Environmental Restoration
University of California
Environmental Restoration Project, MS M992
Los Alamos, New Mexico 87545
505-667-0808/FAX 505-665-4747

U. S. Department of Energy
Los Alamos Area Office, MS A316
Environmental Restoration Program
Los Alamos, New Mexico 87544
505-667-7203/FAX 505-665-4504

Stu

Duplicate

HSWA LANL 4/1049/00

Date: October 30, 1997
Refer to: EM/ER:97-438

OCT 1997

Mr. Benito Garcia
NMED-HRMB
P.O. Box 26110
Santa Fe, NM 87502

SUBJECT: RESPONSE TO REQUEST FOR SUPPLEMENTAL INFORMATION FOR THE CANYONS INVESTIGATION CORE WORK PLAN (FORMER OU 1049)

Dear Mr. Garcia:

The Environmental Restoration Project received your letter dated October 1, 1997, in which you granted our request for extension for supplemental information on the Canyons Investigation Core Work Plan to October 30, 1997. Enclosed please find our responses to this request.

Should you have any questions, please contact Allyn Pratt at (505) 667-4308 or Bonnie Koch at (505) 665-7202.

Sincerely,

Julie A. Canepa, Program Manager
LANL/ER Project

Sincerely,

Theodore J. Taylor, Program Manager
DOE/LAAO

JC/TT/rfr

Enclosure: Response to Request for Supplemental Information for Canyons Investigation Core Work Plan (Former OU 1049)

1448

Cy (w/enc.):
D. Griswold, AL-ERD, MS A906
J. Harry, EES-5, MS M992
B. Koch, LAAO, MS A316
D. Neleigh, EPA, R.6, 6PD-N
A. Pratt, EES-13, MS J521
C. Rodriguez, CIO/ER, MS M769
T. Taylor, LAAO, MS A316
J. White, ESH-19, MS K490
S. Dinwiddie, NMED-HRMB
M. Leavitt, NMED-GWQB
J. Parker, NMED-HRMB
G. Saums, NMED-SWQB
S. Yanicak, NMED-AIP, MS J993
EM/ER File (CT# C361), MS M992
RPF, MS M707

Information Only
T. Baca, EM, MS J591
T. Glatzmaier, DDEES/ER, MS M992
T. Longo, DOE-HQ, EM-453
D. McInroy, EM/ER, MS M992
J. Plum, LAAO, MS A316
S. Rae, ESH-18, MS K497
G. Rael, AL-ERD, MS A906
J. Vozella, LAAO, MS A316
EM/ER File, MS M992

Request for Supplemental Information
Canyons Investigation Core Workplan

INTRODUCTION

This document responds to a letter titled, "Request for Supplemental Information Canyons Investigation Core Workplan Los Alamos National Laboratory NM0890010515." This letter was sent from the New Mexico Environment Department (NMED) Hazardous and Radioactive Materials Bureau to the Los Alamos Area Office of the Department of Energy and Los Alamos National Laboratory (LANL). To facilitate review of this response, NMED's comments (in *italic type*) are included verbatim. The comments are divided into general and specific categories as presented in the letter. LANL's responses (in regular type) follow each NMED comment.

GENERAL COMMENTS

NMED Comment

1. *The Watershed Management Project Plan should be coordinated and consistent with the Canyons Investigation Core Document and the subsequent canyon-specific workplans and reports.*

LANL Response

1. LANL agrees that the approach developed for the Watershed Management Project Plan should be coordinated and consistent with the *Core Document for Canyons investigations* (hereafter referred to as the "Core Document") and the subsequent canyon-specific work plans and reports. The technical staff for the canyons investigations participated in the formulation of the watershed management strategy and contributed to the development of the Watershed Management Workplan. This involvement will ensure that the watershed management approach is coordinated and consistent with the Core Document and the subsequent canyon-specific work plans and reports.

NMED Comment

2. *Please provide a revised schedule for the canyons and canyon aggregates based on negotiations that took place on April 16, 1997 between the Department of Energy/Los Alamos National Laboratory (DOE/LANL) and the Hazardous and Radioactive Materials Bureau (HRMB) representatives. The following sections of the above-referenced document require revision: Executive Summary (Scheduling and Reporting); Table 1-1, Annex 1, and Figure 1-1.*

LANL Response

2. Based on the negotiations that took place on April 16, 1997, LANL has revised the schedule for canyons investigations. Table 1-1 and Figure I-1, which contain the revised schedule, are included at the end of these responses.

NMED Comment

3. *If changes made to the Hydrogeologic Workplan affect this document, please provide an addendum to the Canyons Investigation Core Document.*

radiological constituents only. There are outliers to this definition, such as the canyons. Negotiotions are underway to add the canyons to the HSWA Module.

CHAPTER 2 - BACKGROUND

NMED Comment

5. *Section 2.1.1: A disparity in the elevation of the flanks of the Jemez Mountains occurs between this section [page 2-1] and Section 1.2.1 [page 1-1]. Please clarify.*

LANL Response

5. The elevation of 7,800 ft used to describe the flanks of the Jemez Mountains in Section 2.1.1 has been changed to 7,700 ft to be consistent with the description in Section 1.2.1.

6. *Section 2.3.3:*

NMED Comment

a. *Please revise Table 2-2 to include a column which indicates the geologic unit in which each well is screened.*

LANL Response

a. A revision of Table 2-2, which includes the geologic unit screened in each well, is included at the end of these responses.

NMED Comment

b. *LANL should provide confidence levels associated with the ground elevations presented in Table 2-2. NMED's Hydrologic Evaluation noted several discrepancies in LANL's data.*

LANL Response

b. The revision of Table 2-2 includes qualitative confidence levels on ground elevations.

NMED Comment

c. *Please revise the following text as indicated: "Groundwater protection activities at the Laboratory includes the installation of an extensive groundwater monitoring system for assessment of water quality ..."*

LANL Response

c. The referenced sentence has been revised to state, "Groundwater protection activities at the Laboratory include installation of an extensive (in conjunction with LANL's *Hydrogeologic Workplan*) groundwater monitoring system for assessment of water quality."

NMED Comment

7. *Section 2.3.3.4:*

   a. *Likewise, please revise Table 2-3 to include a column which indicates the geologic unit from which the spring appears to discharge.*

LANL Response

a. Table 2-3 has been revised to include the geologic units from which these springs issue, where known. A copy of this table is included at the end of these responses.

NMED Comment

b. *Please include an up-to-date inventory of all springs including monumented elevations and coordinates of sampling locations.*

LANL Response

b. LANL group ESH-18 is currently monumenting the springs that are being sampled as part of the surveillance program. Each canyon-specific work plan will include updates of spring elevations and coordinates.

NMED Comment

c. *Please revise Table 2-3 such that the water source for Water Canyon Gallery is indicated as emanating from the perched groundwater found within the volcanics on the western sided of the Laboratory. The Water Canyon Gallery is a system designed to collect water from Big Spring which issues from the Bandelier Tuff.*

LANL Response

c. Table 2-3 has been revised to indicate that the spring feeding Water Canyon Gallery issues from the Tshirege Member of the Bandelier Tuff.

NMED Comment

d. *HRMB recommends that LANL sample the intermediate perched groundwater zone in Los Alamos Canyon at Los Alamos Spring in addition to Basalt Spring. Basalt Spring, as stated in the document, may be affected by nearby surface-water-infiltration, whereas, Los Alamos Spring exhibits constant flow, stable water chemistry and is located approximately 45 feet above the Los Alamos Canyon stream bed.*

LANL Response

d. Environmental Restoration (ER) Project personnel are already sampling both Basalt Spring and Los Alamos Spring.

NMED Comment

e. *Please clarify the current status of springs and surface water in Water Canyon including present and intended use of this water resource.*

LANL Response

e. The status of springs and surface water in Water Canyon will be updated as part of the work plan for Water Canyon.

NMED Comment

8. *Section 2.3.4.1: This document states "A 300-ft (91-m) borehole drilled to the top of the basalt at TA-33 encountered wet zones in basalt cinder deposits, but no perched groundwater was found." LANL should investigate the TA-33 300-foot borehole for recharge and assess its potential for affecting contaminant migration before making a determination that no perched ground water exists. Wet zones in basalt cinder deposits may indicate saturation.*

LANL Response

8. Investigations of recharge in the 300-ft borehole on the mesa top at TA-33 are not within the scope of the canyons investigations. However, this comment has been forwarded to the project leader who is responsible for this site.

NMED Comment

9. *Section 2.3.6: It should be clarified that because the surface water samples obtained for the annual environmental surveillance reports are unfiltered, they cannot be used to determine compliance with the New Mexico Water Control Commission standards (except for barium, chromium or cobalt).*

LANL Response

9. The following sentence has been added before the last sentence in Section 2.3.6: "Analyses of these unfiltered water samples are not directly comparable to New Mexico Water Control Commission standards, which are largely based on filtered water samples."

