapping will provide information on the heterogeneity of sediments and rock outcrops in the canyon bottom. In Cañon de Valle, 30 sediment traps and associated water will be selected so that a sample for laboratory analysis is taken approximately every 200 ft. These samples of sediment traps will be selected to provide adequate coverage of the diversity of sediments in the canyon, based on the geomorphologic mapping. Professional judgment suggests that 30 samples will be adequate for a baseline risk assessment.

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Because the primary goal for deep-surface/subsurface sampling in Cañon de Valle is a reconnaissance survey, the deep-surface/subsurface samples will be biased (IWP, Appendix H). Ten laboratory samples will be selected out of up to 60 field-screened deep-surface/subsurface samples. With 10 samples, the probability of detecting contamination is 0.87 if 20% or more of the site is contaminated (see Subsection 4.5, Chapter 4). The use of field screening makes the reconnaissance sampling probability statement very conservative. The deepest deep-surface/subsurface sample from each of the 30 sampling locations will be sampled for soil moisture. In order to determine if an alluvial aquifer is present, it is necessary to have comprehensive, unbiased data.



The Cañon de Valle sampling will assume that the potential contaminants are relatively homogeneously distributed on a sediment-trap scale.

### 5.9.4 Sampling and Analysis Plans

Phase I sampling is designed to provide sufficient data to perform a baseline risk assessment for Cañon de Valle.

SOPs used in this sampling plan are listed in Table 5-54. Sample numbers and necessary analyses are shown in Table 5-55. Field-screening methods are described in Subsection 4.7. SOPs for these procedures are currently in preparation.

**TABLE 5-54**

**STANDARD OPERATING PROCEDURES FOR FIELD ACTIVITIES**

| LANL-ER-SOP | TITLE | NOTES |
|---|---|---|
| 01.02, R0 | Sample Containers and Preservation | Applied to all laboratory samples |
| 01.04, R1 | Sample Control and Field Documentation | Applied to all laboratory samples |
| 06.10, R0 | Hand Auger and Thin-Wall Tube Sampler | Applies to all augered soil/sediment samples |
| 06.13, R0 | Surface Water Sampling | All water samples |
| 11.01, R0 | Measurement of Bulk Density, Dry Density, Water Content, and Porosity of Soil | Subsurface Samples |

**TABLE 5-55**

**SUMMARY OF SITE SURVEYS, SAMPLING AND ANALYSIS FOR CAÑON DE VALLE**

| | | LABORATORY SAMPLES | | | | | | | FIELD SCREENING | | | | | | | FIELD LAB. | | | | | | LABORATORY ANALYSES | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | STRUCTURE | | SURFACE | | DEEP-SURFACE/ SUBSURFACE | | | | | | | | A | | | | | B | | | | C | | | | D | E | F | G | H | |
| PRS | PRS TYPE | SAMPLED MEDIA | | FIELD DUP | | FIELD DUP | | FIELD DUP | GROSS ALPHA | GROSS GAMMA/BETA | ORGANIC VAPOR | HE SPOT TEST | GEOPHYSICS SURFACE | BARIUM - LIBS | GEOLOGICAL CHARACTERIZATION | GROSS ALPHA | GROSS GAMMA/BETA | TRITIUM | VOLATILE ORGANICS | XRF | SOIL MOISTURE | ALPHA SPECTROSCOPY | GAMMA SPECTROSCOPY | NITRATE | TOTAL URANIUM | ISOTOPIC PLUTONIUM | ISOTOPIC URANIUM | VOA (SW 8240) | SEMIVOLATILES (SW 8270) | METALS (SW 6010) | PCBS | HIGH EXPLOSIVES (SW 8330) | CYANIDE |
| None | Canon de Valle | Sediment | | | 30 | 2 | 10 | 1 | | | | 30# | | 30# | 30 | | | | | | 30 | | 40 | 30 | 40 | | | 10 | 40 | 40 | | 40 | 40 |
| None | Canon de Valle | Water* | | | 30 | 2 | | | | | | | | | | | | | | | | | 30* | 30* | 30* | | | 30* | 30* | 30* | | 30* | 30* |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

* Samples taken if water present at sediment sampling points.
\# = The actual number of subsurface samples will depend on the depth to bedrock.
A, B, = not applicable; C, H = full suite subsurface and water samples; D = volatiles in subsurface and water only. E = full suite; F = 1082 suite.

#### 5.9.4.1 Engineering Surveys

The engineering surveys will include a geomorphological study of Cañon de Valle. This survey will document the locations and morphologies of sediment traps, the locations and volumes of water flow, and the locations of tributaries to the canyon. Subsequent to the geomorphic survey, an engineering survey will be done to locate, stake, and document the sampling points for sediment and water analysis. All sample locations will be registered on a base map, scale 1:7 200. If during the course of sampling any sample points must be relocated, the new position will be resurveyed and the revised locations will be indicated on the base map.

The engineering survey will be performed by a licensed professional under the supervision of the field team leader.

#### 5.9.4.2 Sampling

Thirty sediment traps suitable for sampling will be located and flagged in Cañon de Valle at approximately 200 ft intervals for 6 000 ft downstream in Cañon de Valle from MDA R (Fig. 5-57).

Cañon de Valle will be sampled at locations surveyed in as described above. Thirty sediment samples will be taken at approximately 200 ft intervals eastward along the channel within Cañon de Valle. Water samples will be taken at those locations containing standing or flowing water. At each location, a hand-augered sample will be taken to bedrock. Each core will be divided into 6-in. segments. The upper 0 to 6 in. of each will be sent for laboratory analysis. The lower 0 to 6 in. will be analyzed for soil moisture content. All deep-surface/subsurface segments will be field screened for HE and barium. The following hierarchical biasing scheme will be used to select a total of 10 deep-surface/subsurface laboratory samples: 1) up to 10 samples that yield positive HE spot tests, and 2) additional samples to a total of 10 with the highest barium field screening results. If more than 10 samples yield positive HE spot tests, then select at most one deep-surface/subsurface sample in an individual core and choose those samples collected farthest downstream in the canyon.

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**TABLE 5-56**

**POTENTIAL RELEASE SITES AND POTENTIAL CONTAMINANTS OF CONCERN CONTAINED IN OU 1082, MDA R**

| PRS | DESCRIPTION | PRIMARY ACTIVITY LEADING TO A POTENTIAL PROBLEM | ACTIVE | HE | | | | | RAD | METALS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | UNDETONATED HE | HE DETONATION PRODUCTS | HE DEGRADATION PRODUCTS | HE BURN PRODUCTS | SEMI-VOLATILE ORGANICS | URANIUM | METALS SUITE | BARIUM | ASBESTOS |
| 16-019 | MDA R | Disposal area | N | X | X | X | X | X | X | X | X | X |
| | | | | | | | | | | | | |

**TABLE 5-58**

**SUMMARY OF SITE SURVEYS, SAMPLING, AND ANALYSIS FOR MDA R**

| PRS | PRS TYPE | SAMPLED MEDIA | LABORATORY SAMPLES # | | | | | | FIELD SCREENING # | | | | | | | FIELD | | | | | | | LABORATORY ANALYSES # | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | STRUCTURE | | SURFACE | | SUBSURFACE | | | | | | | | A | | | | | B | | | | C | | | D | E | F | G | H | |
| | | | | FIELD DUP | | FIELD DUP | | FIELD DUP | GROSS ALPHA | GROSS GAMMA/BETA | ORGANIC VAPOR | HE SPOT TEST | GEOPHYSICS SURFACE | BARIUM - LIBS | GEOLOGICAL CHARACTERIZATION | GROSS ALPHA | GROSS GAMMA/BETA | TRITIUM | VOLATILE ORGANICS | XRF | SOIL MOISTURE | ALPHA SPECTROSCOPY | GAMMA SPECTROSCOPY | BETA SPECTROSCOPY | TOTAL URANIUM | ISOTOPIC PLUTONIUM | ISOTOPIC URANIUM | VOA (SW 8240) | SEMIVOLATILES (SW 8270) | METALS (SW 6010) | ASBESTOS | HIGH EXPLOSIVES (SW 8330) | CYANIDE |
| 16-019 | MDA R | Soil | | | 32 | 2 | | | | 135 | | 135 | | 135 | | | | | | | | | | | 32 | | | | 32 | 32 | 32 | 32 | |
| 16-019 | MDA R | Tuff/soil | | | | | 8 | 1 | | 8 | | 8 | | 8 | | | | | | | | | | | 8 | | | | 8 | 8 | 8 | 8 | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

# = The actual number of samples will depend on the results of the field screening and the depth of the cores.
A, B, C, D = not applicable; E = full suite; F = 1082 suite; H = full suite.

In a 500 x 300 ft area over the three burning pits, the grid spacing will be halved to 37.5 ft (see Fig. 5-60).

#### 5.10.4.2 Sampling

Low-energy gamma radiation measurements, HE field swipe tests, and barium field screening will be reported at the grid nodes and in the drainage channels surveyed as described above (Baytos 1991, 15-16-339). Measurements will be examined for anomalies that could be used to guide the laboratory sampling described in the following subsections.

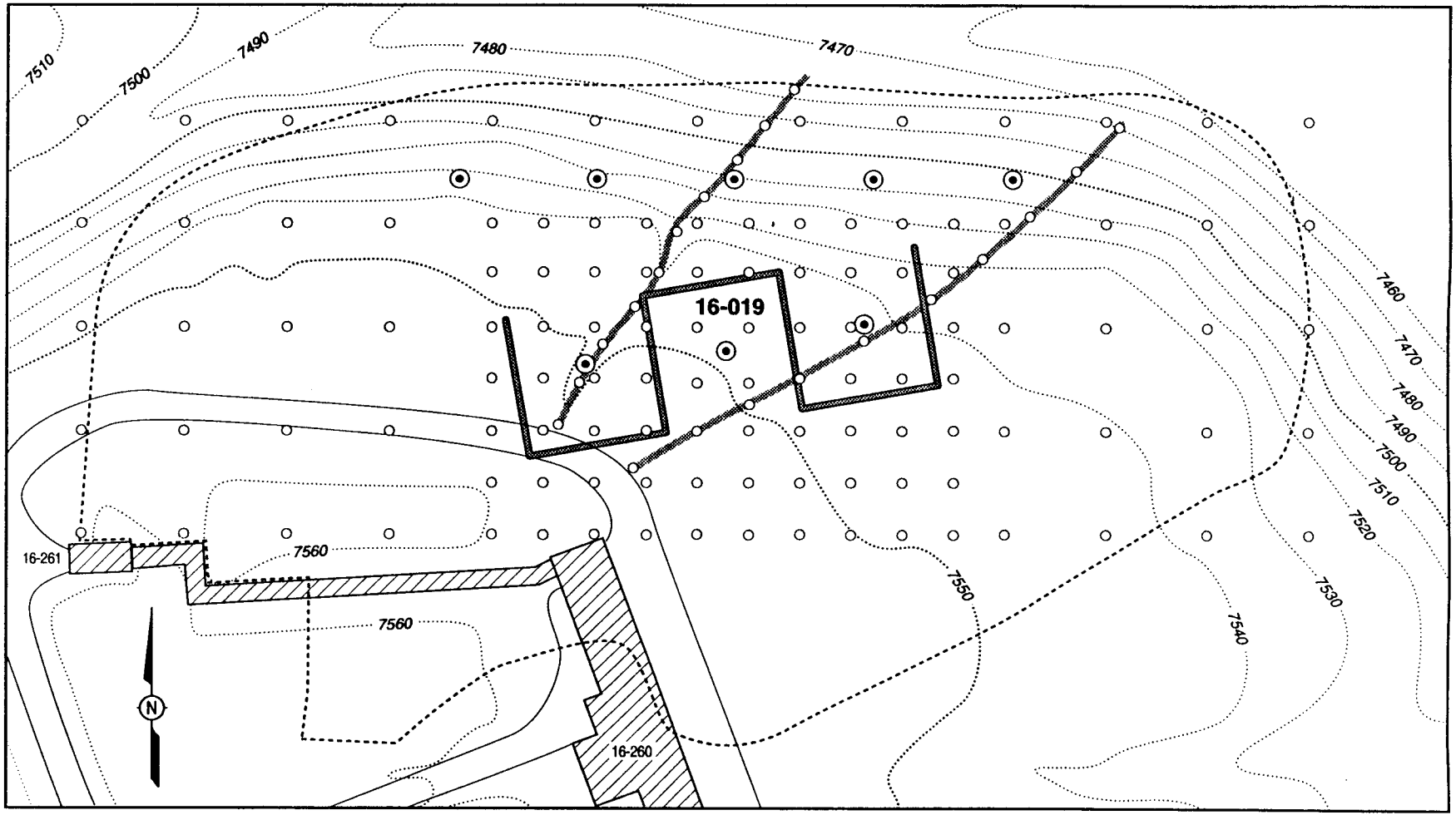
If the radiation, barium, and HE surveys of SWMU 16-019 yield negative results, then 22 field-randomized 3-ft core samples will be taken within the SWMU boundaries at grid node points. Six of these field-randomized cores will be biased into obvious drainages near the canyon rim or in topographic depressions within MDA R. However, if any of the survey points yield above background concentrations for radiation, barium, or HE, then laboratory samples will be collected and analyzed at those points. At these sampling locations, 0 to 3 ft of soil will be collected. These 3-ft samples will be divided into 6-in. intervals and field screened for HE, radiation, and barium. At least one 6-in. sample for laboratory analysis will be taken from each core using the following hierarchical biasing scheme: 1) a sample with a positive HE reading; 2) a sample with an above-background radiation reading; and, 3) the segment with the highest barium field screening reading. Each time a segment from a 3-ft core interval yields a positive screening indicator the deepest segment will be submitted for laboratory analysis along with a positive segment. Any time the bottom 6-in. interval is above background (two times background or more) based on field screening, it will be submitted for laboratory analysis and the core will be continued on 2-ft intervals until a sample within the background range is found. Each of these additional 2-ft spaced samples will be submitted for laboratory analysis.

50a

51a

51a,b

Two drainages crossing MDA R will be sampled five times, biased by the HE screening and radiation screening described. In the absence of positive results for the radiation and HE field screening, five sediment traps at roughly evenly spaced intervals will be taken from the southward terminus of the surveyed zone to the confluence of Cañon de Valle. At these locations, 0 to 6 in. of soil will be collected.




cARTography by A. Kron 11/2/94

0 100 200 300 ft

Contour interval = 10 ft

Permanent structure
Paved road
SWMU area
Drainage pathway
Bermed burning pit
Screening sample location (75-ft grid interval; 37.5 ft over pits)
Core hole location

**Fig. 5-60. Schematic MDA R sampling grid.**

Eight drill cores extending to bedrock (estimated depth 15 ft) will be sampled within the boundaries of SWMU 16-019. Three of these will be located within the surveyed boundaries of each of the three U-shaped berms. The other five will be located along the north rim of Cañon de Valle, evenly spaced over a distance of 375 ft and centered on the surveyed locations of the berms, unless surface screening suggests the drill holes should be located elsewhere (Fig. 5-60). Each core will be divided into 6-in. segments. These segments will be field screened for HE, radiation, and barium. One sample for laboratory analysis will be taken from each core using the following hierarchical biasing scheme: 1) a sample with a positive HE reading; 2) a sample with an above-background radiation reading; 3) the segment with the highest barium field screening reading. Any 15-ft core sample exhibiting an above background field screening reading (two times background or more) will warrant a second sample that represents the deepest core interval. Any core for which the deepest core segment yields a positive reading will be cored deeper in 2-ft intervals until a field screening sample is found that has a within-background reading. Each such positive sample will be submitted for laboratory analysis.

51b

#### 5.10.4.3 Laboratory Analysis

Full laboratory analyses of samples will be at Level III by the following methods: for radionuclides (LANL or DOE method), metals (SW-846 Method 6010), semivolatile organics (SW-846 Method 8270), and HE and its by-products (SW-846 Method 8330). Based on knowledge of contaminants at the modern burning ground, potential contaminants of particular concern are barium, uranium, HE (HMX, RDX, and TNT), and HE by-products such as DNT, TNB, and DNB.

#### 5.10.4.4 Sample Quality Assurance

Field quality assurance samples will be collected according to the guidance provided in the latest revision of the IWP (LANL 1992, 0768). Sampling parameters for MDA R, including appropriate QA/QC field duplicates are provided in Table 5-58.

## 5.11 Surface Waste Disposal Areas, SWMUs 16-009 and 16-016(a,b)

### 5.11.1 Background

SWMUs 16-009, 16-016(a), and 16-016(b) are included in an aggregate because all of them were used as surface waste disposal areas. In addition, all of them have poorly-characterized histories of waste disposal. Our knowledge of waste disposal practices and SWMU histories is primarily derived from studies of aerial photographs.

#### 5.11.1.1 Description and History

**SWMU 16-009.** SWMU 16-009 was a burn treatment area. It was located in a level field near the western end of S-Site north of the administration area (Fig. 5-61). It was located roughly 200 ft northwest of TA-16-54, the WW II barium nitrate grinding facility. The burning area was completed in August 1945 as a trash-burning site (Abernathy et al. 1945, 15-16-420). It was not located in the old HE exclusion area, and during the time of its operation a dedicated HE burning area existed at the MDA R burning ground. Aerial photographs indicate that the burn area was a bermed enclosure about 100 ft square. The berm was about 6 ft high; it surrounded the area on three sides. On the east side was an opening large enough to allow trucks access to the enclosed area. The burn area was in use from the late 1940s into the 1960s. The exact date of decommissioning is not known. The site was decommissioned and the berm leveled. Aerial photos indicate that no further use was made of the site; it is presently an open field of grasses and weeds.

GC7

**SWMU 16-016(a).** SWMU 16-016(a) was a landfill located in the WW II S-Site complex. It is located in a partially forested, level area northeast of bunker TA-16-76 (Fig. 5-62).

GC7

It was designated as a SWMU because it was reported in 1965 that an unspecified amount of metal had been buried in the area during WW II (LASL 1965, 15-16-125). The dates of operation of this landfill are not known exactly. A magnetometer survey was conducted over the area, metallic debris was located, and this material was removed to the Area P landfill (Williams 1965, 15-16-126). Examination of aerial photographs from 1948, 1958, and June 1965 do not reveal any obvious surface disturbances in the

purported landfill area. Location of the landfill was specified as S43 W51 in LASL coordinates in a 1965 memo (Williams 1965, 15-16-126).

**SWMU 16-016(b).** SWMU 16-016(b) is a landfill consisting of broken concrete, mounds of soil, and other debris located approximately 500 ft north of TA-16-540 (Fig. 5-61). No information has been found concerning the dates of use for this landfill. The area is a level open field with scrub growth of small trees and bushes. The 1987 CEARP field survey revealed traces of HE contamination in the landfill (DOE 1987, 0264). The type of HE found is unknown; it is likely that the CEARP survey obtained a positive HE spot test. Examination of aerial photographs suggests that the rubble was deposited in the landfill between 1948 and 1958.

