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HSWA LANL 4/1049/U

RECEIVED

Date: March 31, 1998
Refer to: EM/ER:98-105

Mr. Benito Garcia
NMED-HRMB
P.O. Box 26110
Santa Fe, NM 87501

SUBJECT: SAP FOR UPPER SANDIA CANYON (FORMER FU 4, OU 1049)

Dear Mr. Garcia:

Enclosed please find the Sampling and Analysis Plan for Upper Sandia Canyon. We are submitting it to the New Mexico Environment Department for informational purposes only.

If you have any questions, please call Lynda Hartman at (505) 665-8339 or Joe Mose at (505) 667-5808.

Sincerely,

Brad Martin

Julie A. Canepa, Program Manager
LANL/ER Project

Sincerely,

for Joseph H. Mose

Theodore J. Taylor, Program Manager
DOE/LAAO

JC/rfr

Enclosure: SAP for Upper Sandia Canyon (Former FU 4, OU 1049)

TV

5546

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Sampling and Analysis Plan for Upper Sandia Canyon

Environmental Restoration Project

March 27, 1998

A Department of Energy Environmental Cleanup Program

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Los Alamos
NATIONAL LABORATORY

LA-UR-98-4893

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ACRONYMS AND ABBREVIATIONS

ASTM	American Society for Testing and Materials
BMP	best management practices
CEARP	Comprehensive Environmental Assessment and Response Program
COPC	chemical of potential concern
COPEC	chemical of potential ecological concern
DDT	dichlorodiphenyltrichloroethane
DOE	Department of Energy
DQA	data quality assessment
EM/ER	Environmental Management/Environmental Restoration (Laboratory Program)
EPA	Environmental Protection Agency
EQL	estimated quantitation limit
ER	Environmental Restoration
ESL	ecological screening level
ESH	Environment, Safety, and Health (Laboratory Division)
FIMAD	Facility for Information Management, Analysis, and Display
FOM	field operations manager
FTL	field team leader
FTM	field team manager
GG	Glorietta Geosciences
FSF	Field Support Facility
HAZWOPER	Hazardous Waste Operations (training)
HSWA	Hazardous and Solid Waste Amendments
IWP	Installation Work Plan
JCI	Johnson Controls Inc.
LANL	Los Alamos National Laboratory
NA	not analyzed
N/A	not applicable
N.A.	not available
NMED	New Mexico Environment Department
NMEID	New Mexico Environmental Improvement Division
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Heath Administration
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PMC	Program Management Company
PRS	potential release site
QAPP	Quality Assurance Project Plan

QC	quality control
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
RMRS	Rocky Mountain Remediation Services
RPF	Records Processing Facility
RSP	Radiation Screening Personnel
SAL	screening action level
SAP	sampling and analysis plan
SOP	standard operating procedure
SRS	stratified random sampling
SSO	site safety officer
SWSC	Sanitary Wastewater Systems Consolidation
SW	surface water
SVOC	semivolatile organic compound
TA	technical area
TAL	target analyte list
TSCA	Toxic Substances Control Act
TPH	total petroleum hydrocarbons
UTL	upper tolerance limit
VCA	voluntary corrective action
VOC	volatile organic compound
WM	waste manager
WQCC	Water Quality Control Commission
WWTP	waste water treatment plant

1.0 INTRODUCTION

This sampling and analysis plan (SAP) describes the investigation planned for Upper Sandia Canyon as part of Los Alamos National Laboratory's (LANL's) Environmental Restoration (ER) Project. The investigation will emphasize the wetland area within Upper Sandia Canyon, and it will determine the nature and extent of contamination and inventory of contaminants in sediments and surface water, the storm water quality, the current risk posed by contaminants to ecological and human receptors, and the potential for future contaminant transport in Upper Sandia Canyon. In addition, this investigation will evaluate the need for corrective action to mitigate risk to human and ecological receptors and off-site transport of contaminants. This investigation will be implemented in a manner generally consistent with the approach described in the Core Document for Canyons Investigations, and it will integrate with future assessments of Sandia Canyon by the LANL ER Project Canyons Focus Area (LANL 1997, ER ID# 55622).