CHAPTER 3 - ENVIRONMENTAL SETTING

NMED Comment

10. *Section 3.5.1.2:*

    a. *Please revise the following statement as indicated: "**Currently o**~~O~~nly ~~four~~**seven** of the canyons **are known to** contain perennial (flowing continuously) reaches within Laboratory boundaries (**Pajarito Canyon, Twomile Canyon, Threemile Canyon, Canon de Valle, Sandia Canyon,** ~~Los Alamos Canyon~~, ~~Water Canyon~~, Ancho Canyon, **and** Chaquehui Canyon).*

    Currently, perennial surface-water flow in Water Canyon does not extend onto the western boundary of the Laboratory. Perennial flow in Los Alamos Canyon has not been observed to flow within the Laboratory boundary. Perennial flow in Chaquehui Canyon extends for approximately 300 feet from Spring 9A. Spring 9 flows perennially to the Rio Grande within the Laboratory boundary, but is not located in Chaquehui Canyon. A perennial reach in Sandia Canyon exists as a result of the major discharge of treated sanitary sewage effluent.

LANL Response

a. On page 3-26, the last sentence of the first paragraph has been revised to read as follows: "Currently, only seven of the canyons are known to contain perennial (flowing continuously) reaches within Laboratory boundaries (Pajarito Canyon, Twomile Canyon, Threemile Canyon, Cañon de Valle, Sandia Canyon, Ancho Canyon, and Chaquehui Canyon)."

NMED Comment

b. Please include a discussion of the perennial reaches in Twomile and Threemile Canyons which result from Anderson and TA-18 Springs and the perennial flow from Starmer Gulch and Arroyo de Ladelfe in the discussion of perennial reaches within the Laboratory boundary.

LANL Response

b. The surface water flow characteristics in Twomile Canyon and Threemile Canyon will be discussed in detail in the work plan for Pajarito Canyon, which is presently being developed.

NMED Comment

c. Please revise the description of the perennial reaches in Cañon de Valle and Water Canyon to discount any contribution(s) from Spring 5AA.

LANL Response

c. In the fourth full paragraph on page 3-27, the fourth and fifth sentences, which describe Spring 5AA, has been deleted.

NMED Comment

11. Section 3.5.3: The information obtained from the 6-hour storm modeling seems pertinent to understanding the effect of intense storm activity on the canyon systems. Please summarize the results of this study within this document.

LANL Response

11. Modeling of storm events will be summarized in the appropriate canyon-specific work plans.

NMED Comment

12. Section 3.6.1:

a. Sections 3.6.1.1 through 3.6.1.3 do not appear to directly reflect or correlate with the information provided in Table 3.2. Please provide additional discussion to reconcile Table 3.2 to the information presented in the individual sections.

LANL Response

a. The data presented in Table 3-2 represent average hydraulic properties, whereas the data described in Sections 3.6.1.1 through 3.6.1.3 give ranges of values for hydraulic properties. Therefore, both descriptions of the hydraulic data are valid.

NMED Comment

b. Section 3.6.1.2: This document states: "The results of this investigation suggest that greater infiltration of water occurs beneath the canyon floors that through the mesa tops; however, moisture content values are only presented for canyon floors. Please provide data regarding the moisture content for the mesa tops to support this conclusive statement.

LANL Response

b. The following sentence has been added before the last sentence in Section 3.6.1.2: "In contrast, moisture contents in the upper Otowi Member range from 8 to 13% in the mesa-top borehole 49-2-700-1 at TA-49."

NMED Comment

c. Section 3.6.1.3: This document discusses moisture curves and in-situ moisture characteristics data, but does not explain how they relate to and effect the hydraulic conductivity. Please provide this explanation.

LANL Response

c. The increase in the degree of saturation results in increasing hydraulic conductivity, whereas 100% saturation results in the highest hydraulic conductivities.

NMED Comment

13. Section 3.7.5.2:

a. Please indicate which sample (sample number, sample location, date and time) indicated the presence of tritium at 63 ± 2.2 pCi/L in the regional aquifer. [second paragraph].

LANL Response

a. On May 12, 1993, a sample with tritium activity of 63 pCi/L or 19.7 tritium units was collected from former water supply well LA-1 (Blake et al. 1995, 49931, Table 4, p. 28). Unfortunately, Blake et al. does not include a sample number in the table.

NMED Comment

b. Please revise the description of the age estimates of the regional aquifer to reflect the possibility of mixing due to the length of screen and pump depth in the wells sampled. The usefulness of the data is questioned due to the large screened interval from which these samples were obtained. [second paragraph]

LANL Response

b. This comment addresses Section 3.7.5.3 (pages 3-40 and 3-41). The phrase ", which suggests that groundwater flow . . ." has been deleted in the next to last sentence in the last paragraph of Section 3.7.5.3. The following text has been added: "However, the flow paths within the regional aquifer are heterogeneous and complex; they are not well understood. The large screen lengths within the wells, the vertical gradients, and the chemical heterogeneity influence the ^{14}C age dates obtained from the regional aquifer. The ages of the water samples represent average ages for the screened interval of each well,

which may include mixing of waters from one or more production zones, and not the average age for the entire saturated thickness of the regional aquifer."

CHAPTER 4 - CONCEPTUAL MODEL

NMED Comment

14. Section 4.1.2:

a. The following statement should be qualified to indicate that it may only hold true for the present: "But because surface water is rarely ingested, such water is likely to contribute in only a minor way to the overall exposure of humans to contaminants." [top paragraph, page 4-2]

LANL Response

a. The referenced sentence in the first paragraph on page 4-2 has been revised to read, "But because surface water is rarely ingested under present land use conditions, such water is likely to contribute in only a minor way to the overall exposure of humans to contaminants."

NMED Comment

b. Please include a potential human exposure scenario of a Laboratory worker who also obtains exposures from recreational activities in or near the Canyons. [bulletized scenarios in the middle of the page]

LANL Response

b. The first bullet has been revised to read, "use by Laboratory workers engaged in occupational activities." The second bullet has been revised to read, "recreational use." The following text has been added after the bulleted list: "The approach to exposure is a modular one and assumes that scenarios are not exclusive; individuals and populations may have time-apportioned activities associated with any of the three exposure scenarios (Native American, Laboratory worker, and recreational). For example, a given individual may be a member of San Ildefonso Pueblo, work at the Laboratory, and engage in hiking activities in the canyons. Exposure results will be presented in a modular fashion for specific activities and times. Therefore, activities can be aggregated as appropriate to predict potential exposures for individuals or populations engaged in such multiple activities." This point is discussed further in the response to comment 23a.

NMED Comment

c. Please revise the fourth bullet to clarify that the scenarios will take into consideration whether or not complete exposure pathways exists (not the ". . . effects of human occupation.").

LANL Response

c. The fourth bullet was not intended to reflect complete exposure pathways or exposure to toxicants. The original (and current) intent of the fourth bullet was to acknowledge that the impact of human *activities* on biological communities extends beyond the introduction of toxicants into the environment. Activities such as fencing and livestock grazing can also alter

the ecological balance of the system and therefore need to be considered in ecological evaluation.

NMED Comment

15. Section 4.1.3, Table 4-1

a. LANL should provide a more detailed discussion of perched ground water.

LANL Response

a. This comment was rescinded in response to a phone conversation with NMED on September 30, 1997.

NMED Comment

b. Table 4-1 fails to take into consideration the influence of the dip of stratigraphic contacts on perched ground water flow direction. Other influencing factors on flow direction include grain size of geologic materials, flux through the system, and other geologic structures such as faults and fractures.

LANL Response

b. Controls on groundwater flow directions due to contrast in hydraulic properties between stratigraphic units and dips of stratigraphic contacts are addressed on page 4-6 in the sixth box under "Perched groundwater at depth." The role of fractures as groundwater pathways has been addressed on page 4-5 in the fifth and sixth boxes under "Infiltration and vadose zone flow and transport."

NMED Comment

c. Moisture content and other climatic drivers may also influence the entrainment of dust (Wind-borne dust, page 4-7).

LANL Response

c. On page 4-7, the second box under "Wind-borne dust" has been revised to read, "Entrainment, dispersal, and deposition are controlled by sediment properties, surface roughness, vegetative cover, terrain, moisture content, and other climatic factors."

NMED Comment

d. This table does not clearly consider the bioaccumulation of contaminants from the ingestion of animals and plants as a concept/hypothesis (Animal uptake, page 4-8).

LANL Response

d. The following sentence has been added to the second box under "Animal uptake" on page 4-8: "Certain contaminants can be progressively concentrated in the food chain through bioaccumulation."