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#### 5.11.1.2 Conceptual Exposure Model - Surface Disposal

The conceptual exposure model is presented in Fig. 4-8. Site-specific information on potential release sources, chemicals of concern, migration pathways, and potential receptors is presented below.

##### 5.11.1.2.1 Nature and Extent of Contamination

No quantitative data exists for any of the three SWMUs composing this aggregate. PCOCs for the SWMUs are listed in Table 5-59.

**SWMU 16-009.** SWMU 16-009 served as a waste burning area during the early days of S-Site operations. It probably was not used for burning HE, but may have been used for burning barium nitrate-contaminated material from TA-16-54. Thus, possible COCs in this locality are barium, uranium, other metals, and perhaps semivolatile organics.

**SWMU 16-016(a).** Likely contaminants in SWMU 16-016(a) are metals and perhaps HE and HE by-products.

**SWMU 16-016(b).** Likely contaminants include HE, HE by-products, and perhaps metals.

##### 5.11.1.2.2 Potential Pathways and Exposure Routes

This aggregate consists of a burn treatment/disposal area and two landfills; therefore, potential contamination may be present in surface and subsurface soils as a result of suspected solid and liquid surface disposal, burning,

**TABLE 5-61**

**SUMMARY OF SITE SURVEYS, SAMPLING AND ANALYSIS FOR LANDFILL, SURFACE DISPOSAL, BURN PIT**

| | | LABORATORY SAMPLES# | | | | | | | FIELD SCREENING # | | | | | | | FIELD LAB | | | | | | LABORATORY ANALYSES# | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | STRUCTURE | | SURFACE | | SUBSURFACE | | | | | | | | A | | | | | B | | | | C | | | | D | E | F | G | H | |
| PRS | PRS TYPE | SAMPLED MEDIA | | FIELD DUP | | FIELD DUP | | FIELD DUP | GROSS ALPHA | GROSS GAMMA/BETA | ORGANIC VAPOR | HE SPOT TEST | GEOPHYSICS SURFACE | BARIUM - LIBS | GEOLOGICAL CHARACTERIZATION | GROSS ALPHA | GROSS GAMMA/BETA | TRITIUM | VOLATILE ORGANICS | XRF | SOIL MOISTURE | ALPHA SPECTROSCOPY | GAMMA SPECTROSCOPY | BETA SPECTROSCOPY | TOTAL URANIUM | ISOTOPIC PLUTONIUM | ISOTOPIC URANIUM | VOA (SW 8240) | SEMIVOLATILES (SW 8270) | METALS (SW 6010) | PCBs (SW 8080) | HIGH EXPLOSIVES (SW 8330) | CYANIDE |
| 16-009 | Burn pit | Soil | | | 5 | 1 | | | | 25 | | | | 25 | | | 25 | | | 25 | | | 5 | | 5 | | | | 5 | 5 | | | |
| 16-016(a) | Landfill | Soil | | | | | 1 | | | | | | x | | | | | | | | | | | | 1 | | | | | 1 | | 1 | |
| 16-016(b) | Landfill | Soil | | | 3 | | | | | | | 20 | | | | | | | | | | | | | 3 | | | | | 3 | | 3 | |

A,B,C,D,G = not applicable; E,H = full suite; F = 1082 suite.

# These numbers represent the minimum number of laboratory samples. Additional samples will be collected if positive field-screening results are found.

comparisons between 1948 aerial photographs and 1:7 200 orthophotographs. SWMU 16-016(a) will be surveyed in at LASL coordinates S43 W51 for a distance of 100 ft in each direction from that point. The boundaries of the mounded soil and debris will be surveyed for SWMU 16-016(b).

#### 5.11.4.2 Geophysical Survey

An EM and magnetics grid will be located over the approximate location of SWMU 16-016(a). The approximate corners of this grid are:

| CORNER | EAST | NORTH |
|---|---|---|
| SW | 470900 | 1762100 |
| NW | 470900 | 1762100 |
| NE | 471100 | 1762300 |
| SE | 471100 | 1762300 |

Electromagnetic and magnetic measurements will be made within the surveyed area (Fig. 5-64). SOPs for geophysical investigations are currently in preparation. These will be examined for anomalies that might indicate the presence of buried metal.

#### 5.11.4.3 Sampling

**SWMU 16-009, administration area burning ground.** Low-energy gamma radiation measurements for the detection of uranium and other radionuclides and barium field screening will be performed on 25 20-ft spaced surface points centered over the bermed burning pit within the boundaries of SWMU 16-009 (Fig. 5-65). Anomalous radiation or barium screening measurements by LIBs or XRF will be used to guide subsequent sampling for laboratory analysis. In particular, any values two times background will be considered to be anomalous.

54a

Five laboratory samples will be taken within the boundaries of this grid. At sampling locations, 0 to 3 ft of soil will be collected. Their locations will be based on the highest five radiation or barium field screening tests, if any above-background readings occur. In the absence of five anomalous radiation survey analyses or barium field screening measurements, field randomization

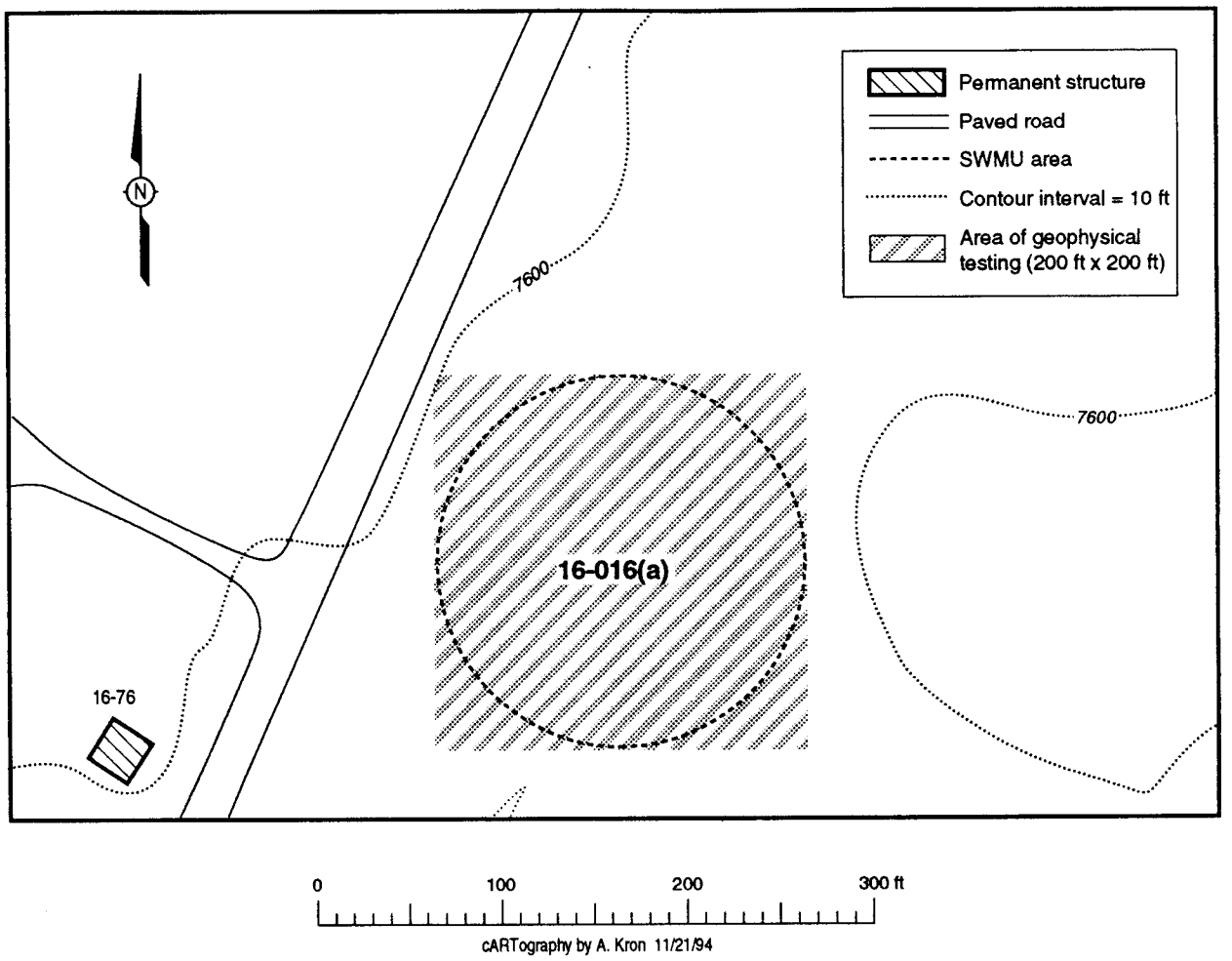



**Fig. 5-64. Schematic location of geophysics and testing for SWMU 16-016(a).**

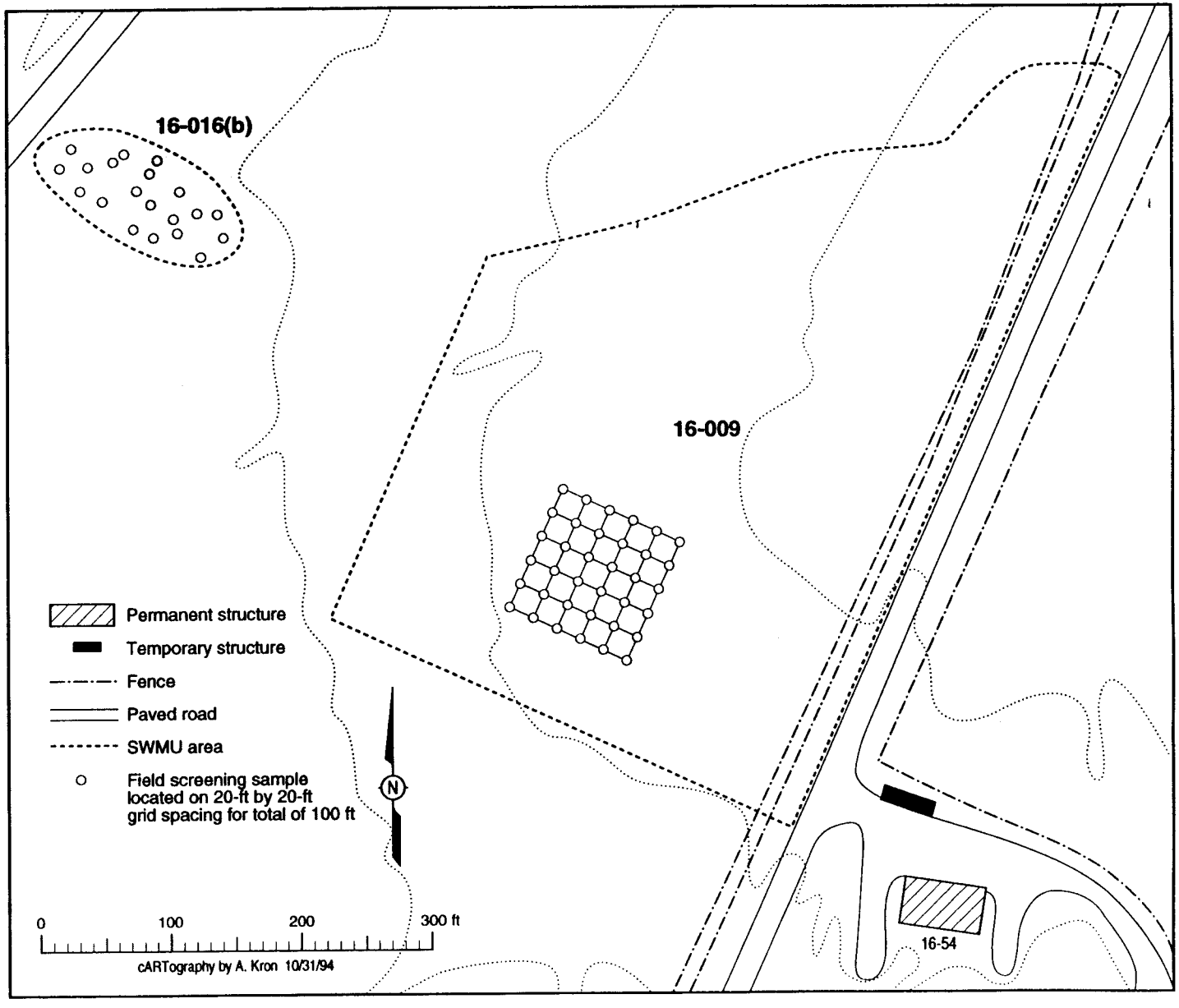



**Fig. 5-65. Schematic sample locations for SWMUs 16-016(b) and 16-009.**

methods will be used within the boundary of the grid to select laboratory samples.

54a
54b

Each core will be divided into 6-in. segments. The 0- to 6-in. interval, the 12- to 18-in. interval and the bottom interval will be screened to select a laboratory sample for analysis. In each core the highest reading interval, relative to background, will be selected for laboratory analysis. If a positive screening reading for barium or radionuclides is found in a core, then the bottom interval will also be submitted for laboratory analysis. If all screening intervals yield measurements within the background range, the 12- to 18-in. interval will be submitted for laboratory analysis.

**16-016(a), former metal burial area.** Laboratory sampling of this SWMU will only occur if a concentration of metallic debris that appears to be the former waste disposal site is discovered during the geophysical survey. If a concentration of debris is located, then a single auger hole (4 ft or to bedrock) will be sited adjacent to the debris and a single 6-in. laboratory sample will be taken from the level of the debris. Debris will be disposed of in a permitted landfill.

**16-016(b), Surface Disposal Area.** Twenty field-randomized HE swipes will be taken in and around the debris within SWMU 16-016(b) (Fig. 5-65). Positive HE readings will be used to guide subsequent sampling for laboratory analysis.

54c

A minimum of three surface samples will be taken within the boundaries of SWMU 16-016(b). At these locations, 0 to 6 in. of soil will be collected. Their location will be based on the HE field screening tests, if any positive readings occur. In the absence of positive HE field analyses, field randomization methods will be used within the boundary of the SWMU. If more than three samples yield positive readings, all positive samples will be sent to the laboratory.

#### 5.11.4.4 Laboratory Analyses

Full laboratory analyses of samples will be at Level III by the following methods: for radionuclides (LANL or DOE method), SVOCs (SW-846 Method 8270), metals (SW-846 Method 6010), and HE and its by-products (SW-846

## 5.12 TA-16 Waste Water Ponds Aggregate, SWMU 16-007(a) and SWMU 16-008(a)

### 5.12.1 Background

The two SWMUs in this aggregate contain a total of five ponds. One SWMU with four ponds has been excavated, filled with clean soil, and is now covered in natural grasses. The fifth pond is intact but inactive. The SWMUs are aggregated on the basis of geographical proximity, similarity of operations in buildings associated with the ponds, nature of use as evaporative ponds, similarities of suspected contaminants, and proposed sampling techniques. The SWMUs are listed in Table 5-62 and shown in Fig. 5-66.

#### 5.12.1.1 Description and History

**SWMU 16-007(a).** SWMU 16-007(a) consists of four backfilled ponds about 100 ft southwest of TA-16-90. The ponds were approximately 100 ft square each, flat-bottomed, and aligned in a row from northwest to southeast. The ponds were located on a level mesa within a depression 8 to 10 ft deep; berms 4 to 6 ft high separated the ponds. Aerial photographs from the 1940s show the ponds containing liquid. The site of the former ponds is now level with the mesa and covered with grasses.

GC7

These four backfilled ponds were located northeast of former buildings TA-16-30, -31, -32, -33, and -34 that were constructed in 1945. Buildings TA-16-31, -32, and -33 were explosives machining buildings; TA-16-30 and -34 were magazines. The drains from the machining buildings discharged to the ponds. Machining operations at these buildings ceased after construction of TA-16-260 in 1951, so no HE wastes would have been discharged to the ponds after that time. The buildings were decommissioned and destroyed by burning in January/February 1960. The ponds were excavated as part of the S-Site demolition and restoration activities in 1967 (Thrap 1970, 15-16-001). In a personal interview with L. Hilton in April 1993, Mr. Hilton indicated that the cleanup of these ponds may not have been very thorough (Hickmott 1993, 15-16-477). The ponds are believed to have received HE-contaminated liquid containing barium and organics. Natural uranium was used in association with some explosive charges (Courtright 1969, 15-16-318) and may have been discharged to the ponds. The aerial

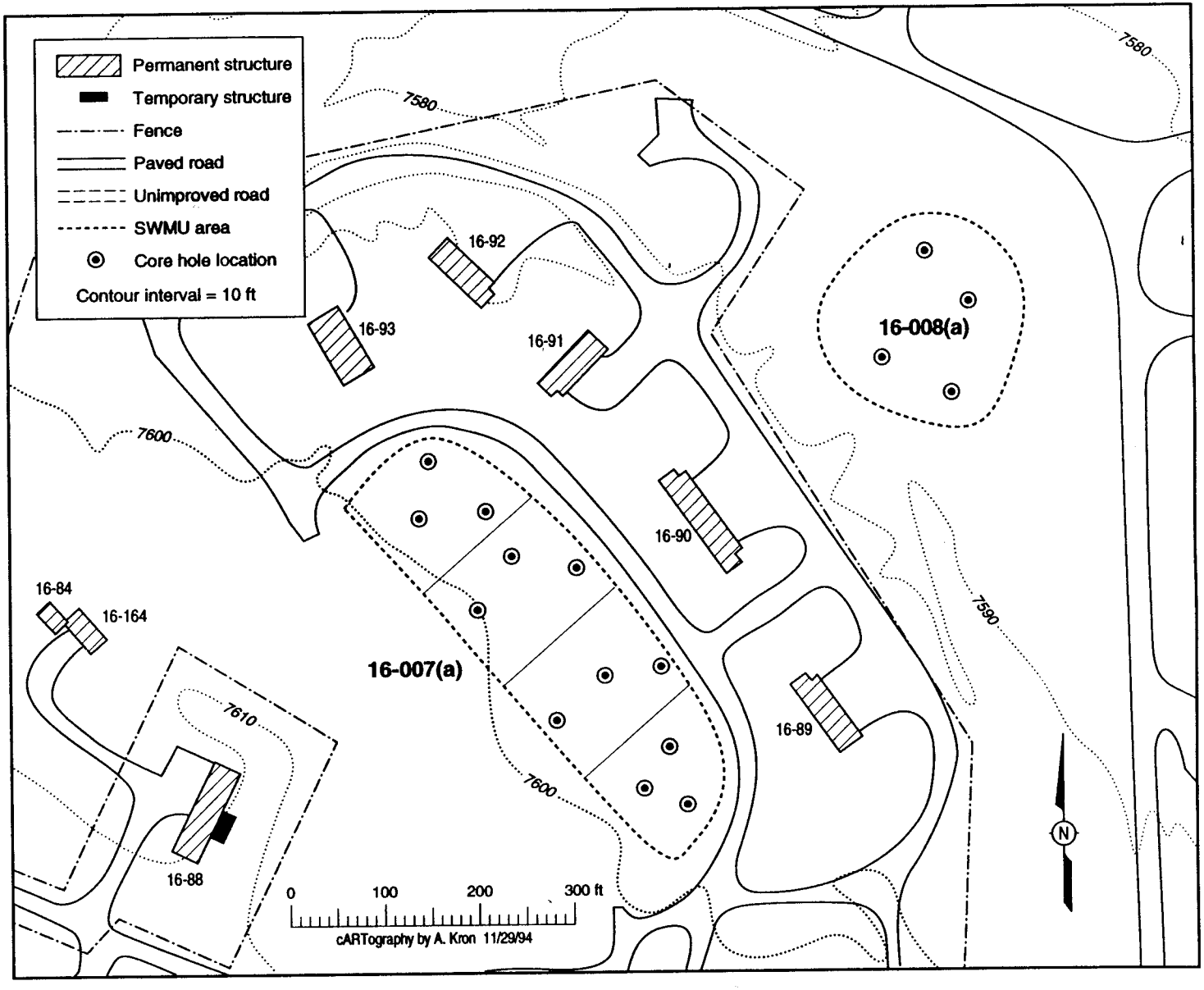



**Fig. 5-66. Schematic sampling plan for ponds.**

photographs show that a release would have to go over the berms surrounding the ponds; there is no documentation that such a release occurred.