Included in this SAP are the site description, problem definition, historical data, regulatory context, sampling approach, and sampling implementation plan. Guidance on the LANL ER Project's overall approach to site investigation, as well as the general history of the Laboratory, is available in the LANL ER Project Installation Work Plan (IWP) (LANL 1996, ER ID# 55574). The IWP also includes the LANL ER Project Quality Assurance Project Plan (QAPP), which describes the requirements for personnel training, sample handling and custody, and data management, review, validation, and verification. When appropriate, this SAP will reference the administrative procedures, quality procedures, and standard operating procedures (SOPs) included in the QAPP.

An investigation of Upper Sandia Canyon was determined to be necessary based on the ecological sensitivity of the wetlands and the presence of polychlorinated biphenyl (PCB) contaminants at numerous potential release sites (PRSs) within the upstream portion of the watershed, especially at PRS 3-056(c). During the remedial action at PRS 3-056(c), the extent of contamination was observed to be greater than initially suspected (for more detailed information, see Appendix B). Human health and ecological risk assessments conducted to address residual levels of PCBs and other chemicals at PRS 3-056(c) identified ecological risk as the remedial action decision driver for the site. These risk assessments also identified upper Sandia Canyon as the key location for assessing the potential impacts of residual contamination. Preliminary samples of wetland sediments and sediments transported in surface water collected up-canyon from the wetland were found to contain detectable quantities of PCBs (only PCB analysis was conducted on these samples). Samples from the internal-organs and fat-tissue of small mammals collected in the wetland also showed detectable quantities of PCBs. In addition to releases documented for PRS 3-056(c), there are known PCB releases at other sites within the upper Sandia Canyon watershed. This suggests that other PCB sources in addition to PRS 3-056(c) may have contributed and may still be contributing to the PCB inventory in the Sandia Canyon wetland. The presence and distribution of non-PCB contaminants is unknown at this time. This is the primary data gap that necessitates the sampling and analysis proposed in this plan. Characterization of all potential contaminants in the wetland is an appropriate next step to define the nature and extent of contamination in upper Sandia Canyon. The need for additional sampling will be determined after completion of the preliminary risk assessment for the upper Sandia Canyon watershed.

1.1 Investigation Objectives

This sampling and analysis plan is designed as the first step to answer the following questions.

1. What are the nature, extent, and inventory of PCBs and/or other contaminants in upper Sandia Canyon sediments?

2. Do elevated concentrations of PCBs or other contaminants pose an unacceptable risk to ecological receptors or humans?

3. What is the nature of contaminant transport and mobility, and the potential for down-canyon or vertical transport of contaminants in surface water and sediment?