NMED Comment

e. *In Table 4-1 (first row under the "Perched groundwater at depth" section), the statement "Several intermediate-depth perched groundwater zones may be present beneath large canyon systems whose headwaters are in the Sierra de los Valles . . ." may be misleading. It seems to relate intermediate depth perched groundwater to the Sierra de los Valles. LANL should revise this statement such that there is no direct relationship between intermediate-depth perched groundwater and the Sierra de los Valles.*

LANL Response

e. The first sentence in the first box under "Perched groundwater at depth" has been revised to read as follows: "Intermediate-depth groundwater may be more common in the canyon systems with large watersheds, particularly those that receive snowmelt and storm runoff from headwaters in the Sierra de los Valles."

NMED Comment

f. *LANL should also revise the same statement in Table 4-1 to exclude Sandia Canyon as having headwaters in the Sierra de los Valles.*

LANL Response

f. Reference to Sandia Canyon (as well as other canyons) has been removed from the first sentence in the first box under "Perched groundwater at depth."

NMED Comment

16. *Section 4.2.2: The following statement contradicts evidence presented in Section 3.7.5.3 (page 3-40): "Groundwater in the regional aquifer generally has long residence times . . ." Section 3.7.5.3 states that age estimates made to date reflect both short and long residence times. Please clarify.*

LANL Response

16. With the clarification to comment number 13b provided above, LANL feels that Section 4.2.2 is consistent and reflects our current understanding of groundwater flow paths and residence times within the regional aquifer.

CHAPTER 5 - TECHNICAL APPROACH

NMED Comment

17. *Section 5.0: This document contends that National Pollutant Discharge Elimination System (NPDES) -permitted discharges are not subject to corrective action because the discharges are not solid wastes. HRMB has indicated in several past Notices of Deficiency that although a PRS is a permitted outfall, it is not exempt from investigation under the HSWA Module of the RCRA permit. The NPDES program does not have provisions for Corrective Action or requirements for the remediation of contaminated areas. LANL shall investigate all PRSs known or suspected to have managed RCRA solid or hazardous wastes and/or constituents, or Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) hazardous substances.*

LANL Response

17. LANL will investigate all PRSs known to or suspected to have managed hazardous constituents or substances.

NMED Comment

18. *Section 5.1.1: This document states: "Mesa tops, alluvial and colluvial deposits on canyon walls and drainages off canyon walls may contain contaminants from individual PRSs and is characterized as part of RFIs conducted for other operable units" (paragraph following bullets 1-3, page 5-1).*

    a. *In several discussions and site visits conducted with DOE/LANL and HRMB representatives, the "deferral" of certain investigatory activities has been mentioned. The "deferral" of activities from one Field Unit (FU) to another has made it very unclear which FU is responsible for which investigatory activity. Please provide the criteria used to determine which FU will take the lead.*

LANL Response

a. FU 4 agrees that the deferral of certain investigations from one FU to another is often poorly documented, and responsibilities for completing certain investigations are poorly defined. The ER Project will investigate the need to develop a protocol for passing investigatory responsibility from one project leader to another.

NMED Comment

b. *For each individual sampling and analysis plan (SAP) provided under this core document, please provide a list of mesa top PRSs, alluvial and colluvial deposits on canyon walls and drainages off canyon walls PRSs that may affect that canyon or canyon system and indicate which FU is conducting their investigation.*

LANL Response

b. Each canyon-specific work plan will include a map showing all the PRSs within the watersheds under investigation. The maps will include specific ER Project areas of responsibility within the watershed.

NMED Comment

19. *Section 5.1.3: Please assess human health risk using a residential land use scenario. (See comment provided in the Notice of Deficiency for Operable Unit 1049 Los Alamos/Pueblo Canyon dated March 17, 1997.)*

LANL Response

19. Residential land use is associated with the American Indian land use scenario described in Section 6.5.4 of the Core Document. Specific activities and intensity of land use for a residential scenario, as defined in EPA documents such as "Use of Standard Default Exposure Factors," are incorporated into the American Indian land use scenario.

NMED Comment

20. *Section 5.2.4.1: Archival data used to support NFA decisions must include adequate analytical data [see the Corrective Action (CA) Flow process document].*

LANL Response

20. Archival data used to support NFA decisions will include all historic information including but not limited to aerial photographs, surveillance data, interviews, and engineering documents.

NMED Comment

21. *Section 5.3.5: LANL must use approved (by the AA) background data for screening chemicals of potential concern. No site should be proposed for No Further Action (NFA) if concentrations are compared to background values which have not been approved.*

LANL Response

21. LANL personnel have recently met with HRMB personnel to discuss HRMB concerns about LANL's background data. LANL is also addressing, in writing, HRMB's request for supplemental information on LANL's background document. Resolution of HRMB's concerns will result in a background data set that is approved by the AA.

NMED Comment

22. *Section 5.3.7, Decision Point Number 3: Please include the option to conduct best management practices and remedial actions at this decision point. Due to cost, time, and effectiveness, it may be more prudent to perform remedial actions rather than further evaluate the uncertainties.*

LANL Response

22. The following two sentences have been added at the end of the first paragraph in Section 5.3.7: "Because of cost, time, and effectiveness, it may be more prudent to perform remedial actions rather than perform further characterization. Therefore, best management practices and remedial actions may be initiated in lieu of further data collection."

NMED Comment

23. *Section 5.3.8.1*

    a. *LANL should refer to the American Indian as a special subpopulation (not a "conservative scenario") and shall evaluate both the adult and child American Indian exposure scenarios.*

LANL Response

    a. In the second sentence of the second paragraph in Section 5.3.8.1, the words "These conservative scenarios" have been replaced by the words "This special subpopulation." The term "American Indian land use scenario" is used to encompass a number of activities consistent with subsistence-based use of the canyons ecosystem by Native Americans. Specific activities (including farming, ranching, hunting, and the use of plant, animal, and mineral resources for artistic, ceremonial, and medicinal purposes) are described in Section 6.5.4 of the Core Document. Exposure assessment activities within a scenario will generally proceed on an activity-specific basis so that individual or population exposures may be

aggregated across activities as necessary to address stakeholder concerns. Therefore, rather than single child and adult American Indian exposure scenarios, a variety of potential exposure conditions (*for example*, scenarios) may be evaluated.

NMED Comment

b. *LANL may utilize Monte Carlo techniques; however, LANL must also calculate the reasonable maximum exposure. See Comment 37.*

LANL Response

b. LANL intends to use Monte Carlo methods primarily to analyze uncertainty and sensitivity to assist in identifying data requirements and facilitate risk-based decision-making, as described in Section 6.2 of the Core Document. Although reasonable maximum exposure (RME) estimates may be readily calculated for receptors associated with present-day recreational and LANL use of the canyons, such estimates are less readily defined for American Indian land use. The different spatial scales on which activities are based (see Figure 6-1 in the Core Document) and the variety of activities under consideration necessarily increase the importance of the subjective element in the definition of an RME estimate for American Indian land use. LANL proposes to work with NMED personnel to define an acceptable approach to estimating RME values within the American Indian land use scenario.

NMED Comment

24. *Section 5.4.2.2: Please provide an explanation why this document states that the study area for the assessment of future exposure and impacts on the Rio Grande is not clearly defined: ". . . in areas both inside and outside the Laboratory boundaries and . . . on the Rio Grande . . ."*

LANL Response

24. This comment was rescinded in response to a phone conversation with NMED on September 30, 1997.

NMED Comment

25. *Section 5.6: Per the negotiated CA Process Flow, significant modifications to the scope of work of any workplan should be provided to the AA for approval. Please include a statement indicating such.*

LANL Response

25. LANL agrees that significant modifications to the scope of work for any work plan should be provided to the AA for approval. The response to comment number 26 (below) suggests some mechanisms for communicating these modifications to the AA. In addition to the proposal under the response to comment number 26, LANL will follow the specific guidelines set forth in the Accelerated Corrective Action Process Annex.

NMED Comment

26. *Section 5.6.2.3: The generic nature of this workplan and the iterative nature of the canyon-specific or canyon aggregate-specific workplans requires enhanced AA involvement at critical decision points. At critical decision points, it appears that the canyons investigation team is making decisions that will influence the field work investigation. LANL should develop,*

document and implement a procedure to communicate more effectively with the AA on these investigations. As emphasized in the Expedited Site Characterization training course presented by DOE in May 1997, frequent faxes and meetings are recommended as a means of communicating recent activities and critical decision points and soliciting regulator input.

LANL Response

26. AA involvement at critical decision points during investigations is essential for the successful implementation of the iterative investigations proposed for the canyon systems. Significant modifications to the scope of work and critical decision points are communicated to the AA through phone calls, letters, faxes, and e-mail. Anticipated modifications to the scope of work can also be addressed in the monthly ER Project progress reports.