**SWMU 16-008(a).** SWMU 16-008(a) is an inactive, unlined pond about 200 ft in diameter. It can contain runoff; documents suggest that it occasionally dries up during the summer. It is located on a level mesa surrounded by trees. Drawing ENG-C 5647 shows that an HE burning area once existed at this location.

An oblique aerial photograph taken during the construction phase suggests that this pond may have been 10 to 15 ft deep.

Thrap (1970, 15-16-001) indicates that this pond received liquid waste from the HE sumps at process buildings TA-16-89, -90, and -91. These buildings were constructed in 1949 as a stopgap machining line prior to the completion of the 260-Line. Machining operations in these buildings decreased significantly after TA-16-260 was completed in 1951; however, the pond may have received minor amounts of waste until the 1960s. The sumps for these buildings were plugged in the late 1960s, although the exact date of this activity is not known. TA-16-92 and TA-16-93 of this complex housed machining and electroplating facilities but did not empty into this pond (LANL 1990, 0145). The pond may have received HE, barium, uranium, and organic cleaning agents and machining oils. No documentation has been found that indicates that the pond has been cleaned.

GC7

#### 5.12.1.2 Conceptual Exposure Model

The conceptual model for this aggregate is detailed in Chapter 4, Fig. 4-9. Subsection 5.12.1.2.1 presents the potential sources of contamination and PCOCs. PRS-specific information on migration pathways and potential receptors is discussed in Subsection 5.12.1.2.2.

##### 5.12.1.2.1 Nature and Extent of Contamination

Table 5-63 summarizes the PCOCs for this aggregate. At SWMU 16-007(a), three grab subsurface soil samples were collected from each of the four ponds as part of Environmental Problem #24, Request LA821 (DOE 1989, 15-16-345). Samples were taken from the bottom 12 to 15 in. of core samples that ranged in depth from 4.5 ft to 5 ft (bedrock interface). Samples

**TABLE 5-66**

**SUMMARY OF SITE SURVEYS, SAMPLING AND ANALYSIS FOR WASTE WATER PONDS AGGREGATE**

| PRS | PRS TYPE | SAMPLED MEDIA | LABORATORY SAMPLES # | | | | | | FIELD SCREENING # | | | | | | | FIELD | | | | | | | LABORATORY ANALYSES * | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | STRUCTURE | | SURFACE | | SUBSURFACE | | | | | | | | A | | | | | B | | | | C | | | | D | E | F | G | H | |
| | | | | FIELD DUP | | FIELD DUP | | FIELD DUP | GROSS ALPHA | GROSS GAMMA/BETA | ORGANIC VAPOR | HE SPOT TEST | GEOPHYSICS SURFACE | BARIUM - LIBS | GEOLOGICAL CHARACTERIZATION | GROSS ALPHA | GROSS GAMMA/BETA | TRITIUM | VOLATILE ORGANICS | XRF | SOIL MOISTURE | ALPHA SPECTROSCOPY | GAMMA SPECTROSCOPY | BETA SPECTROSCOPY | TOTAL URANIUM | ISOTOPIC PLUTONIUM | ISOTOPIC URANIUM | VOA (SW 8240) | SEMIVOLATILES (SW 8270) | METALS (SW 6010) | PCBs (SW 8080) | HIGH EXPLOSIVES (SW 8330) | CYANIDE |
| 16-007(a) | Waste pond | Sediment/tuff | | | | | 12* | 1 | 144# | 144# | 144# | 144# | | | 144# | | | | | | | | 12* | | 12* | | | 12* | 12* | 12* | | 12* | |
| 16-008(a) | Waste pond | Sediment/tuff | | | | | 9* | | 48# | 48# | 48# | 48# | | | 48# | | | | | | | | 9* | | 9* | | | 9* | 9* | 9* | | 9* | |

* A minimum of 12/9 samples will be sent for lab analyses; additional samples can result from positive field screening at the bottom of cores.
\# = Actual number of samples screened will depend on the depths of the ponds.
A = stratigraphic logging, B = barium; C, G = not applicable; D, E, H = full suite, F = 1082 suite.

#### 5.12.4.2 Sampling

55a
55b

**SWMU 16-007(a).** Three core holes will be drilled into each pond at randomly-selected locations (Fig. 5-66). Cores will be collected in 5-ft runs from the surface to a minimum of 2.5 ft into bedrock or fill; three 5-ft cores are anticipated per core hole. Each core will be divided into 6-in. intervals. All intervals will be examined by an HE expert for visible signs of HE. At least twelve intervals in each core will be screened using the HE spot test, and by PID for volatiles. The following intervals will be screened in each core: segments bracketing the bottom of the pond, (anticipated to be between 8 and 10 ft deep), the intervals at the surface, at 3 ft, at 5 ft, at 7 ft, at 13 ft, and at 15 ft (the bottom of the core hole). If the bottom of the pond is at a depth other than 8 to 10 ft, the bottom of the pond will be bracketed with 6 samples and the additional screening sample will be taken with a spacing of 2 ft (Fig. 5-67). Any segments with visible evidence of HE will also be screened. If the deepest interval in any 15-ft core hole yields a positive HE or volatile reading, coring, screening, and laboratory sampling will be continued every 2 ft until a clean zone is delineated. This screening strategy yields at least 36 screening intervals per pond for a total of at least 144 screening intervals for SWMU 16-007(a).

Three laboratory samples will be submitted from each of the four ponds. For each pond, these samples will be the shallowest positive sample, the deepest positive sample, and the sample 2 ft deeper than the deepest positive sample. For each pond, if no samples yield positive field screening indicators, one lab sample will be submitted from each core from within the 3-ft interval bracketing the bottom of the pond. If a single interval in a pond yields a positive reading, the interval, the interval 2 ft deeper than it, and the interval at the same depth in the nearest core will be submitted. This laboratory sampling strategy yields 12 lab samples for the SWMU 16-007(a) ponds.

56a
56b

**SWMU 16-008(a).** Four core holes will be drilled into the pond at randomly selected locations (Fig. 5-66). Cores will be collected in 5-ft runs from the surface to a minimum of 2.5 ft into bedrock. Three 5-ft cores are anticipated per core hole. Each core will be examined and field screened using the strategy described above for cores in SWMU 16-007(a). This yields 48 screening samples in SWMU 16-008(a). The deepest and shallowest positive

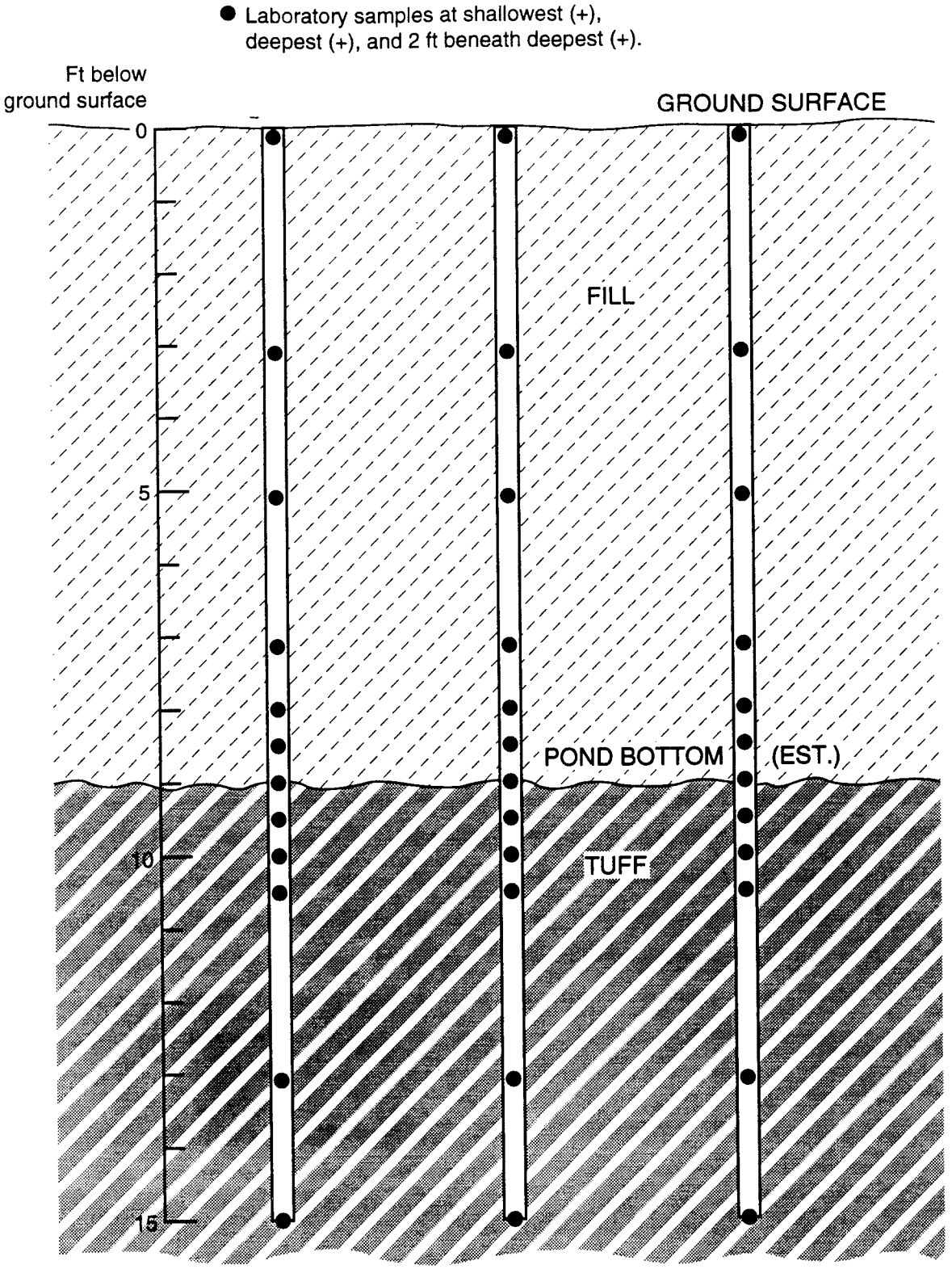



**Fig. 5-67. Example biasing scheme for field screening in ponds in SWMU 16-007(a).**

intervals in each core will be submitted for laboratory analysis. In addition, a sample located 2 ft beneath the deepest positive sample in the pond will also be submitted for laboratory analysis. If any core hole yields less than two positive samples, additional samples will be selected for that hole from within the intervals bracketing the bottom of the pond. This yields a total of nine laboratory samples in SWMU 16-008(a).

#### 5.12.4.3 Laboratory Analysis

Laboratory analyses of samples will be at Level III for radionuclides (LANL or DOE method), metals (SW-846 Method 6010), VOCs (SW-846 Method 8240), SVOCs (SW-846 Method 8270), and HE and its by-products (SW-846 Method 8330). The principal radionuclides of concern are uranium isotopes, the principal HE of concern are TNT and RDX. The principal by-products of concern are DNT, TNB, and DNB. The principal VOCs are hydrocarbon solvents, and the metals of concern are barium and beryllium.

#### 5.12.4.4 Sample Quality Assurance

SOPs that control field activities in this sampling plan are listed in Table 5-65. Field quality assurance samples will be collected according to the guidance provided in the latest revision of the IWP (LANL 1992, 0768). Any QA/QC duplicate samples to be collected during the course of the field investigation are outlined in Table 5-66.

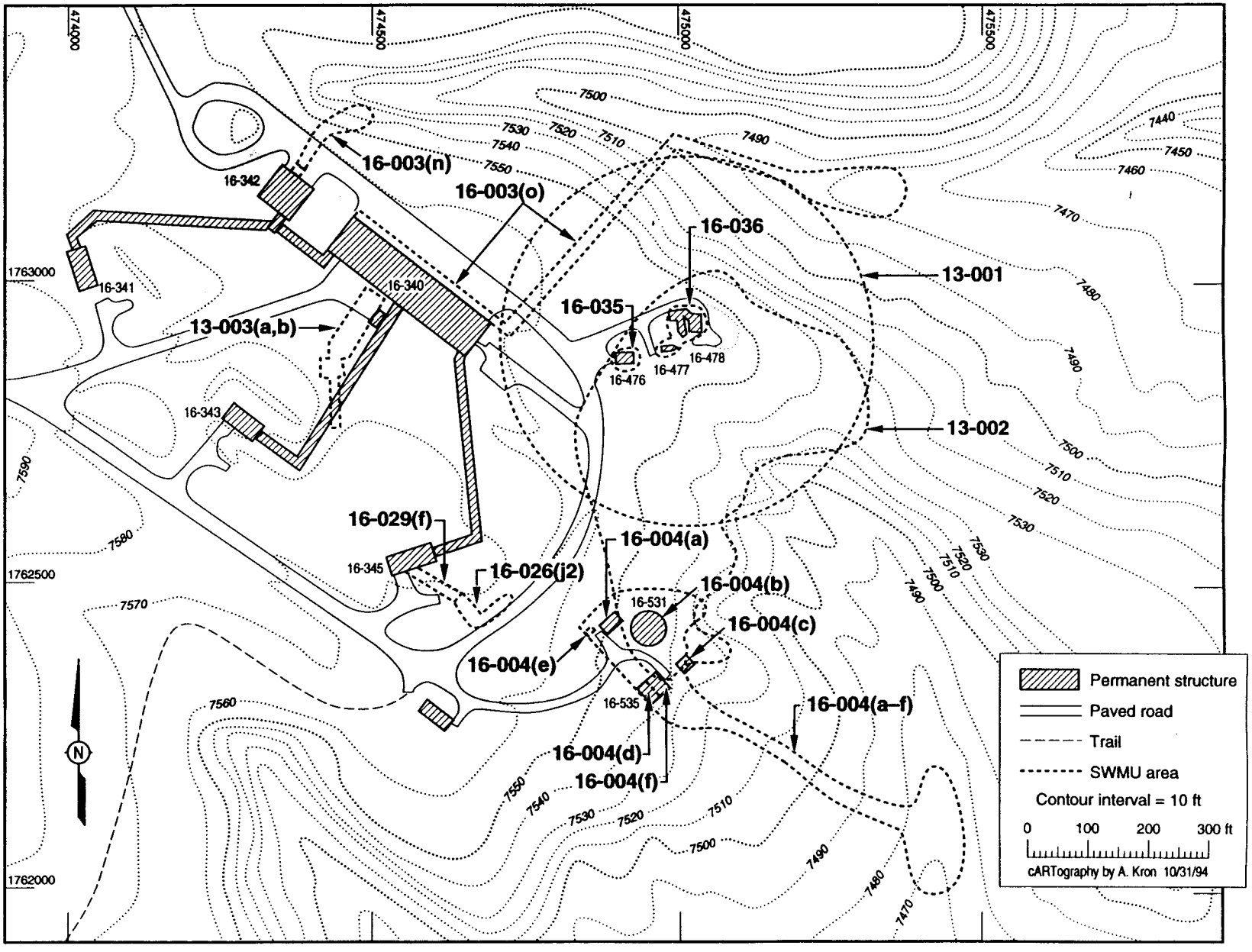



Fig. 5-68. TA-16-340 line, waste water treatment plant, and TA-13 (P-Site).

**SWMU 13-001** is the firing site located between the two battleship bunkers (TA-13-3 and TA-13-4) and soil contaminated by the firing activities to a radius of 300 ft. The area contains a large amount of debris and shrapnel, which includes firing cables, lead balls, and chunks of steel and copper.

**SWMU 13-002** is a landfill to the south and east of the firing point. It is delineated on Fig. 5-68 based on a 1948 aerial photograph. It extends roughly 500 ft south of the firing point. The SWMU boundary was drawn to include the entire cleared area visible on the 1948 aerial photograph; however, a field examination revealed a high concentration of boulders 200 ft south of the firing point. This evidence suggests the limit of the bulldozed area for SWMU 13-002 extended to this distance. The SWMU area includes a large amount of debris and shrapnel scattered around the two battleship bunkers.

59b

**SWMU 13-004** is one or more burning pits at TA-13. These pits were not located on LASL Engineering diagrams or on 1948 aerial photographs. It is likely they were sited in the western half of TA-13 and have been disturbed and covered by construction activities at S-Site.

**SWMU 16-035** is soil contamination associated with control bunker TA-13-2, currently numbered TA-16-476. TA-13-2 is a 17 ft long x 15 ft wide x 7 ft high cement bunker that was constructed in 1944. It is covered by earthen barricades on three sides and on top. TA-13-2 was designed to be the control bunker for firing activities between bunkers TA-13-3 and TA-13-4. The ground around the bunker is level. The building has no drains or plumbing.

57

**SWMU 16-036** is soil contamination located beneath battleship bunkers TA-13-3 and TA-13-4, now numbered TA-16-477 and TA-16-478, constructed in 1944. Initially, they were identical 34 ft long x 13 ft wide x 6.5 ft high structures with 2-ft-thick concrete walls and armor-plate nose cones. A 12 ft x 16 ft utility room was added to TA-13-4 in 1950. Each bunker had an electrical conduit that was used for firing and instrumentation cables and each contained diagnostic equipment for x-ray and other observations of HE firing at P-site. TA-13-4 has a sump and outfall that are discussed in Addendum 2 to the OU 1082 work plan. The ground immediately surrounding the bunkers is level (Fig. 5-68).