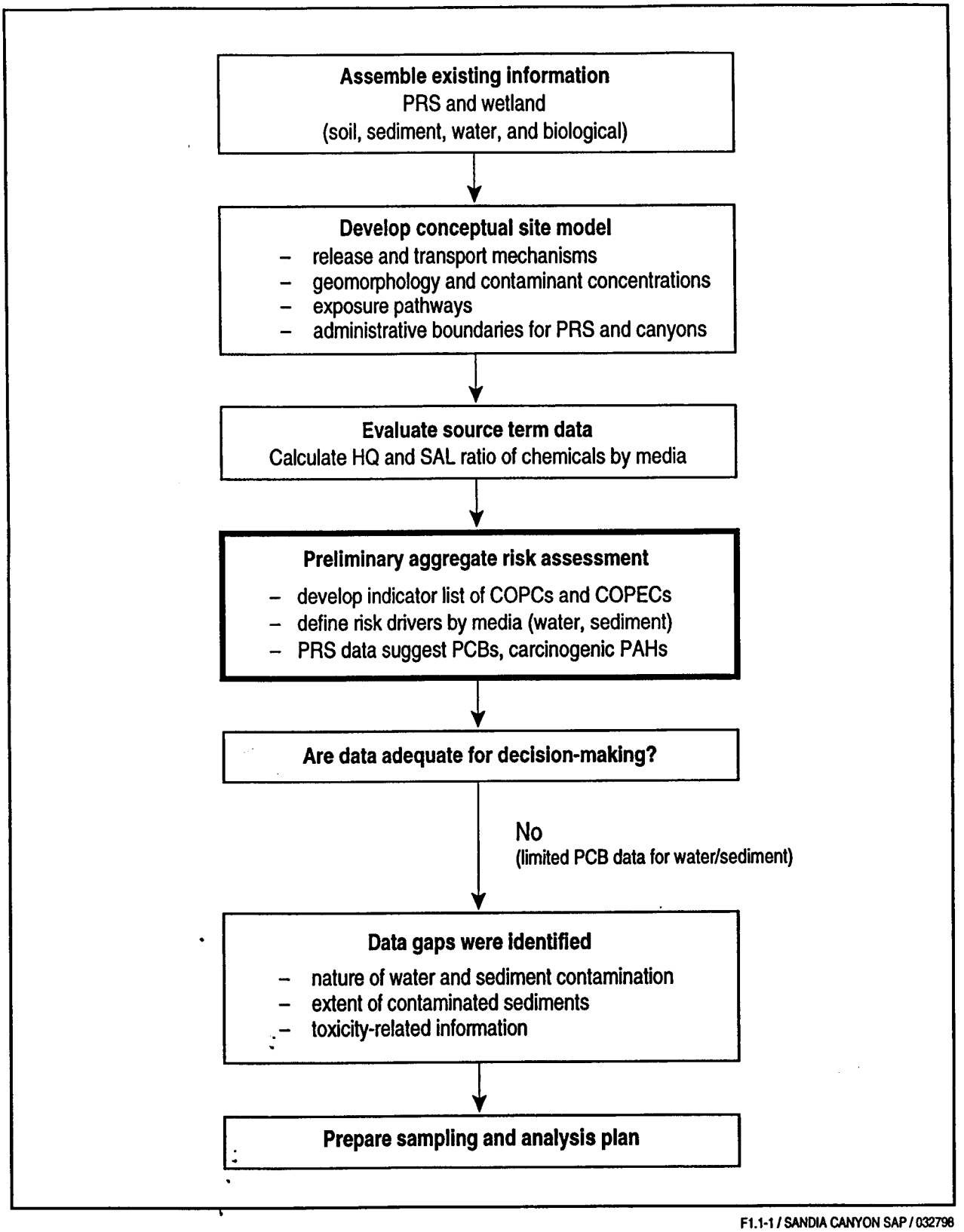
4. What are the appropriate best management practices (BMPs) or interim measures to mitigate off-site transport or unacceptable risks?

The steps followed to produce this sampling and analysis plan are summarized in Figure 1.1-1. The initial step was to compile existing information on upper Sandia Canyon and the relevant PRSs. Data were identified for source PRSs (soil concentrations) and the wetland or contributing drainages (sediment, surface water, and biological information). The next step was to develop a conceptual site model that includes information on release and transport mechanisms, geomorphology and expected contaminant concentration, and receptor exposure pathways. The upper Sandia Canyon conceptual model was developed based on the "Core Document for Canyons Investigations" work plan (LANL 1997, ER ID# 55622).

The conceptual release and transport model for surface water and sediment transport is presented in Figure 1.1-2. This model shows the location of the known or suspected PRS sources, potential nonpoint contaminant sources, and the main contaminant transport mechanisms (surface water runoff and erosion). Contaminated sediments are expected to be localized to geomorphic units, or sediment packages, that relate to the time period of the PRS source releases occurring after approximately 1945. Contaminated geomorphic units represent potential secondary sources for future contaminant migration. It is assumed that surface water, groundwater, sediments, and biota represent the potentially impacted media.