NMED Comment

27. *Section 5.6.3.1: This document states: "The Ancho and Indio Canyon samples were analyzed for metals. Statistical analyses of data from these completed investigations indicate that these data are probably sufficient to establish background concentrations for the remaining canyons." The AA has provided LANL a Notice of Deficiency (NOD) on the background study. LANL should refer to or include this NOD and refer to or provide all data and statistical analyses performed on the data, a map of sampling locations in support of this statement, and substantiating evidence from the other canyons indicating that this data set is appropriate for background use.*

LANL Response

27. Statistical data collected from Ancho Canyon, Indio Canyon, Los Alamos Canyon, Pueblo Canyon, and Guaje Canyon are used to determine background concentrations of metals and radionuclides in sediments. Approximately 30 background sediment samples were collected from these five canyons. In accordance with our agreement with the AA, LANL is preparing a single report that covers background chemistry in different geologic media including sediments. That report will address issues identified by the AA that deal with background investigations.

NMED Comment

28. *Section 5.6.3.2: LANL should obtain and submit samples from each discernible geomorphic unit within each canyon for full suite analyses prior to limiting the potential constituents of concern and performing limited suite analyses. The potential contaminants of concern for each geomorphic unit may vary. Obtaining samples from each unit would allow for the tentative identification of those constituents particular to each geomorphic unit.*

LANL Response

28. Samples for full-suite analyses will be collected from discernible geomorphic units with post-1942 sediments (that is, active channels, inactive channels, and floodplains) within each canyon system in initial sampling events. These data will be used in combination with historic data, surveillance data, geomorphic information, information about the locations of PRSs, and ER Project analytical data collected from adjacent upstream and downstream reaches to narrow the analyte suites for the subsequent sampling events.

NMED Comment

29. *Section 5.6.3.3: Please reference an approved methodology for evaluating risk resulting from exposure to radioactive contaminants. From the discussion presented, it is unclear how*

radiological risk at LANL will be assessed. Previously proposed human health methodology uses a bright line concentration; this document appears to propose using dose and cancer slope factors for risk determination. Neither methodology has been approved by the AA.

LANL Response

29. The approach to assessing the impacts of radiological contaminants on human and ecological receptors is discussed in Chapter 6 of the Core Document. The DOE retains administrative authority for approving the methodology for radiological assessments, although a clear description of methods and the rationale for such assessment are provided to NMED.

NMED Comment

30. *Section 5.7: In most instances, the installation of monitoring wells (as depicted in Table 5-2) significantly post-dates the activities conducted during the implementation of this workplan. Please explain how LANL intends to integrate the activities in this workplan with those in the Hydrogeologic Workplan.*

30. See the response following comment number 32.

31. *Section 5.7.1: This section does not provide an adequate explanation of the relationship of this workplan with that of the Hydrogeologic Workplan. Please revise this section.*

31. See the response following comment number 32.

32. *Section 5.7.2: This section fails to reflect the activities proposed for implementation within this workplan. Please revise this section.*

LANL Response

30. 31. 32. The technical approach for groundwater characterization set forth in the *Hydrogeologic Workplan* was integrated into the Core Document when the latter was prepared. The *Hydrogeologic Workplan* is considered the umbrella document that describes the general strategy and technical approach for conducting groundwater investigations at LANL. The Core Document provides a summary of the strategy and approach for these groundwater investigations, emphasizing those activities being funded by the ER Project. The Core Document also outlines the strategy for characterizing sediments in the canyon systems. Canyon-specific work plans will update the investigations proposed in the *Hydrogeologic Workplan* and the Core Document and will include the sampling and analysis plans that are implemented for groundwater and sediment characterization.

An iterative approach, which uses newly-collected information to modify and refocus ongoing investigations, is an essential part of both groundwater and sediment characterization efforts. The iterative approach allows investigators to continually improve the effectiveness of investigations but requires a mechanism that allows for AA approval of modifications to the scope of work for an investigation. Canyon-specific work plans will incorporate lessons learned from previous and ongoing studies and will update proposed groundwater and sediment investigations for that particular canyon system. This process provides the AA with an opportunity to review and approve evolving investigations on a canyon-by-canyon basis. Because of the iterative nature of the investigations, additional modifications to the scope of work are expected during implementation of canyon-specific work plans. As stated above for comment number 26, AA involvement at critical decision points during investigations is essential for the successful implementation of the iterative investigations proposed for the canyon

systems. Significant modifications to the scope of work and critical decision points are communicated to the AA through phone calls, letters, faxes, and e-mail.

The proposed characterization wells in Table 5-2 were prioritized by the technical staff representing both the ER Project and Defense Programs (DP). The prioritization of wells is designed to meet the goals of the *Hydrogeologic Workplan* as a whole rather than attempting to satisfy the immediate (and sometimes competing) goals of either the ER Project or DP. The prioritization is structured such that those wells installed early in the implementation of the groundwater investigations will have the largest impact on reducing site-wide hydrologic uncertainties. Early collection of critical site-wide data is essential to improving the conceptual model for hydrogeology and will provide an improved technical basis for refining the placement and characterization goals for future wells.

This approach is consistent with the goal of implementing a fully integrated groundwater investigation between the ER Project and DP, a goal endorsed by LANL, DOE, and the AA in numerous meetings before preparation of the *Hydrogeologic Workplan.*

One side effect of this approach is that ER Project wells will be installed in a sequence that is different from the surface-based work in canyon reaches. This means that surface-based investigations of canyon sediments and alluvial groundwater will proceed sequentially canyon by canyon, whereas intermediate-depth and regional aquifer wells will be installed in the sequence determined by the integrated site-wide groundwater investigation. Data developed from ongoing groundwater investigations will be reviewed annually by LANL, DOE, and the AA, and the sequence, placement, and characterization objectives of future groundwater investigation wells will be reassessed and updated.

To provide timely reporting of canyons data, summary reports will be issued on a canyon-by-canyon basis when major portions of the work are completed (for example, after completing reach investigations in a canyon system, after installing alluvial groundwater wells in a canyon, and after installing each regional aquifer well).

NMED Comment

33. Section 5.7.3

a. Please provide further discussion on the decision-making process for installing intermediate-perched zone monitoring wells.

a. See the response following comment number 33b.

b. LANL should present its rationale for determining if an intermediate perched monitoring well should be drilled. Wells monitoring the intermediate perched zone may provide valuable contaminant detection and monitoring for the regional aquifer.

NMED has expressed its concerns regarding LANL's approach to intermediate-perched ground water in the letter entitled "Comments Concerning Groundwater Contamination and Protection at Los Alamos National Laboratory (LANL), Los Alamos, New Mexico" to Mr. Kirkman from Mr. Kelley dated August 17, 1995. More specifically, the letter states "Individual zones of saturation beneath LANL have not been adequately delineated, and the hydraulic interconnection between these is not understood. A facility-wide description of ground-water flow beneath the facility cannot be made without adequate delineation of the perched-intermediate aquifer(s) beneath LANL."

LANL Response

a. b. The approach for groundwater characterization outlined in the *Hydrogeologic Workplan* and the Core Document calls for characterization of all intermediate perched zones at a particular locality by installing a regional aquifer well. This approach provides information on all perched zones in an area and allows the chemistry, distribution, and interconnections of perched systems to be assessed before intermediate perched wells are attempted. Single well penetrations targeting perched systems are risky and of questionable value when sited without supporting hydrogeologic information because of the erratic distribution of many perched systems.

Intermediate perched wells can be installed after sufficient data are collected to determine if a well is needed to monitor contaminant migration in a particular area and if the characteristics of the perched zone are found to be suitable for placement of a monitoring well. After the need for a monitoring well is established, the design, placement, and sampling of the well can be optimized based on the thickness, chemistry, gradient, hydraulic conductivity, connectivity of the perched system with other groundwater bodies, and location along flow paths relative to potential source terms. These decisions need to be made on a site-by-site basis and should be part of the annual evaluation of the *Hydrogeologic Workplan* by LANL, DOE, and the AA.

NMED Comment

34. Section 5.9: Please present proposed studies ("ecosystem receptors and biological communities") in greater detail and obtain approval prior to implementation.

LANL Response

34. LANL has developed an ecological risk assessment methodology that will address the ecological concerns over larger ecological exposure units. The canyons ecological risk assessment will follow this methodology.

The identification of flora and fauna that may provide significant exposure sources for the Native American population may necessitate inclusion of species other than those identified as primary receptors in the LANL-wide ecological approach. The identification of important biota for exposure of the Native American population is currently in progress in collaboration with the Accord Pueblos. After species have been identified, sufficiency of existing data for exposure evaluation will be determined through discussions with the AA. If additional studies are necessary, protocols will be discussed with the AA. Determination of need for LANL-specific data will result from the analyses described in the response to comment number 35.