57

#### 5.13.1.2 Conceptual Exposure Model

The conceptual exposure model is presented in Fig. 4-6. Site-specific information on potential release sources, chemicals of concern, migration pathways, and potential receptors is presented below.

##### 5.13.1.2.1 Nature and Extent of Contamination

The PCOCs at the TA-13 SWMUs include all contaminants likely to be associated with HE lens and initiator testing. These include: 1) metals that would have been components of the explosive assemblies, particularly lead and beryllium; 2) HE residues including barium and environmental breakdown products; and, 3) radionuclides, particularly natural and depleted uranium (Table 5-67).

57

SWMU 16-035 and SWMU 16-036 are suspected to have contained high-activity radionuclide contamination because several late 1940s memoranda suggest high alpha counts in the bunkers, laboratories, and canyons at P-Site (Buckland 1946, 15-13-006; Buckland no date, 15-16-181, Westcott 1948, 15-13-010). Because polonium was the high-activity alpha emitter used at P-Site, virtually all of the contamination has decayed away. The half-life of polonium is 138 days.

It is possible, but extremely unlikely, that radionuclides at the site could include neutron activation products of the initiator experiments or residual 210-lead and polonium. If the chemical separation of 210-lead and polonium was inefficient, then small amounts of residual activity could remain.

No quantitative data relevant to the SWMUs discussed in this subsection are available.

##### 5.13.1.2.2 Potential Pathways and Exposure Routes

At TA-13, potentially-contaminated material consists of surface soils, subsurface soils, and sediments in drainages as a result of detonations, surface disposal, and bulldozed shot debris. Once these contaminants have been released into the environment, the major migration pathway is via surface water runoff carrying contaminants to surface soil beyond the original release site or sediments in either the north or southeastern

SWMUs 13-001, 13-002, 13-004, 16-035, and 16-036 will be located and flagged, if possible. SWMU 13-004 is likely to have been disturbed during construction of TA-16-340; if it cannot easily be found during site surveying, it will be assumed that any regional channel sediment sampling will reveal any health risks associated with the SWMU.

The major channels emanating from the areas encompassing the firing sites and the landfill will be mapped in detail. Sediment traps suitable for sampling will be located and flagged in the large east-west channel north of TA-16-478 and in the largest channel draining the landfill area (SWMU 13-002). The first sediment sample in the northern channel will be located (as nearly as possible) due north of the northeast point of the sampling grid delineated for radiation sampling. The first sediment sampling site in the southeast channel will be located within 10-ft of the topographic break to the southeast of the firing point (SWMU 13-001). All sediment traps will be located in each of these two drainages, and five in each, located at roughly 100-ft intervals, will be flagged as sampling locales. Identified locations should be sufficiently numerous to trace the courses of the channels and to provide a representative subset of sediments between TA-13 and primary drainages.

A 50-ft spaced grid approximately covering the 300 ft radius of SWMU 13-001 will be surveyed to locate points for a radiation survey. Approximate corners of this grid are:

| CORNER | EAST | NORTH |
|---|---|---|
| SW | 474800 | 1762600 |
| NW | 474800 | 1763200 |
| NE | 475350 | 1763200 |
| SE | 475350 | 1762600 |

59c

The sampling grid is shown in Fig. 5-70. At any node of this grid the sampling point will be biased to nearby (within 10 ft) topographic lows or minor drainages.

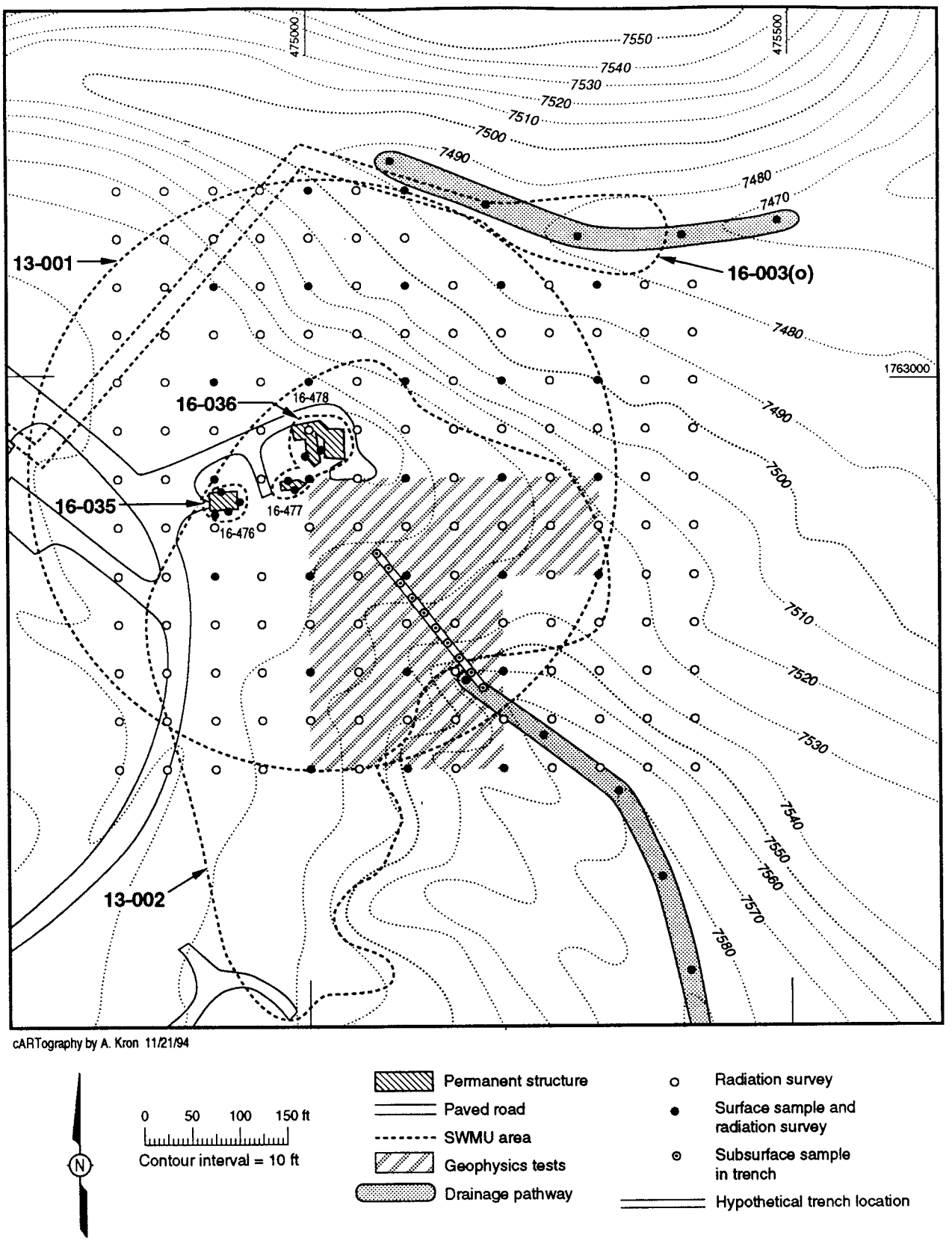



**Fig. 5-70. Schematic sampling grids for TA-13 (P-Site).**

**SWMU 16-035, soil associated with control bunker TA-13-2.** Four surface samples will be collected adjacent to the control bunker TA-13-2. These samples will be located within 5 ft of the bunker; one each will be taken to the north, east, and south of the bunker (Fig. 5-70). At these locations, 0 to 6 in. of soil will be collected. Samples will be sieved (60-mesh) to remove shrapnel-sized metallic chunks.

**SWMU 16-036, soil associated with battleship bunkers TA-13-3 and TA-13-4.** Four surface samples will be collected adjacent to bunkers TA-13-3 and TA-13-4. Two samples will be taken within 5 ft of each bunker. At these locations, 0 to 6 in. of soil will be collected. Samples will be sieved (60-mesh) to remove shrapnel-sized metallic chunks. If possible, these samples will be located to the east and west of the northern bunker and to the north and south of the southern bunker.

59c

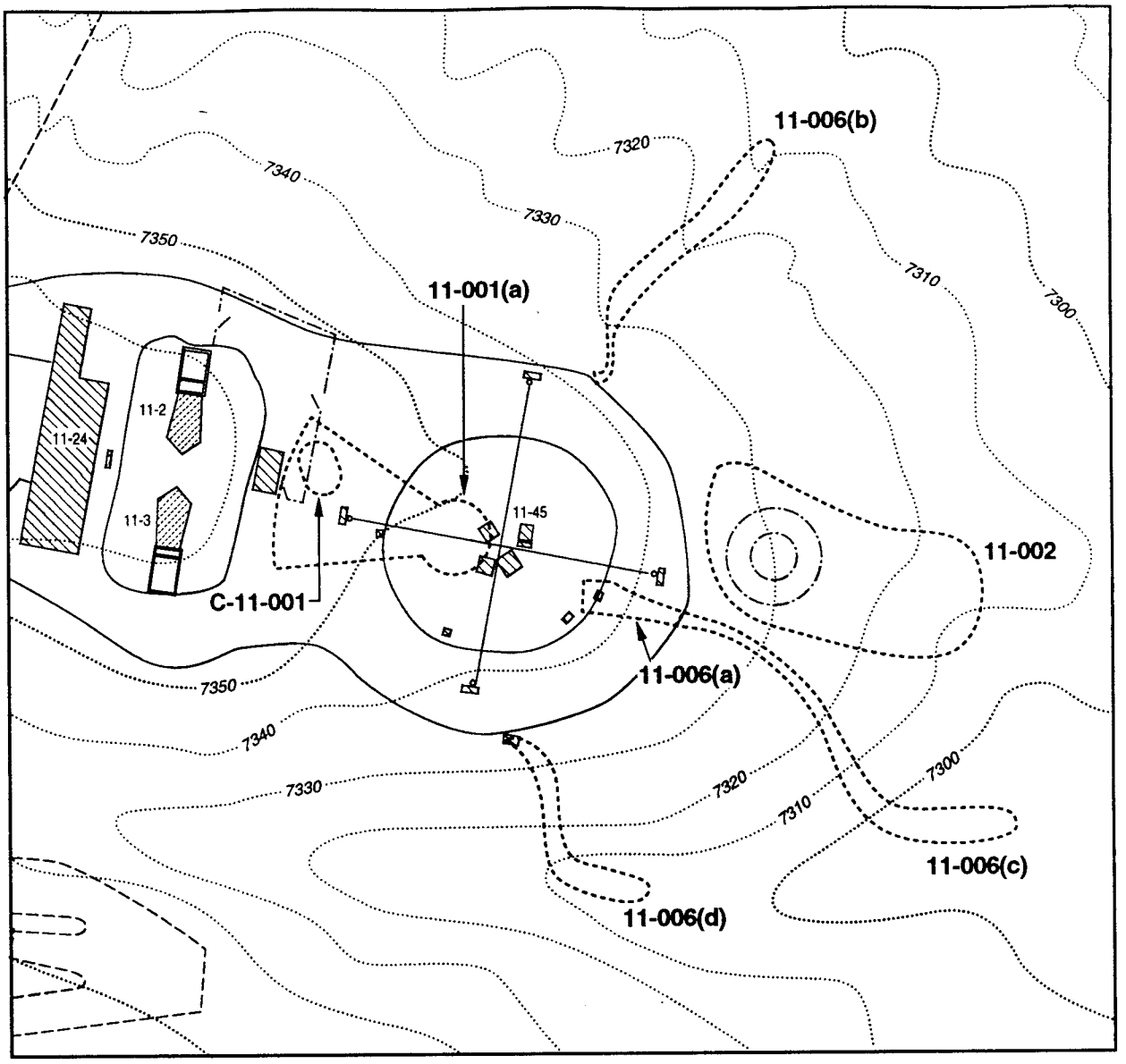
**Drainages.** Five sediment (or soil) samples will be taken near the top of the north and southeastern channels continuing at the 100-ft surveyed intervals. At these locations, 0 to 18 in. of soil will be collected in 6-in. intervals. Each interval will be screened for radionuclides by gross beta-gamma, and HE by spot test. Any positive samples will be sent for laboratory analysis (Table 5-69). In the absence of positive screening hits on each core, the 0 to 6 in. interval will be sent for laboratory analysis.

#### 5.13.4.4 Laboratory Analyses

Full laboratory analyses of samples will be at Level III by the following methods: for radionuclides (LANL or DOE method), metals (SW-846 Method 6010), semivolatiles (SW-846 Method 8270), and HE (SW-846 Method 8330). The principal radionuclide of concern is uranium, the principal HE by-products of concern are DNT, TNB, and DNB; the metals of concern are barium, lead, and beryllium; and the HE of concern are TNT and RDX.

#### 5.13.4.5 Sample Quality Assurance

Field quality assurance samples will be collected according to the guidance provided in the latest revision of the IWP (LANL 1992, 0768). Field QA/QC duplicates are delineated in Table 5-69.



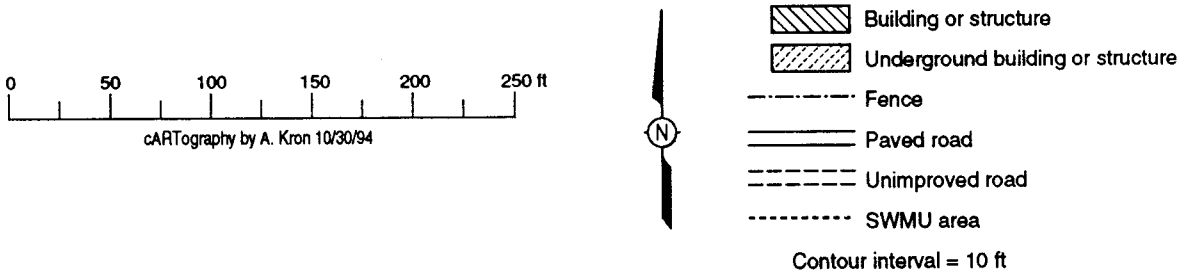




**Fig. 5-72. Detail of firing site.**

The tributary to Water Canyon was a perennial stream from treated effluent released from the TA-16 sanitary waste treatment plant, which was inactivated in 1992.

TA-11 was built in the latter part of 1944 (LASL 1944,15-11-001) to house a betatron and a cloud chamber used in studies of implosion symmetry using x-rays and the magnetic method (Neddermeyer 1945, 15-11-005). The x-rays, generated by a betatron, projected the image of an imploding test device onto a cloud chamber (Hawkins 1961, 15-16-299). The image was recorded using flash photography. The betatron and cloud chamber were installed in two, closely-spaced, steel-reinforced, concrete bunkers (TA-11-2 and TA-11-3, see Fig. 5-71). Two SWMUs in the firing site aggregate are associated with these activities, SWMU 11-001(a) and SWMU 11-001(b).

**SWMU 11-001(a): TA-11-14.** SWMU 11-001(a) was an HE firing pit located approximately 140 ft southeast of TA-11-2. The firing pit consisted of a 12.5 ft x 3 ft x 4.5 ft-deep semicircular concrete wall (TA-11-14) open to the west. The pit was built in early 1945 and was abandoned by 1950. The firing pit was used for testing the integrity of aluminum, steel, and copper nose shields that covered the x-ray ports of TA-11-2 and TA-11-3. The nose ports of TA-11-2 and TA-11-3 were constructed of high-grade concrete in order to withstand blast pressures of 7 000 psi (No author 1944, 15-16-002). The principal HE used in the pit were probably cast explosives such as Composition B and baratol. These were the principal HE processed at TA-16 from World War II through the mid-1950s. The firing pit was demolished during the drop tower complex construction in 1956. Prior to demolition, a radiation survey was conducted at TA-11-14 and no significant radioactive contamination was found (Blackwell 1956, 15-11-013). The location of the firing-pit is now covered by the concrete apron of the drop tower. During construction of the drop tower, the concrete remains of the pit were moved and now lie approximately 125 ft southeast of the drop tower.

60a

**SWMU 11-001(b)**. SWMU 11-001(b) includes the firing pit between the betatron in TA-11-2 and the cloud chamber in TA-11-3. From 1944 to 1945, HE tests of up to 200 lb were detonated in contact with uranium and aluminum in this pit. Test assemblies consisted of uncased HE (Griffin 1992, 15-11-048). This firing pit also was probably used for firing World War II

60c

vintage explosives such as Composition B and baratol. Therefore, detonations would have resulted in little shrapnel apart from small, pulverized remains of the uranium and aluminum and remnants of the wooden or metal stands used to elevate the test assemblies. The extent of possible contamination associated with these tests includes the area surrounding the drop tower. A walk-through survey of the area by the OU 1082 Project Leader on May 22, 1992, revealed little debris beyond an approximate 700 ft radius from the drop tower. Therefore, the area surrounding the drop tower out to a radius of 700 ft is also included in this SWMU. This boundary is preliminary and will be changed if the RFI indicates a larger or smaller area is appropriate.

Between January 1946, and late 1956, photofission studies of uranium, uranium-235, uranium-238, and plutonium were conducted in a shelter (TA-11-23) in the area between TA-11-2 and TA-11-3 (Hawkins 1961, 15-16-299). The shelter no longer exists and the area (including TA-11-2 and TA-11-3) is currently covered by a 15 ft berm, spray coated with gunite. TA-11-2 and TA-11-3 are currently used as control centers for the drop tower complex. A radiation survey made at TA-11-2 and TA-11-3 just prior to February 1956, (Blackwell 1956, 15-11-013) found no "significant radioactive contamination".

**C-11-001: TA-11-5.** C-11-001, an AOC, is also associated with the 1946-1956 photofission experiments. C-11-001 is the site of a TA-11-5, a 6 x 32 ft wood frame building constructed after 1945 and removed some time prior to 1956. This building may have housed the laboratory used to prepare samples for the photofission experiments on uranium and plutonium. TA-11-5 might also have been used as a darkroom. This AOC is currently covered by the asphalt apron of the drop tower.

**SWMU 11-003(b)**, a mortar impact area, is the target area associated with the decommissioned air-gun facility, TA-11-24.

The air-gun facility was completed in 1956. The gun itself had a 24-in. bore and an overall length of 96 ft. The purpose of the gun was twofold: to launch experimental packages into the targets located to the south of building TA-11-24 or, in what was known as the closed barrel mode, to first accelerate

packages down the barrel and then decelerate them against the compressed cushion of air at the closed end of the tube.

The targets, located 150 to 250 ft south of TA-11-24, were 12 ft x 12 ft x 1-ft-thick poured concrete slabs set in line with the bore of the gun. Various weapons packages, designed to withstand extremes of acceleration and deceleration, were tested by firing them into the targets. Some devices contained HE and depleted uranium. Interviews with site personnel who were employed at TA-11 during the active life of the air-gun facility indicate that there was no launch of the devices containing HE and depleted uranium in which the outer payload envelope was compromised (Martin 1992, 15-11-069). A review by OU 1082 personnel of several volumes of post-shot target/projectile photographs currently stored at TA-11 also revealed no evidence of a breach of any outer payload envelope.