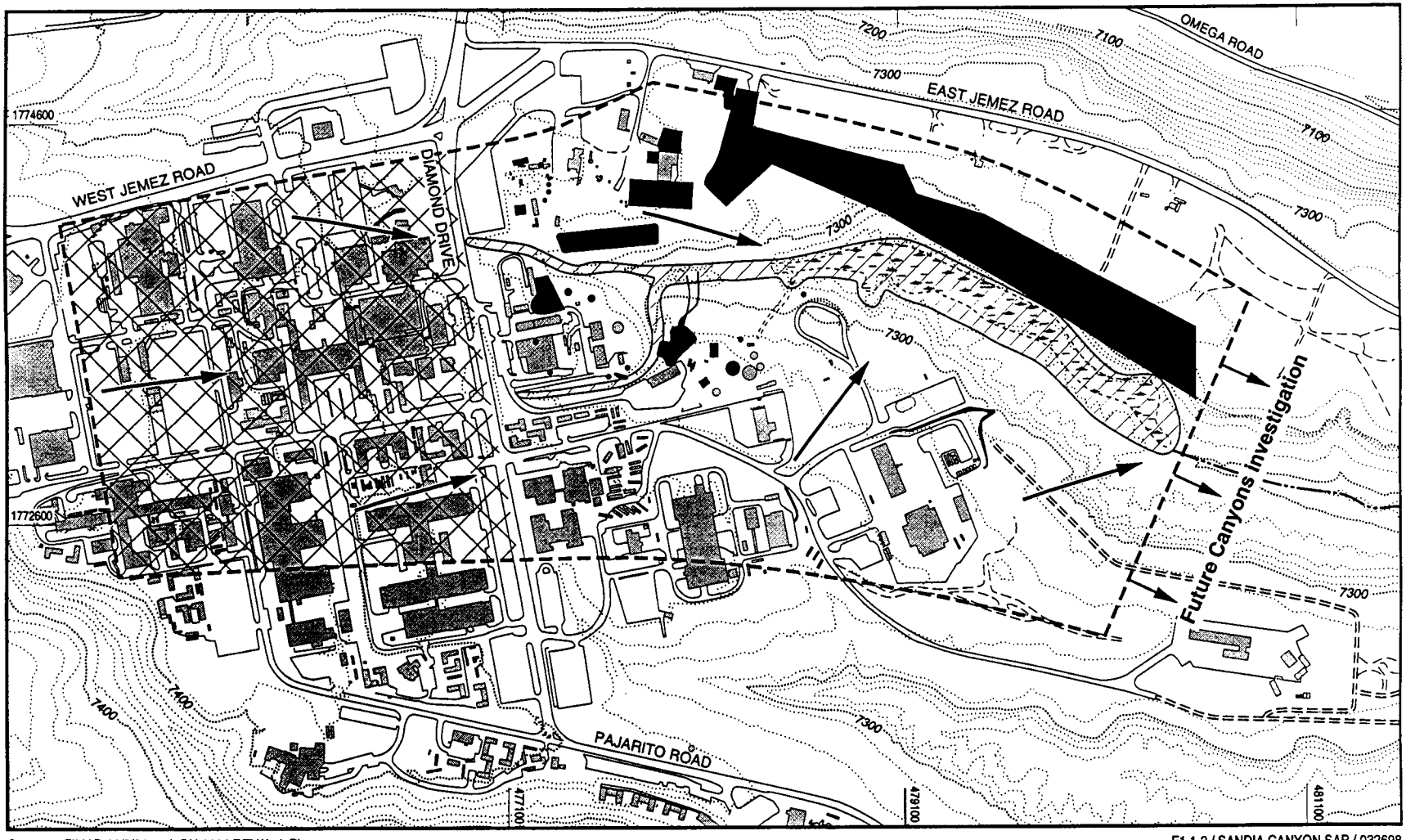
The conceptual exposure model is presented in Figure 1.1-3. This model shows the media receiving contaminants, the fate and transport of releases in environmental media, and the exposure pathways used in the ecological and human health risk assessments. This investigation will provide data to refine the conceptual model, and will use the pathways presented in the model to estimate the risk associated with the site and the potential for future transport of contaminants. The biological pathways include both aquatic and terrestrial ecological food chains. If needed, air, groundwater, and biological sampling will be conducted after information on the source term has been gathered and refinements have been made to the conceptual model. Air, groundwater, and biological investigation plans will be provided, as necessary, in addenda to this SAP.