If biota sampling is required, protocols for sampling and analysis of biota will differ from canyon to canyon due to differences in species and contaminants to evaluate, as well as the probable utilization of the species by humans. Therefore, the acceptable detection limits may vary based on soil concentrations and partitioning of contaminants in specific tissues. For these reasons, LANL proposes discussions of methods and protocols as the issues arise.

NMED Comment

35. Section 5.9.3: Issue: LANL should either conduct a screening risk assessment prior to site-specific sampling of plants, wildlife, and livestock or present the reasoning for omitting this step.

LANL Response

35. The need for site-specific biota sampling to evaluate human health exposures will result from sensitivity analyses performed on the preliminary data from reach sampling. Only species

contributing to pathways that are drivers in decision-making will be evaluated on a site-specific basis. As discussed with the AA in the September 30, 1997, meeting, this preliminary exposure assessment and identification of significant contaminants and pathways through sensitivity analyses is in effect a screening step that will direct further investigation. This iterative approach is discussed in more detail in Section 6.2 of the Core Document.

CHAPTER 6 - RISK ASSESSMENT MODELS AND APPROACH

NMED Comment

36. Section 6.2.1: For all risk-based decision making, LANL should calculate a reasonable maximum exposure. The technical approach presented only incorporates a probabilistic approach. In addition to the calculated reasonable maximum exposures, LANL may present the probabilistic approach to justify site recommendations.

LANL Response

36. Please see comment number 23b for a discussion of reasonable maximum exposures.

NMED Comment

37. Section 6.5.4: Issue: Please document a procedure for either using measure animal concentrations or calculating animal concentrations. The ecological risk assessment methodology has not been approved by the AA and will probably not require calculation of concentrations in all of these animals.

LANL Response

37. These procedures are presently being developed and are addressed by the LANL-wide approach to ecological studies.

CHAPTER 7 - REPORTING

NMED Comment

38. This Chapter should include a method by which LANL intends to communicate more effectively with the AA regarding recent activities and critical decision points and to more actively solicit regulator input.

LANL Response

38. Chapter 7 has been modified to include the approach proposed in the LANL responses to comment number 25 and comment number 26.

ANNEX I - PROJECT MANAGEMENT PLAN

NMED Comment

39. Section 2.0: The first bullet in this section states: "to determine . . . combined releases from all sites . . . that contribute residual contamination . . ." This sentence is somewhat misleading or subject to the interpretation that <u>all</u> contamination in the canyons is "residual" in nature. Please revise and clarify this statement.

LANL Response

39. The first bullet in Section 2.0 has been revised to read, "to determine to what extent portions of the canyon systems have been or are likely to be affected by the combined releases from all sites that contribute contamination to them and"

NMED Comment

40. Section 2.1.1: The opening paragraph does not include the evaluation of transport as suggested in the Executive Summary (page ES-1). Please include the evaluation of transport in this section.

LANL Response

40. The first bullet in the opening paragraph of Section 2.1.1 has been revised to state, "determine the nature, extent, and transport of Laboratory-derived contamination in the appropriate canyons."

ANNEX IV - PUBLIC INVOLVEMENT PLAN

NMED Comment

41. Section 2.7: If this quarterly technical report is synonymous with the quarterly technical report that the LANL ER Program intends to replace with the monthly Progress Tracking System report, then this section should be revised.

LANL Response

41. Reference to the quarterly technical report has been replaced with a reference to the monthly Progress Tracking System report.

APPENDIX A - MAPS

NMED Comment

a. Figure A-2: Please revise this figure to indicate if it reflects current or projected land use.

LANL Response

a. Figure A-2 (copy attached) has been revised to indicate that it represents current land use.