On a single occasion in 1972, a steel target was erected approximately 250 ft from the gun muzzle for an impact test of an inert mock-up of a radioactive thermal generator power supply. The device was a 12-in.-diameter, hollow-steel sphere filled with steel or lead ball bearings suspended in a graphite matrix. The sphere fractured upon impact (Griffin 1992, 15-11-070). The air gun has not been used since 1972.

GC7

**SWMUs 11-004(a-f): TA-11-25, -26, -27, -28, -41, and -42.** In 1956, TA-11 was modified to conduct explosives and weapons safety studies (LASL 1945, 15-16-148; Brooks 1956, 15-11-014; Thrap 1964, 15-11-024). Modification involved construction of a 160-ft-high drop tower (TA-11-25) surrounded by a 130-ft-diameter concrete pad (TA-11-26). SWMUs 11-004(a-f) are components (hoists, pads, the tower itself, and the underlying concrete and asphalt aprons) of this drop tower complex located 180 ft east of TA-11-2 and TA-11-3. The components are well maintained. The drop tower was used for conducting drop and skid sensitivity tests and continues as an active test firing facility. Cased warheads and bare explosives charges were dropped from the tower to measure impact sensitivity. The maximum amount of explosive in cased experiment devices was 600 lb (Brooks 1959, 15-11-015). For cased experiments, the HE does not detonate, but fragments of undetonated HE and metal components of the warheads may be scattered by breakup upon impact. HE of concern at these SWMUs

60d

consist primarily of plastic-bonded explosives containing HMX, RDX, TNT, and TATB. Potential metals of concern are uranium and beryllium. Bare high explosive skid sensitivity tests, however, routinely detonate. In incomplete detonations high explosive debris may also be distributed beyond the drop tower complex. The arrangement of the pads on the concrete apron is such that debris is thrown primarily to the south and east. Therefore, possible contamination associated with the drop tower complex includes the surrounding area affected by the explosive tests debris.

Interviews with workers at TA-11 and an October 1987, CEARP Phase I Draft report (DOE 1987, 0264) indicate that debris is generally located within a 350 ft radius of the drop tower. Several walk-through surveys of the area by the OU 1082 Project Leader revealed little debris beyond approximately 500 ft from the drop tower.

**SWMUs 11-006(a-d): TA-11-39, -50, -51, and -52.** Currently the drop tower complex sits on a concrete pad, about 130 ft in diameter with a curb, which is surrounded by a further asphalt apron, also with a curb. After an HE drop from the tower, large pieces of unexploded HE are gathered by hand and the concrete and asphalt aprons surrounding the drop tower are cleaned using high-pressure water hoses. Potential metals of concern for 11-006(a-d) are the same as for 11-004(a-f), i.e., uranium and beryllium. The concrete pad drains to an HE sump, TA-11-39 [SWMU 11-006(a)], located to the east of the drop tower complex. The sump consists of a concrete box, 4.5 x 5.3 x 4.25 ft deep, the upper rim of which is at the level of the concrete pad. (A general description of high explosive sumps is given in Subsection 5.2.1). The sump, in turn, drains across the asphalt into one of three catch basins (TA-11-51). (The sump was installed in 1961; however, the catch basins were not installed until 1970.) The three catch basins are concrete boxes, 6 x 4 x 2 ft deep [SWMUs 11-006(b, c, and d)], with aluminum tops and overflow drains. These are TA-11-50, TA-11-51, and TA-11-52, respectively. The catch basins receive wash down and runoff from the asphalt apron. Their outfalls are NPDES permitted (EPA 05A069, EPA 05A096, EPA 05A097) and are channeled along asphalt-lined drainages into natural drainages flowing east from TA-11 to Water Canyon. After the HE in the sump and catch basins has settled, it is collected for disposal at the TA-16 burning ground.

**SWMU 11-002.** SWMU 11-002, an active burn area about 30 ft in diameter, is located east of the drop tower at the edge of its asphalt apron. The area slopes to the east and is intersected by a small drainage. It was used as an experimental burning area for components on or in assembled configurations with HE, propellants, and jet fuel. HE and propellant burns were conducted directly on the sand pad. The jet fuel burns took place within an open-topped steel containment tank. These activities occurred from 1948 to October 1992. Non-experimental burns of depleted uranium and HE-contaminated materials have also occurred (LANL 1990, 0145). It remains an active experimental area with individual experiments for which permit applications have been submitted to the State of New Mexico. The burn area is scheduled for a series of 12 test burns involving fuels, HE, depleted uranium, and polyurethane during 1995 and 1996 (Vozella 1994, 15-16-571).

60e

During three 1975 safety tests, several iridium-encased thorium oxide containers were burned on top of as much as 3 000 pounds of Titan III propellant. Combustion products of Titan III propellant consist of carbon dioxide, carbon monoxide, water vapor, hydrogen, nitrogen, hydrogen chloride, and aluminum oxide. The gases dissipated into the air and no residual hydrochloric acid is expected at this site (Martell 1992, 15-11-066) since burning would distribute the combustion products widely and the hydrochloric acid would return to the ground much like acid rain and be neutralized by the local alkaline soil. In all tests, the iridium casings remained intact and no alpha contamination was detected (Gibbons 1974,15-11-028; Gibbons 1975, 15-11-029; Amies 1975, 15-11-030).

#### 5.14.1.2 Conceptual Exposure Model

The on-site conceptual exposure model for the firing site aggregate PRSs is presented in Chapter 4, Fig. 4-6. Subsection 5.14.1.2.1 presents the source and extent of contamination, and PCOCs. PRS-specific information on migration pathways and potential receptors is discussed in Subsection 5.14.1.2.2.

##### 5.14.1.2.1 Nature and Extent of Source

Table 5-70 summarizes the PCOCs for this aggregate. Past and future activities at these sites indicate that a major pathway would be off-site

migration of potential contaminants. Subsurface contamination does not present a current source for off-site migration and will be addressed in detail when the site is decommissioned. Decommissioning is not scheduled, but will probably occur after 2100. Because of the uncertainty associated with the schedule for decommissioning, subsurface units will be sampled during Phase I activities. The most likely transport mechanism is movement of constituents with sediment in the Water Canyon drainages.

**PRSs buried under and adjacent to the drop tower complex.** The locations of SWMU 11-001(a) and AOC C-11-001 are covered by the concrete and asphalt aprons surrounding the active drop tower. The firing pit associated with SWMU 11-001(b) is covered by the berm over TA-11-2 and TA-11-3. Potential contaminants associated with SWMU 11-001(a) include constituents from explosives testing, such as undetonated HE, HE residuals, and barium (Table 5-70). Potential contaminants associated with AOC C-11-001 include constituents from photofission experiments (uranium-235, uranium-238, plutonium-238, and plutonium-239, plutonium-240) and chemicals from photoprocessing activities. Potential contaminants associated with SWMU 11-001(b) include constituents from explosives testing (undetonated HE, HE residuals, beryllium, and uranium) and constituents associated with photofission experiments. SWMU 11-003(b) may contain lead balls of approximately 0.5-in. diameter.

**Drop tower complex.** The potential contaminants from SWMUs 11-004(a-f) consist of debris and particulates dispersed within 700 ft of the firing site including undetonated HE, HE residuals from partial detonation and weathering, metals (including beryllium and barium), and uranium (Table 5-70). This site is currently used at most four times per year.

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**SWMUs 11-006(a-d).** Potential contaminants from SWMUs 11-006(a-d) are the same as those associated with SWMUs 11-004(a-f) (Table 5-70). Potential contaminants could be located under the sump or catch basins, and/or in the drainages associated with the outfalls from the catch basins.

**SWMU 11-002**. Potential contaminants associated with SWMU 11-002 include HE residuals (e.g., barium and burn by-products), uranium, beryllium, and lead (Table 5-70). This experimental unit is scheduled for 12 burns during the next 3 years (Vozella 1994, 15-16-571).

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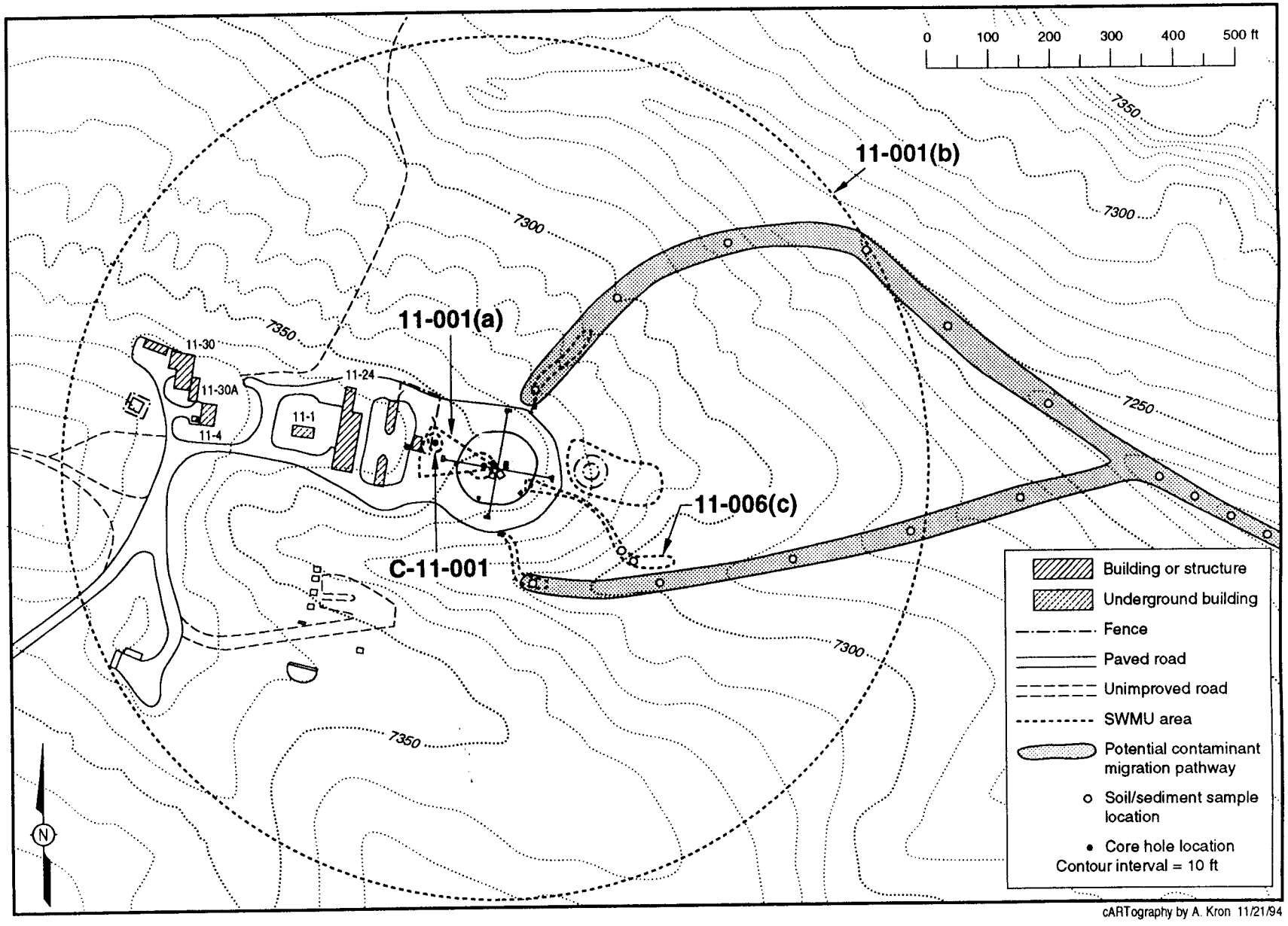
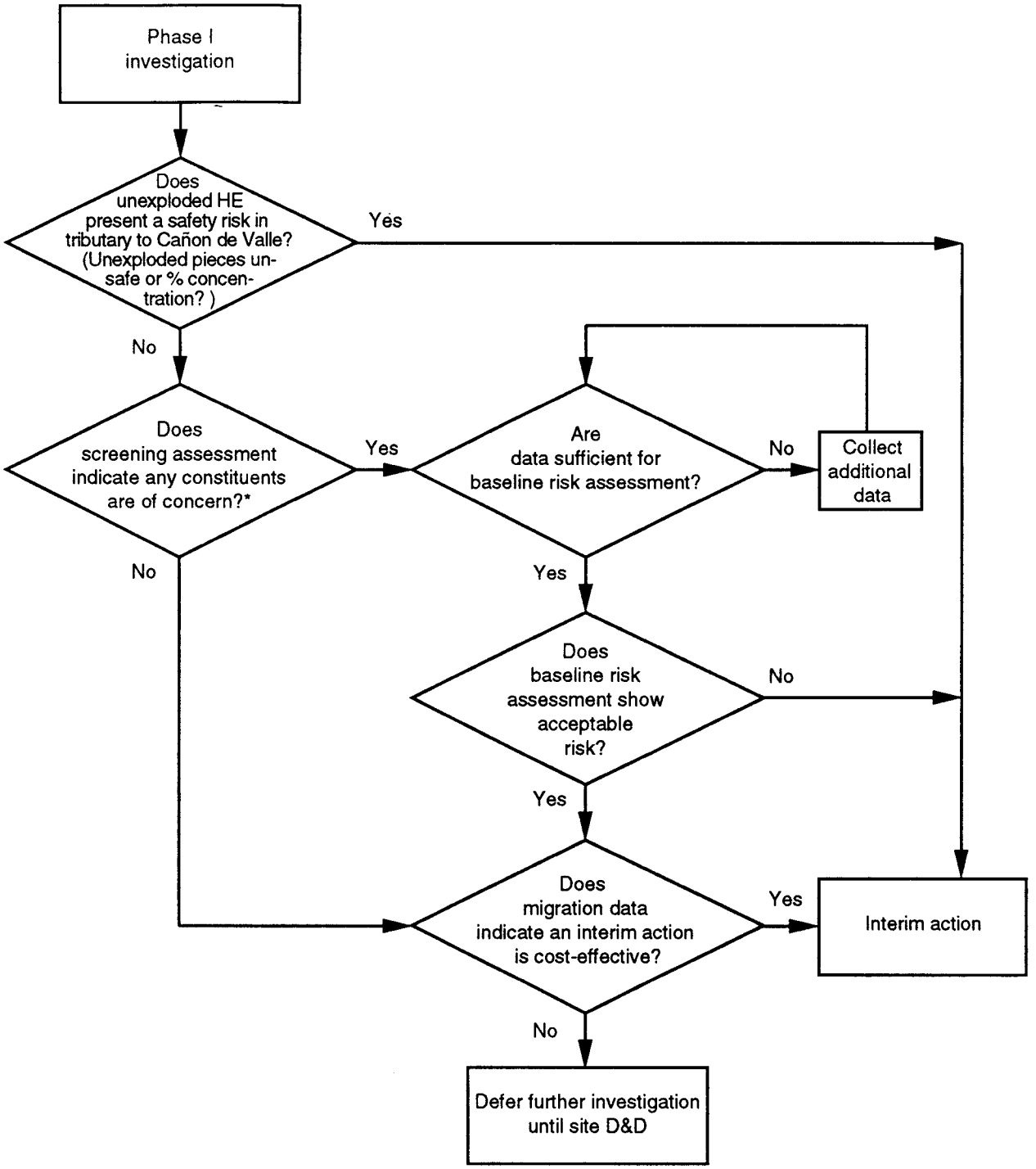



cARTography by A. Kron 11/21/94

**Fig. 5-73. Map showing possible path of potential contaminant transport and sampling locations.**




*PCOCs> SALs or possible multiple contaminant problem

**Fig. 5-74. Decision flow for PRS Aggregate A.**

catchments are expected to have collected PCOCs, and should provide an upper bound to PCOC concentrations.

It is assumed that if potential contaminants have reached the tributary to Water Canyon, they will be detectable in one or more of the four large sediment catchments below the confluence of the south drainage with the tributary (Fig. 5-73). The primary PCOC for this study is HE. All samples in the Water Canyon tributary will be analyzed for HE (both laboratory analytic measurement on the sieved soil sample and a safety screen on the complete field sample) and other PCOCs (Table 5-70).

Sediment catchments every 200 ft in the north and south drainages will be sampled for HE to evaluate the pattern of contaminant migration. These data will help design a Phase II survey, if it is needed. All samples will be screened to see if they meet health and safety requirements. Appropriate transport and laboratory safety procedures will be implemented based on the field screening data.

PCOCs are expected to be homogeneous in the x and y dimensions of the sediment catchments, but there may be some stratification (in the z dimension). For this reason, three full laboratory analyses (one per soil core) are recommended for each of the catchments in the tributary of Water Canyon below the confluence of the south drainage and the tributary. Five or six full laboratory analyses will be adequate for sediment catchments in the north and south drainages. Two full laboratory samples will be adequate for the drainage for SWMU 11-006(c).

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The presence or absence of contamination at the PRSs beneath the drop tower complex is unknown. It is desirable to demonstrate that there is no large amount of contamination at the PRSs. A single core through the concrete apron of the drop tower complex to bedrock will be drilled and sampled at 6-in. intervals for each of these PRSs. This sample design is based on professional judgment.

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### 5.14.4 Sampling and Analysis Plan

SOPs that control field activities in this sampling plan are listed in Table 5-71. Sample numbers and required analysis are shown on Table 5-72.

**TABLE 5-71**

**STANDARD OPERATING PROCEDURES FOR FIELD ACTIVITIES**

| LANL-ER-SOP | TITLE | NOTES |
|---|---|---|
| 01.02, R0 | Sample Containers and Preservation | Applies to all laboratory analytical samples |
| 01.04, R1 | Sample Control and Field Documentation | Applies to all laboratory analytical samples |
| 04.01, R0 | Drilling Methods and Drill Site Management | Applies to all cores through the concrete apron |
| 06.09, R0 | Spade and Scoop Method for Collection of Soil Samples | Applies to the collection of soil/sediment samples |
| 06.10, R0 | Hand Auger and Thin-Wall Tube Sampler | Applies to augered soil samples |
| 06.11, R0 | Stainless Steel Surface Soil Sampler | Applies to the collection of soil/sediment samples |

#### 5.14.4.1 Engineering Surveys

The four major sediment catchments in the tributary to Water Canyon and the sediment catchments in the upstream north and south drainages will be surveyed and flagged. The locations of SWMU 11-001(a), SWMU 11-001(b), and C-11-001 will be accurately determined using historic aerial photographs. These data will be recorded on a base map, scale 1:7 200. If during the course of sampling any sample points must be relocated, the new position will be surveyed and the revised locations will be indicated on the map. The engineering survey will be performed by a licensed professional under the supervision of the field team leader.

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#### 5.14.4.2 Offsite Migration Sampling

**Tributary to Water Canyon.** The four major sediment catchments below the confluence of the south drainage and the tributary to Water Canyon will be sampled (Fig. 5-73). A transect across each catchment perpendicular to the tributary will be sampled with the auger and thin-wall sample method. Samples will be collected at three points and analytical samples removed at two or three depths at each point: at the surface, middle, and bottom of the catchment; or, at the surface and bottom. The field team will make the decision as to total sample depth based upon the depth of the catchments. Analytical samples will be a minimum of 0.2 ft in length. The specific lateral

**TABLE 5-72**

**SUMMARY OF SITE SURVEYS, SAMPLING AND ANALYSIS FOR TA-11 FIRING SITE AGGREGATE**

| | | | LABORATORY SAMPLES# | | | | | | | | FIELD SCREENING | | | | | | | FIELD LAB | | | | | | | LABORATORY ANALYSES# | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | STRUCTURE | | SURFACE | | DEEP SURFACE/ SUBSURFACE | | | | | | | | | A | | | | | | B | | | | C | | | | D | E | F | G | H | |
| PRS | PRS TYPE | SAMPLED MEDIA | | FIELD DUP | | FIELD DUP | NO. OF CORES | NO. OF SAMPLES PER CORE | TOTAL | FIELD DUPLICATES | GROSS ALPHA | GROSS GAMMA/BETA | ORGANIC VAPOR | HE SPOT TEST | GEOPHYSICS SURFACE | BARIUM - LIBS | GEOLOGICAL CHARACTERIZATION | GROSS ALPHA | GROSS GAMMA/BETA | TRITIUM | VOLATILE ORGANICS | XRF | SOIL MOISTURE | ALPHA SPECTROSCOPY | GAMMA SPECTROSCOPY | BETA SPECTROSCOPY | TOTAL URANIUM | ISOTOPIC PLUTONIUM | ISOTOPIC URANIUM | VOA (SW 8240) | SEMIVOLATILES (SW 8270) | METALS (SW 6010) | ASBESTOS | HIGH EXPLOSIVES (SW 8330) | CYANIDE |
| TA-11* | Runoff - N drainage | Sediment | | | 6 | 1 | | | | | | | | 6 | | | | | | | | | | | 6 | | | 6 | 6 | | 6 | 6 | 6 | 6 | 6 |
| | Runoff - S drainage | Sediment | | | 5 | | | | | | | | | 5 | | | | | | | | | | | 5 | | | 5 | 5 | | 5 | 5 | 5 | 5 | 5 |
| TA-11* | Tributary to Water Canyon | Sediment | | | | | 12 | 1 | 12 | 1 | | | | 12 | | | | | | | | | | | 12 | | | 12 | 12 | | 12 | 12 | | 12 | 12 |
| 11-006(c) | Sump drainage | Sediment | | | 2 | | | | | | | | | 2 | | | | | | | | | | | 2 | | | 2 | 2 | | 2 | 2 | | 2 | 2 |
| 11-001(a) | Firing pit | Sediment | | | | | 1 | 2 | 2 | 1 | | | | 2# | | 2# | | | | | | | | | 2 | | 2 | | | | 2 | 2 | | 2 | |
| 11-001(b) | Firing pit | Sediment | | | | | 1 | 2 | 2 | | 2# | 2# | | 2# | | 2# | | | | | | | | | 2 | | 2 | 2 | 2 | | 2 | 2 | | 2 | |
| C-11-001 | Decommissioned structure | Sediment | | | | | 1 | 2 | 2 | | 2# | 2# | | 2# | | 2# | | | | | | | | | 2 | | 2 | 2 | 2 | | 2 | 2 | | 2 | 2 |

A,B,C,D = not applicable; E,H = full suite; F = 1082 suite

All PRSs are not being sampled individually for the aggregate. Rather, the sampling strategy for surface PRSs is to look for potential off-site migration.

# The minimum number of samples per core. The actual number will depend on the depth to bedrock. In addition, more laboratory samples will be taken if positive field screening indicators are found.

spacing of the three sampling holes will be determined by the field team based upon surface morphology.

First, analytical samples will be sifted to identify HE fragments that pose a safety hazard. The fragments diverted by sifting will be weighed in the field as well as the parent sample from which the HE is separated. Each interval will be screened using the HE spot test. All cores in which a positive result is found will have all segments sent to the laboratory for analysis. In cores with no positive HE tests, the deepest interval will be selected.

GC8

**North and south drainages.** Surface soil/sediment samples (0 to 6 in.) will be collected at catchments spaced approximately every 200 ft in the north and south drainages (Fig. 5-73). This spacing yields six samples in the north drainage and five samples in the south drainage. HE swipe tests will be performed on all samples to determine presence or absence of HE. All samples will be submitted for full laboratory analysis.

62b

**Drainage from SWMU 11-006(c).** Surface soil/sediment samples (0 to 6 in.) will be collected at the first sediment trap in the drainage downstream from the breach in the concrete trough and at the sediment trap in the drainage 10 ft from the K-Site south drainage (Fig. 5-73). These samples will be submitted for full laboratory analyses.

62a

**Subsurface potential release sites.** Each subsurface PRS in this group, SWMUs 11-001(a), 11-001(b), and C-11-001, will be sampled (Fig. 5-73). For each PRS, a single vertical core will be drilled through the concrete apron of the drop tower to the soil-tuff interface. These cores will be sampled on 6-in. intervals. These samples will all be field screened for HE and barium; those for SWMU 11-001(b) and C-11-001 will also be screened for radionuclides. All samples exhibiting positive field indicators, defined as a positive HE spot test or barium or radionuclides at twice the local background, will be submitted for full laboratory analysis (Table 5-72). For each core, in the case of a single sample exhibiting a positive screening indicator, submit two laboratory samples, the positive sample along with the sample above the soil-tuff interface. In the absence of positive field indicators submit two samples, the sample beneath the concrete apron and that above the soil-tuff interface, for laboratory analysis.

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## 5.15 TA-11 Outfalls Aggregate, SWMU 11-005(c), SWMUs 11-011(a-c)

### 5.15.1 Background

The SWMUs in the outfalls aggregate have a mixture of potential surface and subsurface contamination from past activities (Table 5-73 and Fig. 5-75). All but SWMU 11-005(c) are active outfalls. All outfalls had low flow. These SWMUs have no quantitative historical data on the concentration of potential contaminants. A single Phase I sampling approach will be taken to evaluate potential contamination that resulted from past activities.

#### 5.15.1.1 Description and History

**SWMU 11-005(c).** SWMU 11-005(c) is an outfall north of TA-11-2 from a drain line (now plugged) that served TA-11-2. It is unknown when the outfall was plugged. TA-11-2 housed the betatron which was removed prior to construction of the drop tower complex in 1956. The drain line was installed in 1944, when the building was constructed and served a sink, hot water heater, and a floor drain. Activities at TA-11-2 are described in Subsection 5.14.1.1. PCOCs are uranium and plutonium isotopes associated with the photofission experiments. Cleaning solvents may have been used in association with this activity. Photographic processing may been associated with the WW II betatron activities. The discharge from the outfall is to a slightly sloped area consisting of fill from an adjacent road bed.

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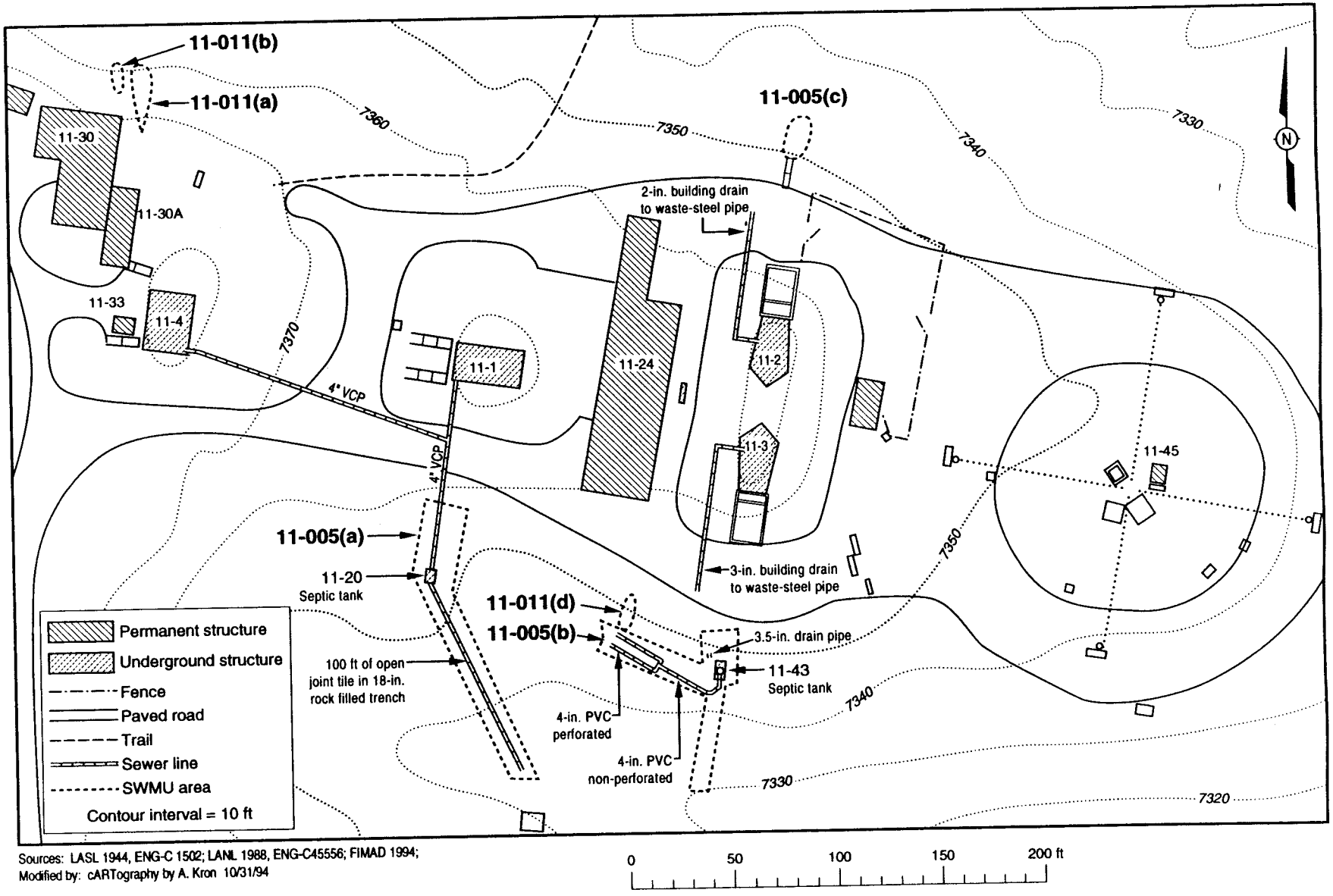
The area is currently heavily vegetated, which would restrict the movement of potential contaminants.

**SWMU 11-011(a): NPDES 03A130.** SWMU 11-011(a) is an active outfall associated with TA-11-30A, which contains support equipment for the vibration test facility in TA-11-30. TA-11-30A was constructed in 1956. The electrical equipment in TA-11-30A is cooled by water circulating through a cooling tower. Blowdown from the cooling tower is not treated prior to release through the outfall. TA-11-30A floor drains are also connected to this outfall. The outfall consists of a 2-in. pipe (surrounded by a 2-in. layer of insulation) located approximately 6 ft east of the NE corner of TA-11-30.

GC7 63

The outfall discharges to a short (approximately 20 ft drainage channel). The soil is loosely compacted and porous.




Sources: LASL 1944, ENG-C 1502; LANL 1988, ENG-C45556; FIMAD 1994;
Modified by: cARTography by A. Kron 10/31/94

**Fig. 5-75. Septic systems and outfalls at TA-11.**

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**SWMU 11-011(b).** SWMU 11-0011(b) is an active outfall that serves the floor drains of TA-11-30, which was constructed in 1959. A sink drain formerly connected to this outfall has been removed. TA-11-30 houses an electrodynamic vibration facility. SWMU 11-0011(b) lies on a slope approximately 15 ft due north of TA-11-30. The outfall consists of a 3-in. pipe that extends approximately 10 in. beyond the side of the hill.

The outfall discharges to a short (approximately 5 ft drainage channel). The soil is loosely compacted and porous and the area is heavily vegetated.

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**SWMU 11-011(d).** SWMU 11-0011(d) is an active outfall associated with TA-11-24 which contained the air gun facility, and was constructed in 1956. The outfall consists of a 4-in. steel pipe located on the south side of TA-11-24. The air gun was used to conduct acceleration and impact tests on full-scale warhead mock-ups. TA-11-24 is currently used as offices and a light machine shop.

The discharge from the outfall is to a sloped area of unconsolidated porous soil. Thus, the concentration of potential contaminants from this outfall would be highest directly below the discharge area.

#### 5.15.1.2 Conceptual Exposure Model

The conceptual model for the outfalls aggregate is presented in Chapter 4, Fig. 4-3. Subsection 5.15.1.2.1 presents the PCOCs for each SWMU and the potential release sources. PRS-specific information on migration pathways and potential receptors is discussed in Subsection 5.15.1.2.2.

##### 5.15.1.2.1 Nature and Extent of Contaminants

Table 5-73 summarizes the PCOCs for this aggregate. There are no existing quantitative environmental chemistry data, but the historical data were adequate to narrow the list of potential contaminants for some SWMUs (Table 5-73).

**SWMU 11-005(c).** Potential contaminants are volatile organics (cleaning solvents) from routine building operations, uranium and plutonium isotopes and metals from photofission experiments. PCOCs include silver and cyanide that may have been used in photographic processing during WW II-era activities.

### 5.15.3 Data Needs and Data Quality Objectives

**Decision Inputs and Investigation Boundary (DQO Steps 3 and 4)**

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**Outfalls on moderate slopes: SWMU 11-005(c) and SWMU 11-011(d).** Data needs for these SWMUs consist of concentrations of potential contaminants in the surface and subsurface soils in the discharge area beneath the outfall and in the soils downgradient from the outfall. The area below these outfalls is a moderately sloping hillside.

**Outfalls on steep slopes: SWMU 11-011(a) and SWMU 11-011(b).** Data needs for these SWMUs consist of concentrations of potential contaminants in the surface and subsurface soils in the discharge areas beneath the outfalls and in the first sediment trap downstream of the discharge areas. The area below these outfalls is roughly twice as steep as the preceding SWMUs.

**Decision Logic (DQO Step 5)**

If the maxima of the potential contaminants in any sample are above SALs, then a baseline risk assessment will be conducted. The baseline risk assessment will help decide on whether to propose NFA, do a VCA, or collect more data in a Phase II.

**Design Criteria (DQO Step 6)**

Reconnaissance sampling will be used at all outfalls. The rationale for biasing sample collection is based on the flow rates of PCOCs at the outfalls, the lack of drivers to redistribute PCOCs, and the tendency for PCOCs to migrate from the outfall source (steepness of the slope, consolidation of the fill below the outfall). Field screening will also be used to help select the location of soil cores.

Two soil cores will be required for all the outfalls. Significant flushing of potentially contaminated soil below the outfall is not likely in either case, since flow from the outfall pipes was low and none of the pipes is in a drainage which has perennial or intermittent flow (e.g., storm water runoff). Based on the low flow from these outfalls, PCOCs are expected to be most concentrated in the surface soil (0 to 6 in.) just below the outfall, but soil cores will be taken to a depth of 18 in. to test this assumption. Two out of

64b

three samples per core will be submitted for full laboratory analysis. The samples submitted will be biased by field screening.

It is expected that the data will form an adequate basis for NFA. A baseline risk assessment will be possible if the outfall data is combined with other soil samples collected in the adjoining SWMUs (Fig. 5-75).

### 5.15.4 Sampling and Analysis Plan

SOPs that control field activities in this sampling plan are listed in Table 5-74. Sample numbers and required analyses are shown on Table 5-75.

**TABLE 5-74**

**STANDARD OPERATING PROCEDURES FOR FIELD ACTIVITIES**

| LANL-ER-SOP | TITLE | NOTES |
|---|---|---|
| 01.02, R0 | Sample Containers and Preservation | Applied to all laboratory analytical samples |
| 01.04, R1 | Sample Control and Field Documentation | Applied to all laboratory analytical samples |
| 06.10, R0 | Hand Auger and Thin-Wall Tube Sampler | Applied to augered soil samples |

#### 5.15.4.1 Engineering Surveys

The SWMUs in the TA-11 outfalls aggregate will be field surveyed, which will consist of site engineering (geodetic) mapping and geomorphologic mapping. Site mapping is required to accurately record the location of the SWMUs. In the field, the engineering survey will locate, stake, and document the location of the SWMUs. Sample locations will be registered on a base map, scale 1:7 200. If during the course of sampling any sample points must be relocated, the new position will be surveyed and the revised locations will be indicated on the map. The engineering survey will be performed by a licensed professional under the supervision of the field team leader.

Geomorphologic mapping will provide an accurate picture of where outfall sediment sampling locations should be placed. The geomorphologic survey will consist of the mapping of the drainage channels downslope of any identified drain outfall.

**TABLE 5-75**

**SUMMARY OF SITE SURVEYS, SAMPLING, AND ANALYSIS FOR TA-11 OUTFALLS AGGREGATE**

| | | | LABORATORY SAMPLES | | | | | | | | FIELD SCREENING | | | | | | | FIELD LAB | | | | | | LABORATORY ANALYSES | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | STRUCTURE | | SURFACE | | DEEP SURFACE/ SUBSURFACE | | | | | | | | | | A | | | | | B | | | | C | | | | D | E | F | G | H | |
| PRS | PRS TYPE | SAMPLED MEDIA | | FIELD DUP | | FIELD DUP | NO. OF CORES | NO. OF SAMPLES PER CORE | TOTAL | FIELD DUPLICATES | GROSS ALPHA | GROSS GAMMA/BETA | ORGANIC VAPOR | HE SPOT TEST | GEOPHYSICS SURFACE | BARIUM - LIBS | GEOLOGICAL CHARACTERIZATION | GROSS ALPHA | GROSS GAMMA/BETA | TRITIUM | VOLATILE ORGANICS | XRF | SOIL MOISTURE | ALPHA SPECTROSCOPY | GAMMA SPECTROSCOPY | BETA SPECTROSCOPY | TOTAL URANIUM | ISOTOPIC PLUTONIUM | ISOTOPIC URANIUM | VOA (SW 8240) | SEMIVOLATILES (SW 8270) | METALS (SW 6010) | PCBs (SW 8080) | HIGH EXPLOSIVES (SW 8330) | CYANIDE |
| 11-005(c) | Outfall | Soil | | | | | 2 | 2 | 4 | 1 | 6 | 6 | 6 | | | | | 6 | 6 | | 6 | 6 | | | 4 | | | 4 | 4 | 4 | 4 | 4 | | | 4 |
| 11-011(d) | Outfall | Soil | | | | | 2 | 2 | 4 | | | | 6 | | | | | | | | 6 | 6 | | | | | | | | 4 | 4 | 4 | | | 4 |
| 11-011(a) | Outfall | Soil | | | | | 2 | 2 | 4 | 1 | | | 6 | | | | | | | | 6 | 6 | | | | | | | | 4 | 4 | 4 | | | 4 |
| 11-011(b) | Outfall | Soil | | | | | 2 | 2 | 4 | | | | 6 | | | | | | | | 6 | | | | | | | | | 4 | 4 | 4 | | | 4 |

A,C,G,H = not applicable; B,D,E = full suite; F = 1082 suite.