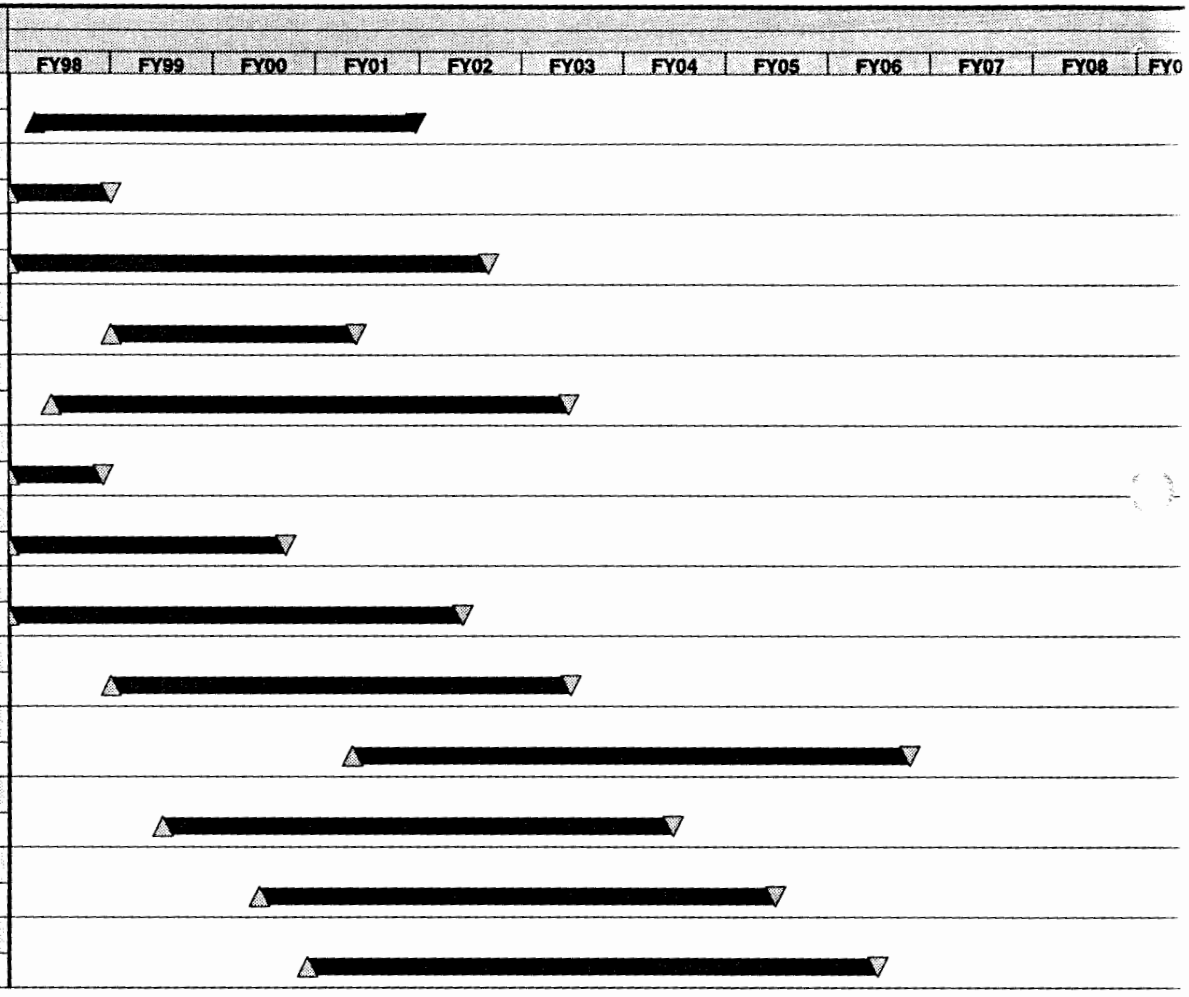
TABLE 1-1

OPERABLE UNIT 1049 CANYONS AND ASSOCIATED OPERABLE UNITS AND TECHNICAL AREAS

Canyon Groups	Associated Technical Areas	Associated Operable Units	Task/Site Work Plan Date[a]
Core Document	N/A[b]	N/A	April 1997
Group 1			
Los Alamos/DP	Former TA[c]: 1 Current TAs: 0, 2, 3, 21, 41, 43, 53, 62, 72, 73, 74	1071, 1078, 1098, 1100, 1106, 1111, 1114, 1136	November 1995
Pueblo/Acid	Former TAs: 1, 45 Current TAs: 0, 72, 73, 74	1071, 1078, 1079, 1100, 1106	
Group 2			
Mortandad and Sediment Traps	Current TAs: 3, 4, 5, 35, 42, 48, 50, 55, 59	1114, 1129, 1147	September 1997
Group 3			
Pajarito	Current TAs: 6, 7, 8, 9, 14, 18, 22, 23, 36, 40, 46, 50, 51, 54, 65, 66, 67, 69	1093, 1111, 1129, 1130, 1140, 1157	September 1998
Twomile	Current TAs: 3, 55, 58, 59, 64	1111, 1114, 1129	
Threemile	Current TAs: 14, 15, 18, 36, 67	1085, 1086, 1093, 1130	
Group 4			
Cañada del Buey	Current TAs: 5, 18, 46, 51, 52, 54	1129, 1140, 1148	September 1999
Sandia	Current TAs: 3, 53, 60, 61, 72	1100, 1114	
Group 6			
Water	Current TAs: 11, 16, 28, 36, 37, 49, 68, 71	1082, 1086, 1122, 1130, 1132, 1144	March 2000
Cañon de Valle	Current TAs: 9, 11, 14, 15, 16, 37, 67	1082, 1085, 1086, 1157	
Group 7			
Ancho	Current TAs: 33, 39, 49	1122, 1132, 1144	September 2000
Indio	Current TAs: 39, 49, 70	1132, 1144	
Chaquehui	Current TA: 33	1122	
Group 8			
Potrillo	Current TAs: 14, 15, 36, 67	1085, 1086, 1130	March 2001
Fence	Current TAs: 36, 68, 70, 71	1122, 1130	
Group 5			
Guaje	Current TAs: 74, residences	1071	June 2001
Bayo	Current TAs: 0, 10, 74, residences	1071, 1079	
Barrancas	Current TAs: 74, residences	1071	
Rendija	Current TAs: 0, 74, residences	1071	

a. Based on budgets
b. N/A = not applicable
c. TA = Technical Area

Activity Description	Orig Dur	Early Start	Early Finish
+ ARCH AND BIO SURVEYS			
	928	02JAN98	19SEP01
+ CANYONS CHARACTERIZATION(MISC)			
	249	01OCT97	30SEP98
+ DEEP WELLS			
	1,160	01OCT97	31MAY02
+ INTERMEDIATE WELLS			
	588	01OCT98	14FEB01
+ ALLUVIAL WELLS			
	1,254	02MAR98	13MAR03
+ LOS ALAMOS/PUEBLO CANYONS			
	230	01OCT97	02SEP98
+ MORTANDAD CANYON			
	673	01OCT97	15JUN00
+ PAJARITO,TWO & THREE MILE CANYON			
	1,097	01OCT97	04MAR02
+ SANDIA & CANADA DEL BUEY CANYONS			
	1,109	01OCT98	20MAR03
+ GUAJE,BAYO,BARRANCAS & RENDIJA CANYONS			
	1,361	01FEB01	14JUL06
+ WATER & CANON DEL VALLE CANYONS			
	1,238	01APR99	22MAR04
+ ANCHO,INDIO & CHAQUEHUI CANYONS			
	1,251	15MAR00	23MAR05
+ POTRILLO & FENCE CANYONS			
	1,381	01SEP00	22MAR06



Project Start 01OCT89
Project Finish 09FEB07
Data Date 01OCT97
Run Date 29OCT97

Early Bar
Progress Bar
Critical Activity

9873

Sheet 1 of 1

Figure I-1
FY98 Estimated Schedule for
Implementing Canyons Investigations

TABLE 2-2

CURRENT ENVIRONMENTAL SURVEILLANCE GROUNDWATER MONITORING WELLS

Station	Date Installed	East-West[a] Coordinate	North-South[a] Coordinate	Ground Elevation (ft MSL[b])	Depth of Casing (ft)	Depth of Screened Interval (ft)	Purpose	Geologic Unit Screened/ Comments
Regional Aquifer Wells								
DT-10	1960	1628988	1754449	7020	1409	1080–1390	Test	Basalt, Puye Formation, Santa Fe Group
DT-5A	1960	1625310	1754789	7144	1821	1172–1392	Test	Basalt, Puye Formation, Santa Fe Group
DT-9	1960	1628994	1751493	6936	1501	1040–1500	Test	Totavi Lentil and Santa Fe Group
G-1	1950	1656191	1783609	5973	2000	282–1980	Supply	Santa Fe Group, Basalt
G-1A	1954	1655241	1784353	6014	1519	272–1513	Supply	Santa Fe Group, Basalt
G-2	1954	1654210	1785123	6056	1970	281–1960	Supply	Santa Fe Group
G-3	1951	1651676	1786218	6139	1792	441–1785	Supply	Santa Fe Group, Basalt/Off line
G-4	1951	1648949	1786452	6229	1930	426–1925	Supply	Santa Fe Group, Basalt
G-5	1951	1646950	1787907	6306	1840	462–1830	Supply	Santa Fe Group, Basalt
G-6	1964	1644824	1786851	6422	1530		Supply	Santa Fe Group
LA-1A	1946	1668082	1776927	5824	870	60–865	Observation	Alluvium, Santa Fe Group/ Plugged 1993
LA-1B	1960	1668248	1776952	5602	1750	326–1690	Observation	Santa Fe Group/No pump
LA-2	1946	1666924	1777219	5651	870	105–865	Supply	Santa Fe Group
LA-5	1948	1659826	1772533	5840	1750	440–1740	Observation	Santa Fe Group/No pump
O-1	1991	1649396	1772232	*6400.9*	2497	1017–2477	Supply	Santa Fe Group, Basalt/Off line
O-4	1991	1637337	1772995	*6639.0*	2596	1115–2596	Supply	Santa Fe Group, Basalt
PM-1	1965	1647734	1768112	*6513.2*	2499	945-2479	Supply	Santa Fe Group, Basalt
PM-2	1965	1636786	1760326	*6712.0*	2300	1001–2280	Supply	Puye Formation, Santa Fe Group, Basalt
PM-3	1966	1642631	1769426	*6610.9*	2552	956–2532	Supply	Santa Fe Group, Basalt
PM-4	1981	1635717	1764674	*6916.1*	2875	1260–2854	Supply	Puye Formation, Santa Fe Group, Basalt
PM-5	1982	1632110	1767790	*7094.0*	3093	1440–3072	Supply	Puye Formation, Basalt, Santa Fe Group
TW-1	1950	1650041	1772077	*6369.9*	642	632–642	Test	Puye Formation
TW-2	1949	1634231	1777268	*6646.4*	834	779–789	Test	Totavi Lentil
TW-3	1949	1637727	1773138	*6626.9*	815	805–815	Test	Totavi Lentil

TW-4	1950	1624048	1777680	*7242.7*	1205	1195–1205	Test	Tschicoma Formation
TW-8	1960	1632574	1769507	*6875.5*	1065	953–1065	Test	Puye Formation

a. Coordinates listed are based on the New Mexico planar coordinate system as used in the maps in Appendix A of this core document. All locations are shown in Figure A-4 of Appendix A. A more complete list of wells in the Los Alamos area is available in Appendix E of the GPMPP (LANL 1995, 50124). Locations of wells are updated continually as new wells are installed and other wells are abandoned and plugged.

b. MSL = mean sea level, the elevations in italics are either surveyed or they are taken from the Digital Elevation Model for the Laboratory; these elevations are considered to be of good quality. The remaining elevations are literature values, and they are of unknown quality.

TABLE 2-2 (continued)

CURRENT ENVIRONMENTAL SURVEILLANCE GROUNDWATER MONITORING WELLS

Station	Date Installed	East-West[a] Coordinate	North-South[a] Coordinate	Ground Elevation (ft MSL[b])	Depth of Casing (ft)	Depth of Screened Interval (ft)	Purpose	Geologic Unit Screened/ Comments
Intermediate Perched Zone Wells								
TW-1A	1950	1650057	1772066	*6369.8*	225	215–225	Test	Basalt
TW-2A	1949	1634185	1777288	*6646.4*	132	127–132	Test	Puye Formation
Alluvial Groundwater Observation Wells								
APCO-1	1990	1649210	1773020	6368	19.7	4.7–14.7	Observation	Alluvium, Puye Formation/HSWA Special Permit
CDBO-4	1985	1645475	1758547	6565	12	8–12	Observation	Alluvium, Bandelier Tuff
CDBO-5	1992	1633583	1765818	6879	17	7–17	Observation	Alluvium
CDBO-6	1992	1636209	1764760	6817	49	34–44	Observation	Bandelier Tuff/ Water from PM-4 pump start-up
CDBO-7	1992	1637400	1763301	6871	44	29–39	Observation	Bandelier Tuff/ Water from PM-4 pump start-up
CDBO-8	1992	1639294	1762366	6722	23	13–23	Observation	Alluvium, Bandelier Tuff
FCO-1	1989	1642412	1751182	6509	12.4	2.4-12.4	Observation	Alluvium, Bandelier Tuff/ Dry; HSWA Special Permit
LAO-0.3	1994	1624799	1774512	6968	8.33	5.9–10.9	Observation	Alluvium/TA-2/41 specific
LAO-0.6	1994	1626748	1774333	6910	10.54	8.0–13.0	Observation	Alluvium/TA-2/41 specific
LAO-0.7	1994						Observation	Alluvium/TA-2/41 specific
LAO-0.8	1994	1627700	1774275	6887	7.5	7.5–12.5	Observation	Alluvium/TA-2/41 specific
LAO-0.91	1994	1628654	1774207	6862	9.5	9.5–14.5	Observation	Alluvium/TA-2/41 specific
LAO-1	1966	1629395	1773956	6836	25.4	8–28	Observation	Alluvium, Bandelier Tuff (?)
LAO-2	1966	1637608	1773096	6593	29	12–32	Observation	Alluvium, Bandelier Tuff (?)
LAO-3	1966	1638011	1773098	6578	24	16–32	Observation	Bandelier Tuff (?)
LAO-3A	1989	1637981	1773100	6579	15	4.7–14.7	Observation	Alluvium