#### 5.15.4.2 Sampling

**Outfalls on moderate slopes: SWMUs 11-005(c) and 11-011(d).** One hand-augered core sample will be bored to a maximum of 18 in. immediately adjacent to each outfall. A second 18-in. sample will be collected 5 ft downgradient from each outfall. Cores will not penetrate into tuff. Specimens will be selected from the samples at surface, 12 in., and 18 in. or the soil-tuff interface and will be 0.2 ft minimum in length. If the soil in the sediment trap is shallow, then a spade or scoop will be used to collect the sample. Field screening may be used to select the location of the hand-augered sample location (Fig. 5-76).

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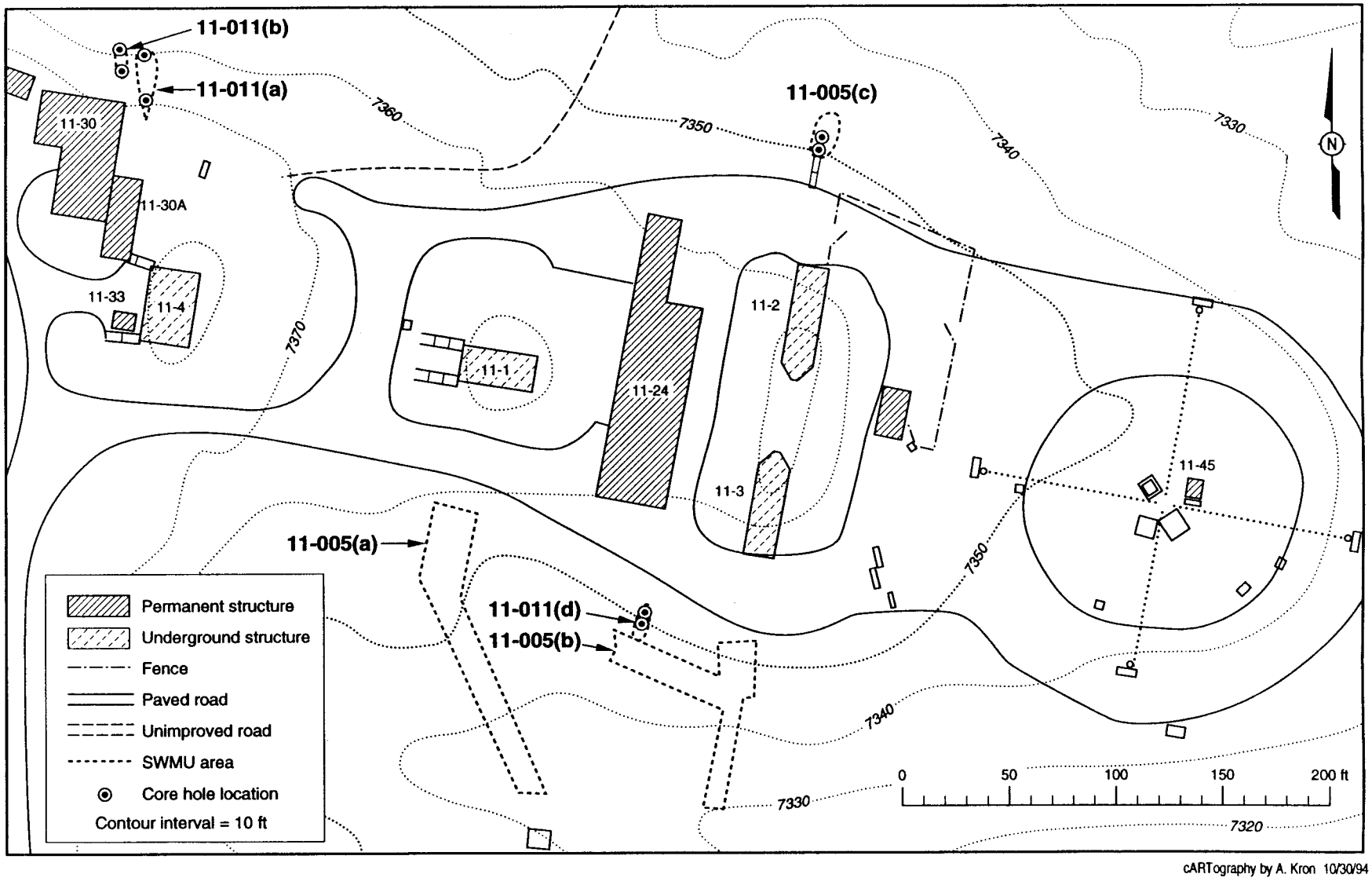
**Outfalls on steep slopes: SWMUs 11-011(a) and 11-011(b).** Two hand-augered core sample will be bored to a maximum of 18 in. One from the catchment immediately adjacent to the outfall, and one from the first sediment trap downslope in the drainage. Specimens will be selected from the samples at surface, 12 in., and 18 in. and will be 0.2 ft minimum in length. If the soil in the sediment trap is shallow, then a spade or scoop will be used to collect the sample. Field screening may be used to select the location of the hand-augered sample location.

Each sample from SWMU 11-005(c) will be field screened for radioactivity by FIDLER, volatiles, and metals by XRF. The samples from SWMU 11-011(b) will be screened for volatiles only. The samples from SWMUs 11-011(a) and 11-011(d) will be screened for metals and volatiles. This screening will be performed to guide the selection of samples submitted for laboratory analysis. Field screening methods are described in Subsection 4.7.

The two highest field screening readings relative to SALs will dictate the selection of two analytical samples for each core. If the screening of the core results in all measurements in the background range, then 0.2 ft minimum intervals at the bottom and middle of the core will be submitted for laboratory analysis. If the soil-bedrock interface is encountered and screening detects no PCOCs, then 0.5 ft sample at the soil-bedrock interface will be submitted for analysis along with the interval representing the middle of the core.

GC4




cARTography by A. Kron 10/30/94

**Fig. 5-76. Schematic sampling plan for TA-11 outfalls.**

accumulated for disposal. This area is presently covered by several concrete blocks approximately one foot thick.

A February 1956 survey found buildings TA-11-7, TA-11-8, TA-11-9, and TA-11-10 free of radioactive contamination (Blackwell 1956, 15-11-013). A 1959 inspection of the buildings found all four clean of radioactivity but showed contamination with HE (LASL 1959, 15-11-018). All four storage magazines were burned in late February of 1960 (Wingfield 1961, 15-16-111).

It was standard Laboratory procedure to burn buildings of this type once they were declared excess. Burning these structures ensured that any small amounts of residual explosives missed in the pre-burn visual inspection would be consumed. Any remaining post-burn combustible materials were segregated and removed to the TA-16 burning ground and burned again. Post-burn noncombustibles were taken to the TA-16 Area P landfill for disposal (Courtright 1966, 15-16-128).

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**C-11-002: TA-11-12**. Area of concern C-11-002 is the site of a 7 x 9 x 8 ft wood frame building (TA-11-12). According to the Facilities Engineering Structure List it was constructed in December 1944. TA-11-12 is present on a 1954 Engineering drawing (ENG-R 128), and is listed as a laboratory building. It is also shown on utility location map (R 646) dated 1958; no utility lines are shown serving the building. TA-11-12 is visible on an oblique photograph of the airgun target range and appears to be a construction shack. No current visible signs of the building exist; however, scaling of Engineering drawing ENG-R 126 places it approximately 65 ft east-northeast of the air gun target's earth berm. This building may possibly have housed the laboratory used to prepare samples for the P Division photofission experiments on uranium and plutonium isotopes. Because TA-11-12 was small (7 x 9 ft) it is unlikely that it was the chemistry building used to handle active samples at TA-11. The building used to handle active samples is described as having unsatisfactory hoods and entrance and exit doors (Ogle 1950, 15-11-011). Laboratory TA-11-5 was 6 x 32 ft and probably was the building used for the active samples. TA-11-12 might also have been used as a darkroom. Surrounding soils may have been contaminated with HE, photoprocessing chemicals (silver and cyanide), and uranium and plutonium isotopes that may have resulted from the preparation of photofission

65

experiments. TA-11-12 was monitored in 1956 and found free of radioactive contamination (Blackwell 1956, 15-11-013) and was removed to salvage in March 1959.

**SWMU 11-001(c).** SWMU 11-001(c) is the location of a former firing pit. It was a 12.5 ft semicircular wall, 4.5 ft high constructed of 37-in. thick concrete, southwest of TA-11-15. This area was known as K-Site west, and is located west of the main K-Site facility (Fig. 5-77). No known documentation as to the precise use of this firing pit has been found. It is known to be a World War II vintage site, but exact dates of use are unknown.

GC7

#### 5.16.1.2 Conceptual Exposure Model

The conceptual exposure model for the potential surface contamination aggregate is presented in Chapter 4, Fig. 4-8. Subsection 5.16.1.2.1 presents the PCOCs for each PRS. PRS-specific information on potential receptors is discussed in Subsection 5.16.1.2.2.

##### 5.16.1.2.1 Nature and Extent of Source

Table 5-76 summarizes PCOCs for the PRSs in this aggregate. The nature of the PCOCs is primarily the possible debris and PCOCs that may remain after demolition of the structures.

**SWMUs 11-012(a,b,c,d).** HE, HE impurities, and HE degradation products are the potential contaminants associated with these buildings. With the exception of HE, these buildings were all found to be clean before their D&D. They were burned and the ashes removed. Therefore, it is unlikely that residual contamination exists.

**C-11-002: TA-11-12.** Although unlikely, soils at the former location of this building could have residual contamination from photographic materials, HE, and uranium and plutonium isotopes from photofission experimentation.

**11-001(c): Associated with TA-11-15.** No documentation has been found which describes activities that occurred at this firing pit. An engineering sketch (ENG-R 126) depicts the firing pit with the same graphic as SWMU 11-001(a). SWMU 11-001(a) was a firing pit used for testing the integrity of aluminum, steel, and copper nose shields that covered the x-ray ports of TA-11-2 and TA-11-3. However, because of the uncertain history of

**Decision Process (DQO Step 2)**

The decision process is the same for all SWMUs. If potential contaminants are found above SALs, then a baseline risk assessment will be performed to determine if a corrective action to remove contaminated soil is required to protect human health and the environment. If potential contaminants are not found above SALs, the sites will be proposed for NFA.

### 5.16.3 Data Needs and Data Quality Objectives

**Decision Inputs and Investigation Boundary (DQO Steps 3 and 4)**

The exact locations of the former structures are difficult to determine. However, areas that are sufficiently large to encompass the locations of the previous structures will be determined through the use of period photographs, surveyed, and staked. Sample cores will be taken to a depth of 18 in. because leveling berms and regrading the locations of the decommissioned structures probably redistributed surface constituents to a depth less than 18 in. Field screening data for the PCOCs will be collected and positive samples will be submitted to the central laboratory for confirmation. Concentration data for each PCOC will be needed.

66a

**SWMUs 11-012(a,b,c,d).** Concentrations of HE in surface and subsurface soils in the surveyed locations will be determined.

**C-11-002: TA-11-12.** Concentrations of HE, metals, cyanide, and radioactivity (uranium and plutonium isotopes) in surface soils in the surveyed location will be determined.

**SWMU 11-001(c).** Concentrations of HE and radioactivity (natural and depleted uranium) in surface and subsurface soils in the surveyed location will be determined. The depth boundary for this SWMU will extend to 3 ft.

66b

**Decision Logic (DQO Step 5)**

**SWMUs 11-012(a,b,c,d).** The maximum of the concentration of PCOCs from the surface and near surface soil samples collected at each location will be compared to the SAL for HE and HE by-products. If the SAL is exceeded, then a baseline risk assessment will be undertaken to determine if worker risk is unacceptable.

**TABLE 5-78**

**SUMMARY OF SITE SURVEYS, SAMPLING, AND ANALYSIS FOR TA-11 POTENTIAL SURFACE CONTAMINATION AGGREGATE**

| PRS | PRS TYPE | SAMPLED MEDIA | LABORATORY SAMPLES# | | | | | | | | FIELD SCREENING | | | | | | | FIELD LAB | | | | | | LABORATORY ANALYSES# | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | STRUCTURE | | SURFACE | | DEEP-SURFACE/ SUBSURFACE | | | | | | | | | | A | | | | | B | | | | C | | | | D | E | F | G | H | |
| | | | | FIELD DUP | | FIELD DUP | NO. OF CORES | NO. OF SAMPLES PER CORE | TOTAL | FIELD DUPLICATES | GROSS ALPHA | GROSS GAMMA/BETA | ORGANIC VAPOR | HE SPOT TEST | GEOPHYSICS SURFACE | BARIUM - LIBS | GEOLOGICAL CHARACTERIZATION | GROSS ALPHA | GROSS GAMMA/BETA | TRITIUM | VOLATILE ORGANICS | XRF | SOIL MOISTURE | ALPHA SPECTROSCOPY | GAMMA SPECTROSCOPY | BETA SPECTROSCOPY | TOTAL URANIUM | ISOTOPIC PLUTONIUM | ISOTOPIC URANIUM | VOA (SW 8240) | SEMIVOLATILES (SW 8270) | METALS (SW 6010) | PCBs (SW 8080) | HIGH EXPLOSIVES (SW 8330) | CYANIDE |
| 11-012(a) | Former HE magazine | Soil | | | | | 4 | 1 | 4 | | | | | | | | | | | | | | | | | | | | | | 4 | 4 | | 4 | |
| 11-012(b) | Former storage | Soil | | | | | 4 | 1 | 4 | 1 | | | | | | | | | | | | | | | | | | | | | 4 | 4 | | 4 | |
| 11-012(c) | Former storage | Soil | | | | | 4 | 1 | 4 | | | | | | | | | | | | | | | | | | | | | | 4 | 4 | | 4 | |
| 11-012(d) | Personnel shelter | Soil | | | | | 4 | 1 | 4 | 1 | | | | | | | | | | | | | | | | | | | | | 4 | 4 | | 4 | |
| C-11-002 | Former storage | Soil | | | | | 4 | 1 | 4 | | | | | | | | | | | | | | | | | | 4 | 4 | 4 | 4 | 4 | 4 | | 4 | 4 |
| 11-001(c) | Firing site | Soil | | | | | 4 | 2 | 8 | | | | | | | | | | | | | | | | | 8 | | | | 8 | 8 | | | 8 | |

A,B,C,D,G = not applicable; E,H = full suite; F = 1082 suite

#### 5.16.4.1 Engineering Surveys

The SWMUs and an AOC composing this aggregate will be field-surveyed before sample collection. Site mapping is required to accurately record the location of SWMUs. In the field, the engineering survey will locate, stake, and document the location of each SWMU. Sample locations will be registered on a base map, scale 1:7 200. If during the course of sampling any sample points must be relocated, the new position will be surveyed and the revised locations will be indicated on the map. The engineering survey will be performed by a licensed professional under the supervision of the field team leader.

#### 5.16.4.2 Sampling

Sample cores will be augered to 18 in. deep at a maximum. A sufficient volume of soil will be removed from the entire length of the core to yield 300 ml (Fig. 5-79 and Fig. 5-80). The summary of site sampling and analysis requirements is provided in Table 5-78.

**SWMUs 11-012(a,b,c,d).** The sampling of each of these sites of former wooden storage structures will include hand-augered boreholes to a depth of 18 in. The surface of each SWMU will be divided into quadrants and one borehole will be placed within each quadrant. Only HE and HE by-products will be analyzed at this first set of SWMUs.

**AOC 11-002.** The technique for collection of samples of this area of concern will be identical to the above SWMUs. The only departure will be that in addition to HE and HE by-products, the presence of uranium, plutonium isotopes, organics, metals, and cyanide will be investigated.

66b

**SWMU 11-001(c).** This former firing pit will include 4 hand-augered boreholes to a depth of 3 ft or the soil-tuff interface, whichever is shallower. Specimens will be analyzed for HE and HE by-products, uranium, and beryllium. Two samples will be taken from each core, one of the 0 to 18 in. interval, the other from the 6 in. above the soil-tuff interface or the bottom 6 in. of the core.