LAO-4	1966	1640752	1772729	6519	24	14–24	Observation	Bandelier Tuff (?)
LAO-4.5	1969	1643659	1772088	6452	40	10–40	Observation	Alluvium, Puye Formation (/)
LAO-4.5A	1989	1643500	1772052	6460	18.5	8.5–18.5	Observation	Basalt/Dry; HSWA Special Permit
LAO-4.5B	1989	1643512	1772055	6459	34.9	24.9–34.9	Observation	Puye Formation (/) Dry; HSWA Special Permit
LAO-4.5C	1989	1643547	1772077	6458	23.3	13.3–23.3	Observation	Alluvium, Puye Formation (/) Dry; HSWA Special Permit
LAO-6	1966	1646222	1771330	6395	16	6–16	Observation	Basalt/Dry
LAO-6A	1989	1646222	1771344	6396	14.2	4.2–14.2	Observation	Alluvium, Puye Formation (/) HSWA Special Permit
LAO-B	1994	1615149	1775170	7323	14.24	11.8–26.8	Observation	Alluvium/ Background

a. Coordinates listed are based on the New Mexico planar coordinate system as used in the maps in Appendix A of this core document. All locations are shown in Figure A-4 of Appendix A. A more complete list of wells in the Los Alamos area is available in Appendix E of the GPMPP (LANL 1995, 50124). Locations of wells are updated continually as new wells are installed and other wells are abandoned and plugged.

b. MSL = mean sea level, the elevations in italics are either surveyed or they are taken from the Digital Elevation Model for the Laboratory; these elevations are considered to be of good quality. The remaining elevations are literature values, and they are of unknown quality.

TABLE 2-2 (continued)

CURRENT ENVIRONMENTAL SURVEILLANCE GROUNDWATER MONITORING WELLS

Station	Date Installed	East-West[a] Coordinate	North-South[a] Coordinate	Ground Elevation (ft MSL[b])	Depth of Casing (ft)	Depth of Screened Interval (ft)	Purpose	Comments
LAO-C	1970	1622158	1775250	7050	12.2	3–13	Observation	Alluvium/ Baseline well
MCO-3	1967	1627363	1770237	7053	12	2–12	Observation	Alluvium, Bandelier Tuff
MCO-4	1963	1631215	1769786	*6897.5*	19	14–19	Observation	Alluvium, Bandelier Tuff
MCO-4A	1989	1632028	1769700	*6886.6*	19.4	9.4–19.4	Observation	Alluvium, Bandelier Tuff/ HSWA Special Permit
MCO-4B	1990	1632036	1769695	*6886.7*	33.9	8.9–28.9	Observation	Alluvium, Bandelier Tuff/ HSWA Special Permit
MCO-5	1965	1632466	1769537	*6875.7*	46	21–46	Observation	Alluvium, Bandelier Tuff
MCO-6	1974	1633634	1769012	*6849.5*	47	27–47	Observation	Alluvium, Bandelier Tuff/ Replaces original MCO-6
MCO-6A	1989	1633633	1768961	*6849.7*	36	22.7–32.7	Observation	Alluvium, Bandelier Tuff/ HSWA Special Permit
MCO-6B	1990	1633630	1768982	*6850.3*	47.1	22–42	Observation	Alluvium, Bandelier Tuff/ HSWA Special Permit
MCO-7	1960	1634516	1768508	*6827.3*	69	39–69	Observation	Alluvium, Cerro Toledo interval
MCO-7.5	1961	1635463	1768496	*6808.9*	60	35–60	Observation	Alluvium, Bandelier Tuff
MCO-7A	1989	1634501	1768508	*6827.6*	44.8	34.8–44.8	Observation	Alluvium, Bandelier Tuff
MCO-8	1960	1636021	1768529	*6796.7*	84	64–84	Observation	Bandelier Tuff, Cerro Toledo interval/Out of service since 1977
PCO-1	1985	1637919	1759991	6687	12.3	4.3–12.3	Observation	Alluvium, Bandelier Tuff
PCO-2	1985	1641700	1757443	6618	9.5	1.5–9.5	Observation	Alluvium, Bandelier Tuff
PCO-3	1985	1646089	1755489	6547	17.7	5.7–17.7	Observation	Alluvium, Bandelier Tuff
SCO-1	1989	1642298	1769502	6619	19.3	9.3–19.3	Observation	Alluvium/Dry; HSWA Special Permit
SCO-2	1989	1647259	1767864	6501	19.4	9.4–19.4	Observation	Alluvium, Bandelier Tuff/ Dry; HSWA Special Permit

WCO-1	1989	1632759	1755069	6616	34.4	24.4–34.4	Observation	Alluvium (?), Bandelier Tuff/ Dry; HSWA Special Permit
WCO-2	1989	1636870	1753228	6625	23.5	13.5–23.5	Observation	Alluvium, Bandelier Tuff/ Dry; HSWA Special Permit
WCO-3	1989	1640213	1750620	6436	12.4	9–14	Observation	Alluvium, Basalt/ Dry

a. Coordinates listed are based on the New Mexico planar coordinate system as used in the maps in Appendix A of this core document. All locations are shown in Figure A-4 of Appendix A. A more complete list of wells in the Los Alamos area is available in Appendix E of the GPMPP (LANL 1995, 50124). Locations of wells are updated continually as new wells are installed and other wells are abandoned and plugged.

b. MSL = mean sea level, the elevations in italics are either surveyed or they are taken from the Digital Elevation Model for the Laboratory; these elevations are considered to be of good quality. The remaining elevations are literature values, and they are of unknown quality.

Source: LANL 1995, 50124

TABLE 2-3

CURRENT SPRINGS SAMPLED IN THE ENVIRONMENTAL SURVEILLANCE PROGRAM

Spring	East-West Coordinate[a]	North-South Coordinate[a]	Elevation (ft MSL[b])	Source (Geologic Unit)
Alluvial				
Water Canyon Gallery	1604144	1762562	8000	Bandelier Tuff
Intermediate				
Basalt Spring	1656544	1770762	6000	Landslide blocks over Puye Formation
Regional Aquifer				
Ancho Spring	1645644	1739962	5700	Totavi Lentil
Doe Spring	1642325	1733598	5600	Cerros del Rio maar deposits
Indian Spring	1665944	1777262	5640	Santa Fe Group (?)
La Mesita Spring	1656544	1770762	5580	Santa Fe Group (?)
Rio Spring 1	1667928	1767857	5615	Unknown
Rio Spring 2	1667312	1766348	5600	Unknown
Rio Spring 2A	1662644	1754862	5495	Landslide blocks over Santa Fe Group
Rio Spring 3	1661487	1753562	5560	Landslide blocks
Rio Spring 3A	1661520	1753298	5560	Landslide blocks
Rio Spring 3AA	1661291	1751050	5560	Landslide blocks
Rio Spring 3B	1661354	1749814	5500	Unknown
Rio Spring 4	1656028	1747887	5570	Landslide blocks
Rio Spring 4A	1656144	1747862	5570	Landslide blocks
Rio Spring 5	1656056	1742541	5770	Unknown
Rio Spring 5A	1655365	1742005	5395	Unknown
Rio Spring 5AA	1651144	1742562	5760	Unknown
Rio Spring 5B	1561044	1738162	5390	Unknown
Rio Spring 6	1648882	1735517	5380	Unknown
Rio Spring 6A	1646562	1734272	5375	Unknown
Rio Spring 7	1645044	1733562	5370	Unknown
Rio Spring 8	1644444	1733462	5370	Unknown
Rio Spring 8A	1643818	1733508	5520	Cerros del Rio maar deposits
Rio Spring 8B	1643244	1733562	5480	Cerros del Rio maar deposits

a. Coordinates listed are based on the New Mexico planar coordinate system as used in the maps in Appendix A of this core document. All locations are shown in Figure A-4 of Appendix A.

b. MSL = mean sea level

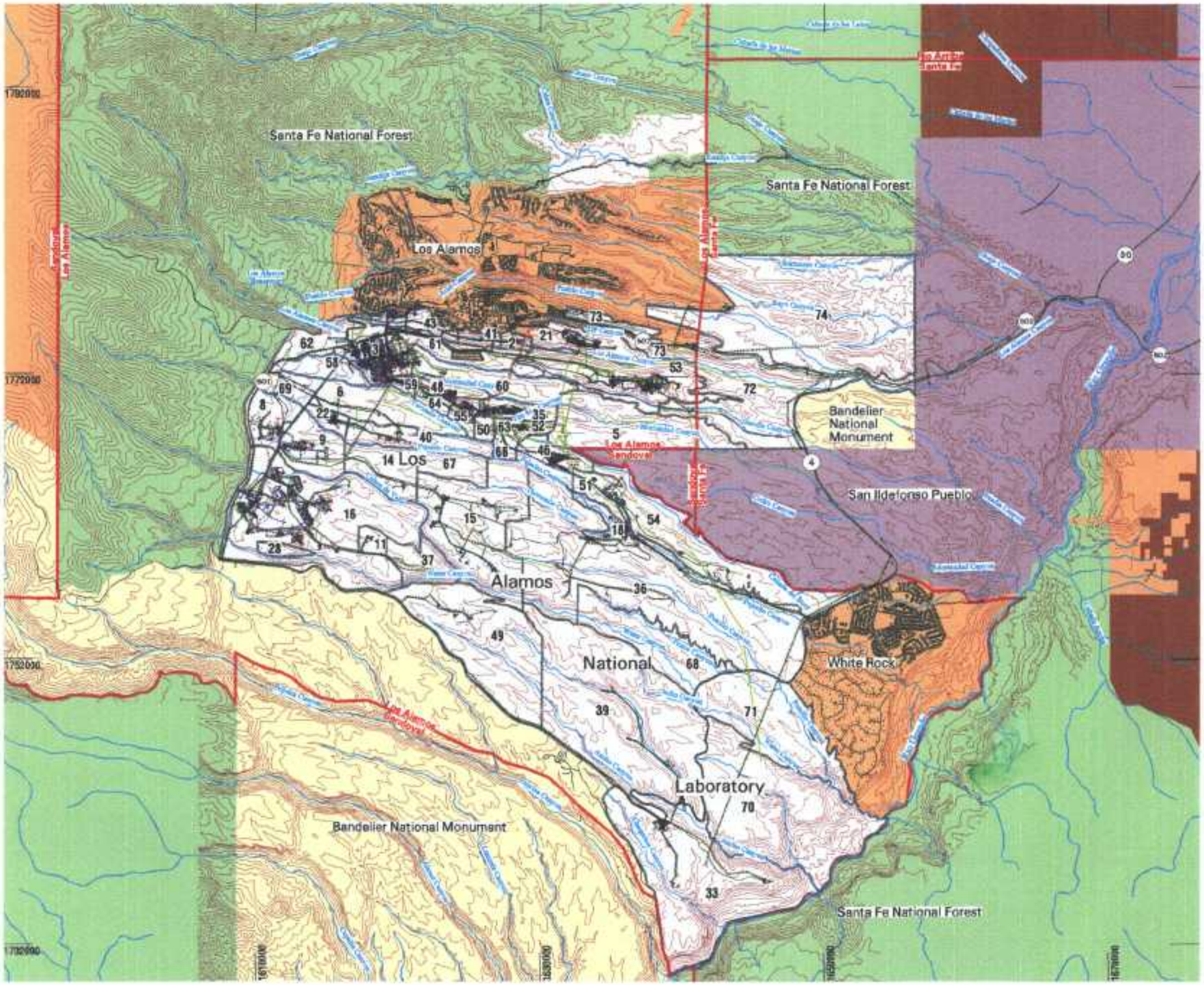


Figure A-2. Current land use map for Operable Unit 1049.

LEGEND

- Contour, 100-ft
- County Boundary
- Drainage
- Gas Line
- Industrial Waste Line
- Paved Road
- Power Line >13.2 kV
- Power Line <13.2 kV
- Radioactive Liquid Waste Line
- Sewer Line
- Storm Drain
- Technical Area Boundary
- Telephone Line
- Water Line
- Permanent Structure

- Bandelier National Monument
- Bureau of Land Management
- Pueblo Land
- Department of Energy/ Los Alamos National Laboratory
- Private and County Ownership
- Santa Fe National Forest

State Plane Coordinate System, New Mexico Central Zone, 1983 North American Datum

Grid provides NM State Plane coordinates in feet.
Grid interval, in feet: 20000

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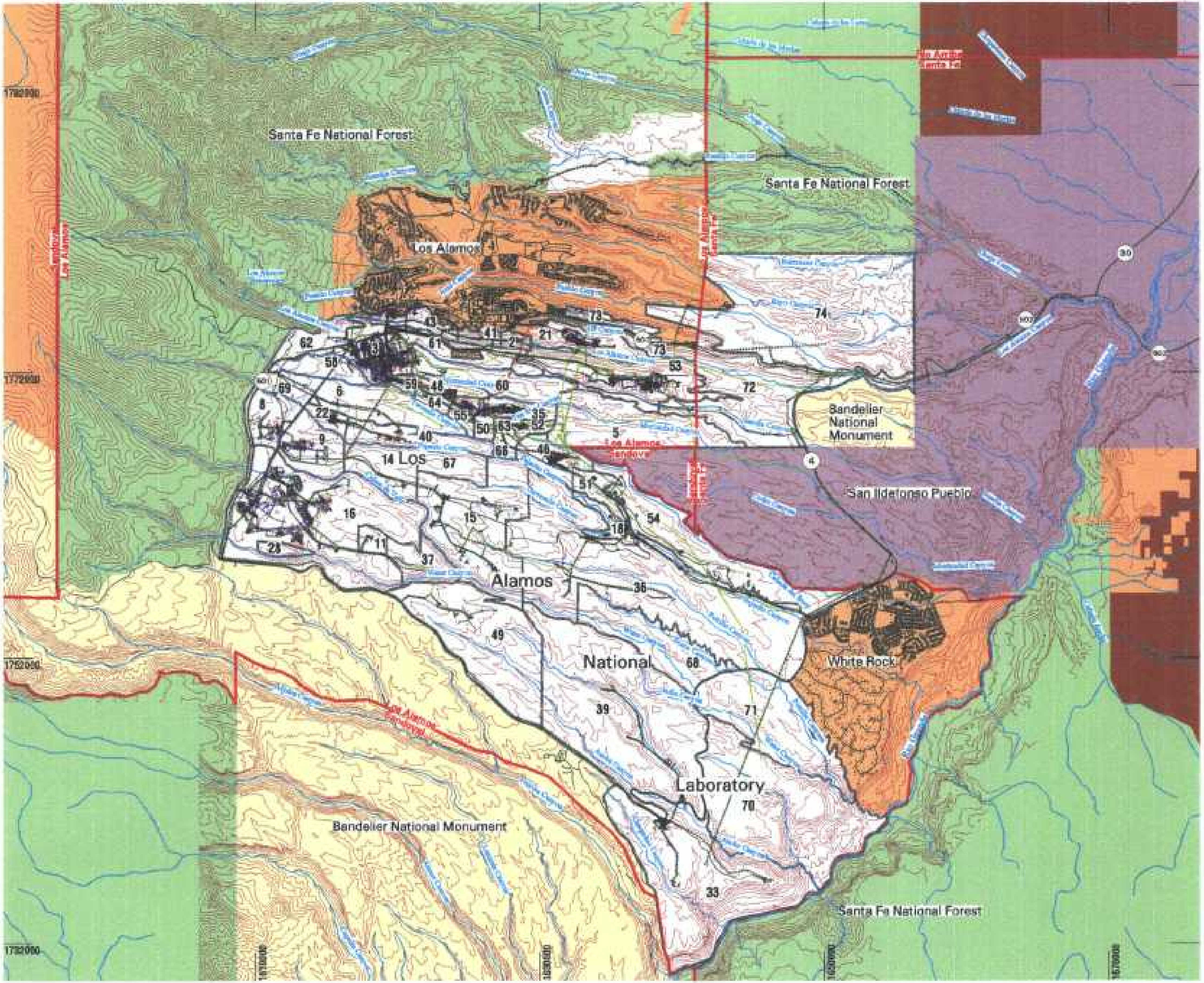

Figure A-2. Current land use map for Operable Unit 1049.

LEGEND

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State Plane Coordinate System, New Mexico Central Zone.
1983 North American Datum

Grid provides NM State Plane coordinates in feet.
Grid interval, in feet: 20000

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