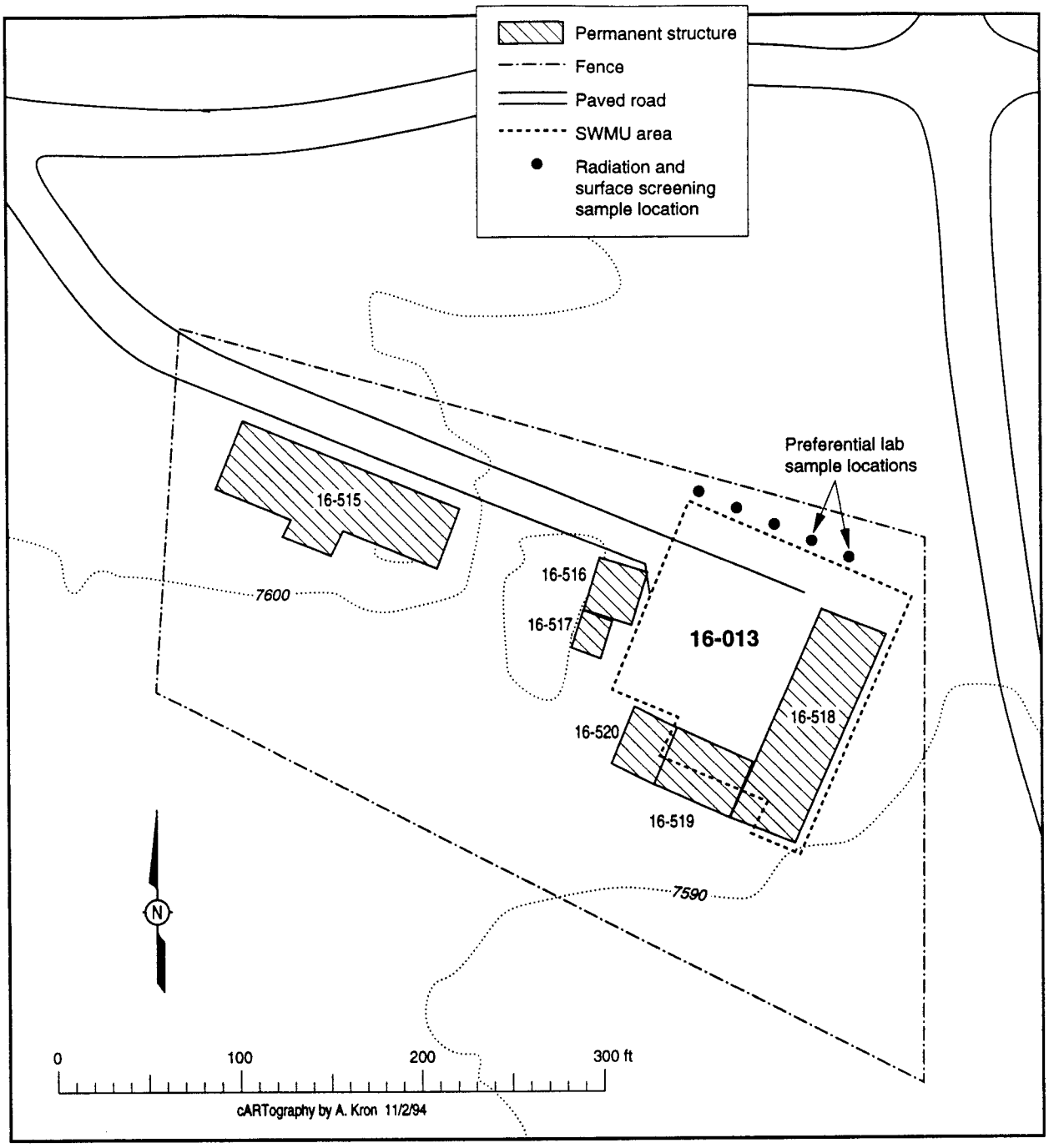


**Fig. 5-81. Sampling plan for decommissioned waste storage area.**

CEARP Report also noted that empty boxes and cans containing radioactive material were in the area along with open drums containing barium nitrate and what appeared to be empty drums that had contained lithium hydride (DOE 1987, 0264). The area has since been cleaned (LANL 1990, 0145). The cleanup consisted of removal of the empty boxes, cans, and drums. The nature of all activities that occurred during that time is unknown, as are the possibilities for a release of materials used at the site. No data exist that suggest significant contamination of the asphalt courtyard, of the storage sheds at SWMU 16-013, or of the soils surrounding the site. It is suspected that various chemicals, such as acetone, n-butyl acetate, chloroethene, 1,2-dichloroethane, dimethylformamide, ethyl acetate, dimethyl sulfoxide, methanol, methylene chloride, methyl ethyl ketone, and toluene (Panowski and Salgado 1971, 15-16-038); and barium nitrate and uranium were stored in these areas.



#### 5.17.1.2.2 Potential Pathways and Exposure Routes

At SWMU 16-013 potentially hazardous contaminants may have been deposited on the paving, on cracks therein, or in soil beneath it. Runoff and snowmelt may have carried hazardous material into the surrounding fields, where contaminants may migrate via sorption onto surface soil or infiltration into deeper soils. Although the mesa is wide, level, and covered with grasses, with no obvious drainage pattern, surface water overflow may have collected in ditches beside roadbeds near the site.

At SWMU 16-013 excavation or erosion of soil can lead to dermal contact or involuntary ingestion. Though the site is currently paved with asphalt and the surrounding soil well-vegetated with grasses, this may become disrupted at some future date leading to potential for inhalation through wind-driven volatiles or dust. Exposure via a water route is unlikely on this level mesa.

### 5.17.2 Remediation Decisions and Investigation Objectives

**Problem Statement (DQO Step 1)**

The nature and extent of contamination at SWMU 16-013 is unknown. No large releases of material have been documented and contamination is expected to be low due to natural dispersion processes and weathering over many years. Reconnaissance sampling is necessary to determine the

**TABLE 5-80**

**STANDARD OPERATING PROCEDURES FOR FIELD ACTIVITIES**

| LANL-ER-SOP | TITLE | NOTES |
|---|---|---|
| 01.02, R0 | Sample Containers and Preservation | Applied to all laboratory analytical samples |
| 01.04, R1 | Sample Control and Field Documentation | Applied to all laboratory analytical samples |
| 06.11, R0 | Stainless Steel Surface Soil Sampler | Applied to surface soil samples |

#### 5.17.4.1 Engineering Surveys

SWMU 16-013 will be field surveyed, which will consist of site engineering (geodetic) mapping and geomorphologic mapping. Site mapping is required to accurately record the location of the SWMUs. In the field, the engineering survey will locate, stake, and document the location of the SWMUs. Sample locations will be registered on a base map, scale 1:7 200. If during the course of sampling any sample points must be relocated, the new position will be surveyed and the revised locations will be indicated on the map. The engineering survey will be performed by a licensed professional under the supervision of the field team leader.

Geomorphologic mapping of the source area will be performed to determine drainage patterns. This mapping will include drainage patterns and sediment traps adjacent to the paved storage area.

#### 5.17.4.2 Sampling

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Surface soil samples (0 to 6 in.) will be collected at intervals downgradient along the edge of the asphalt pavement (Fig. 5-81). The specific locations will be determined by site mapping. No staining is currently visible in this area. Five samples will be collected in a 5 ft wide band beyond the pavement in the area that drains the paved area. However, sample collection points may be varied to include possible nearby sediment traps. Each sample will be field screened for radionuclides by hand-held beta-gamma detector and metals by XRF. Field screening methods are described in Subsection 4.7. Any samples that show positive screening for PCOCs above SALs will be submitted for laboratory analysis. If no samples have a positive screening

**TABLE 5-81**

**SUMMARY OF SITE SURVEYS, SAMPLING, AND ANALYSIS FOR DECOMMISSIONED WASTE STORAGE AREA**

| | | LABORATORY SAMPLES | | | | | | | FIELD SCREENING | | | | | | | FIELD LAB | | | | | | LABORATORY ANALYSES | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | STRUCTURE | | SURFACE | | SUBSURFACE | | | | | | | | A | | | | | B | | | | C | | | | D | E | F | G | H | |
| PRS | PRS TYPE | SAMPLED MEDIA | | FIELD DUP | | FIELD DUP | | FIELD DUP | GROSS ALPHA | GROSS GAMMA/BETA | ORGANIC VAPOR | HE SPOT TEST | GEOPHYSICS SURFACE | BARIUM - LIBS | GEOLOGICAL CHARACTERIZATION | GROSS ALPHA | GROSS GAMMA/BETA | TRITIUM | VOLATILE ORGANICS | XRF | SOIL MOISTURE | ALPHA SPECTROSCOPY | GAMMA SPECTROSCOPY | BETA SPECTROSCOPY | TOTAL URANIUM | ISOTOPIC PLUTONIUM | ISOTOPIC URANIUM | VOA (SW 8240) | SEMIVOLATILES (SW 8270) | METALS (SW 6010) | PCBs (SW 8080) | HIGH EXPLOSIVES (SW 8330) | CYANIDE |
| 16-013 | Waste storage | Soil | | | 2# | 1 | | | | 5 | | | | | | | 5 | | | 5 | | | | | 2# | | | | 2# | 2# | | | |

A,C,G,H = not applicable; B,D,E = full suite of analytes; F = 1082 suite.
# = Minimum number of samples; additional samples may be taken based on field screening.

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for PCOCs, then two samples will be selected at the most prominent drainages from the paved area. Those two locations represent the two eastern sampling points (Fig. 5-81). If one sample yields positive results, the additional sample will be the sample from the easternmost prominent drainage.

#### 5.17.4.3 Laboratory Analysis

Laboratory analyses of samples will be at Level III for radionuclides (LANL or DOE method), metals (SW-846 Method 6010), and SVOCs (SW-846 Method 8270). The principal radionuclide of concern is uranium, the principal VOCs are hydrocarbon solvents, and the full suite of metals.

#### 5.17.4.4 Sample Quality Assurance

Field quality assurance samples will be collected according to the guidance provided in the latest revision of the IWP (LANL 1992, 0768). Any QA/QC duplicate samples planned to be collected during the course of the field investigation are outlined in Table 5-81.

**TABLE 6-3**

**SWMUs WITH INTERIM STATUS**

| SWMU | STRUCTURE | FUNCTION |
|---|---|---|
| 16-010(b) | TA-16-387 | Flash pad |
| 16-010(c) | TA-16-388 | Burn table |
| 16-010(d) | TA-16-399 | Burn table |
| 16-010(e) | TA-16-401 | Filter tank |
| 16-010(f) | TA-16-406 | Filter tank |
| 16-010(j) | TA-16-394 | Filter bed |

**SWMU 16-010(b)** is an active flash pad associated with structure TA-16-387. The pad was constructed in 1951 and used for flash burning high explosives-(HE) contaminated material. The burn area is enclosed by a 100 ft long x 100 ft wide fence and is composed of a layer of sand several inches thick over a soil surface (LANL 1990, 0145).

**SWMU 16-010(c)** is a former burn slab converted to a burn table, structure TA-16-388. It is used for disposing of HE scrap. Currently, the 100 ft long by 100 ft wide enclosed area consists of a concrete pad, used for unloading explosives, and a burn table. The burn table is 2 ft above the ground and holds a tray that is 16 ft long x 4 ft wide. HE is placed on the tray and burned. The table has a metal-covered rain guard that can be rolled back to expose the tray (LANL 1990, 0145).

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**SWMU 16-010(d)** is also a former burn slab converted to a burn table, TA-16-399. The physical layout and operation of this burn table is the same as SWMU 16-010(c) (LANL 1990, 0145).

**SWMU 16-010(e)** is a pressure filter tank, structure TA-16-401, built in 1961 to filter HE-laden wash water from the basket wash facility, TA-16-390. Wash water was carried from the basket wash facility to the pressure filter tank via trough TA-16-1129. This arrangement was in use until 1966, when building TA-16-390 was decommissioned.

modifications are contained in the closure plan and a copy of the reasons for these modifications is included. NMEID approves this closure plan in accordance with the New Mexico Hazardous Waste Management Regulations (HWMR-5, as amended 1989), Part VI, 40 CFR 265.112 (d)(4), with an effective date of February 12, 1990. This date will become the starting date for the final closure schedule in Subsection 5.1.9 of the closure plan" (Ellvinger 1990, 15-16-372). The surface impoundment referred to in that correspondence is the Hypalon pond at the TA-16 burning ground designated SWMU 16-008(b).

On September 19, 1990, Harry T. Season, Jr., Acting Area Manager, Department of Energy, Los Alamos Area Office, submitted the closure documentation for the TA-16 Surface Impoundment to Ms. Kathleen Sisneros, Director Hazardous Waste Bureau, NMEID. This transmittal read in part, "Los Alamos National Laboratory (LANL) received an approved Resource Conservation and Recovery Act (RCRA) closure plan for the TA-16 Surface Impoundment on February 12, 1990. Upon the receipt of this document, LANL proceeded with the closure of this unit. This closure was completed on June 12, 1990" (Ellvinger 1990, 15-16-372). NMED approved the closure of this unit in a letter dated June 7, 1994 (Sisneros 1994, 15-16-561).

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### 6.1.3 SWMUs Recommended for No Further Action Under Step Two of the Four-Step Criteria

#### 6.1.3.1 Filter/Treatment Unit, SWMU 16-010(g)

##### 6.1.3.1.1 Background

**SWMU 16-010(g)** is a carbon filter/treatment unit, TA-16-363 (previously designated as structure TA-16-228). This unit was constructed in 1988 to treat waste water draining from the pressure filter tanks (TA-16-401 and TA-16-406). The drainage from the tanks enters the filtering system through a common drain line that originates at a manhole located approximately 75 ft north of building TA-16-363. The waste water is filtered and monitored before discharge from national pollutant discharge elimination system (NPDES) Outfall 05A055 located on the southeast side of the building.

erosion control in the immediate area. The small amount of road-building debris has likewise accumulated over the years (Griffin 1992, 15-11-052).

#### 6.1.5.1.2 Recommendation

75

SWMU 11-007 is recommended for NFA and delisting from the SWMU Report and the HSWA Module because it does not meet the definition of a SWMU (LANL 1992, 0768).

#### 6.1.5.1.3 Rationale for Recommendation

The history of the air gun facility targets associated with this SWMU is found in Subsection 5.14.1.1. Based on interviews with site personnel and a review of post-test photographs, no evidence has been found that the outer envelope of any of the test devices containing hazardous materials launched into these targets was breached. Therefore, the targets associated with this SWMU contain no hazardous or radioactive constituents as a result of mortar impacts. No archival information has been found that would indicate that the road-building debris contains RCRA hazardous or radioactive constituents.

### 6.1.5.2 MDA S, SWMU 11-009

#### 6.1.5.2.1 Background

SWMU 11-009 is a fenced, active experimental plot approximately 10 x 10 ft located just south of the *cul-de-sac* in front of the storage magazine, TA-11-36. The area is used to study the effect of soil and weather on the decomposition of explosives (DuBois and Baytos 1972, 15-16-286). The area, which slopes to the southwest, is well vegetated with grasses and weeds, locust shrubs, and two small ponderosa pines. The general area is covered with ponderosa pines and oak thickets. There is no sign of erosion and no drainage transects the site. This experiment continues with a maximum of less than 80 grams of HE remaining in the experimental plot (DuBois and Baytos 1991, 0718; Griffin, 1992, 15-11-048). The sample materials that remain are in 7-in. diameter x 6-in. high tubing. The tubing has a fine mesh stainless steel screen on the bottom and hardware cloth (0.25 x 0.25 in.) over the top. The sample containers are buried in the experimental plot: their tops are flush with the surrounding surface.

**TABLE 6-5**

**HIGH EXPLOSIVES SCREENING ACTION LEVELS IN SOIL**

| HIGH EXPLOSIVE COMPOUND | SAL (ppm)[a] |
|---|---|
| RDX | 64 |
| HMX | 4 000 |
| TNT (2,4,6-trinitrotoluene) | 40 |
| TNB (1,3,5-trinitrobenzene) | 13 |
| DNB (1,3-dinitrobenzene) | 8 |

[a] Calculated using method described in the IWP, Appendix J.

in the late 1980s, a section of clay sewer pipe was unearthed (Palmer 1992, 15-16-373). This septic tank, which served building TA-16-101 (a guard house), had a drain field associated with it, Engineering drawing ENG-C 2674. There is no information that suggests handling or storage of hazardous substances in TA-16-101.The septic tank has never served any building besides the guard house.

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#### 6.1.5.3.2 Recommendation

SWMU 16-005(o) is recommended for NFA and delisting from the SWMU Report and the HSWA Module because there is no reasonable basis for characterization of the site based on considerations of human health and environmental risk, community concern, Laboratory operations, and value of information (LANL 1992, 0768).

#### 6.1.5.3.3 Rationale for Recommendation

There is no documentation to indicate that this septic tank received anything other than sanitary waste from its associated guard house and, in the absence of hazardous constituents, there is no potential for a release to the environment. Septic tanks that manage only domestic waste are excluded from being SWMUs under 40 CFR 261.4(a)(1)(i).

#### 6.1.5.5.3 Rationale for Recommendation

This septic tank was placed in service after March 1987, receives only sanitary waste, and has been covered under the authority of the Clean Water Act.

### 6.1.5.6 Rest Houses, SWMUs 16-012(a,b,c,e,f,g,h,k,o,q,r,s,v,w,y,z); and Container Storage Area, SWMU 11-010(a)

#### 6.1.5.6.1 Background

Rest houses are auxiliary buildings used as intermediate storage points in the distribution of HE material. Rest houses were incorporated into the design of the TA-16 explosives process buildings that were constructed in the late 1940s and early 1950s. They function as intermediate storage areas for raw explosives being delivered to process buildings, for finished products ready for transport, or for scrap being removed for disposal. Usually, but not always, different rest houses are used for incoming and outgoing materials.

Rest houses at TA-16 and the container storage area at TA-11 that functions similarly to the rest houses are remote from other buildings and are often surrounded by a berm. In most cases they are connected to the process building by an enclosed, shed-like walk way up to several hundred feet long.

A typical rest house at the S-Site complex is a reinforced-concrete building about 40 ft long x 20 ft wide. Heavy double doors open to an exterior loading dock at the front. There are no windows. Floors are painted, polished concrete. Open-lattice metal doors connect the rest house with the walk way.

High-explosive material is transported to and from the rest house on 6 ft long x 3 ft wide flat-bed, wheeled, Colson carts. The carts are open-sided but have bungee ropes along the sides to cushion the contents and prevent containers from slipping off. High explosives are always packaged in cardboard but may be stored on the carts in a variety of secondary outer containers including cardboard boxes, cardboard drums, wooden boxes, or wooden crates.

Rest houses without exterior drains to a high-explosives sump are listed in Table 6-6, and those with exterior drains to a high-explosives sump are listed in Table 6-7. The three rest houses with exterior drains attached to

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sumps may have had finished or raw HE packaged and unpackaged within them. TA-16-360 currently is used for packaging; the other two buildings may have been used for these activities in the past. The SWMUs associated with the high-explosives sumps attached to the rest houses in Table 6-7 are addressed in Chapter 5, Subsection 5.2.

#### 6.1.5.6.2 Recommendation

SWMUs 16-012(a,b,c,e,f,g,h,k,o,q,r,s,v,w,y,z) and 11-010(a) are recommended for NFA and with the exception of SWMU 11-010(a), which is not a HSWA SWMU, delisting from the SWMU Report and the HSWA Module because there is no reasonable basis for characterization of these sites based on considerations of human health and environmental risk, community concern, Laboratory operations, and value of information (LANL 1992, 0768).

#### 6.1.5.6.3 Rationale for Recommendation

All listed rest houses are currently part of active operations, managed under rigid safety procedures. Activities are currently covered under standard operating procedures (SOPs) listed in Table 6-8 (Barr 1992, 15-16-329). Activities have always been conducted in compliance with DOE Explosives Safety Manual DOE/E1/06194 (DOE 1991, 15-16-309) and its Department of Defense predecessors.

Containerized HE material is delivered to and from rest houses under strictly controlled operating procedures. Rest houses are cleaned and maintained on regular schedules. Then, cleaning water and all materials are collected, packaged, and transported to the TA-16 burning ground for treatment. Any special activities in a rest house require a safety work permit issued by the Engineering and Information Resources Group (WX-12) safety office or its predecessors. Recent field screening indicates that no HE material has leaked or spread from any of these structures to the exterior loading docks (Barr 1992, 15-16-329).

These rest houses are governed by handling, safety, and cleaning procedures, precluding a pathway for contaminants to the surrounding environment. Therefore, under the fourth step of the detailed review for no current RCRA facility investigation and delisting, there is no reasonable

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| 4 | A183 | Legal Counsel<br>Cheryl Mack | Joseph Blachelle by Cheryl revisions on | ✓ - subject to attached 10 pages. | | 11/28/94 |
| 3 | K498 | Other<br>Pat Shanley | J Shanley | ✓ | | 11/28/94 |
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