Existing data, primarily for source PRSs in the upper Sandia Canyon watershed, were evaluated to help determine which chemicals are likely risk drivers for human and ecological receptors. It was determined that the existing PRS and wetland data were inadequate primarily as a result of the limited analytical data for wetland surface water, sediment, and biological samples (data were only available for PCBs).



F1.1-1 / SANDIA CANYON SAP / 032798

Figure 1.1-1. Summary of the process used to develop the upper Sandia Canyon SAP.



Sources: FIMAD 11/8/91 and OU 1114 RFI Work Plan

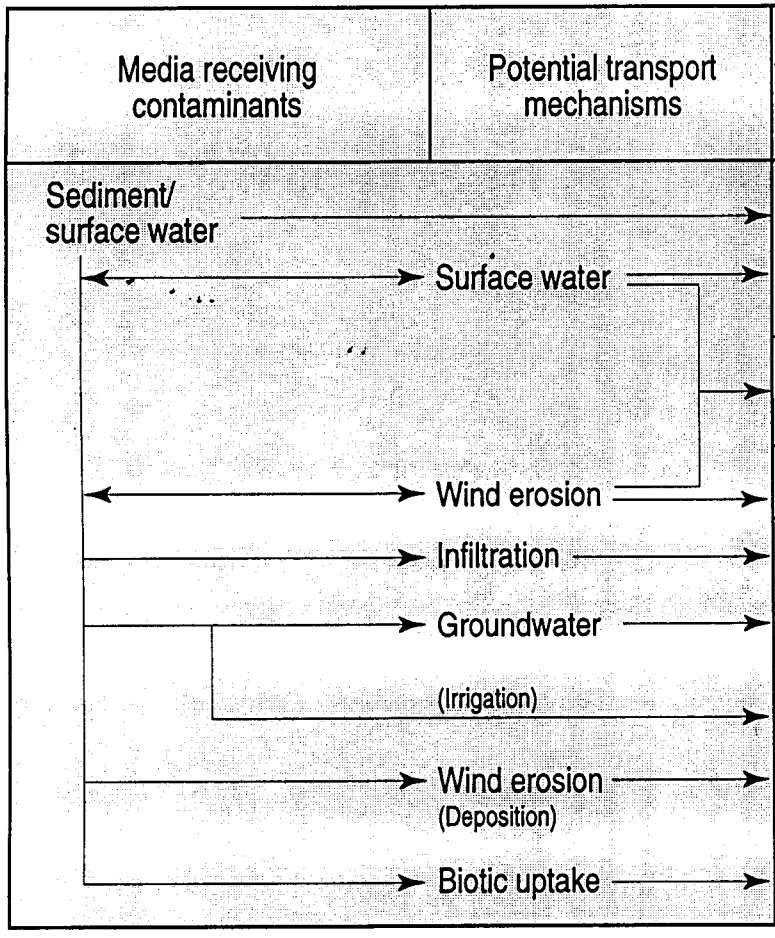
F1.1-2 / SANDIA CANYON SAP / 032698

0 500 1000 ft

Coordinates are NMSP NAD-83

Building/structure
Paved road
Unpaved road
Contour interval 20 ft
Direction of water flow
Watershed boundary
Wetland area
Upper Sandia Canyon investigation area
PRS location
Non-point source of contamination

Figure 1.1-2. Conceptual release and transport model for surface water and sediment transport for upper Sandia Canyon.



Exposure		Human receptors		Ecological receptors	
Medium	Route	Worker	Recreational	Terrestrial	Aquatic
Sediment	Ingestion	♦	♦	♦	♦
	Dermal	♦	♦	♦	♦
	External	♦	♦	♦	♦
Surface water	Ingestion	—	♦	♦	♦
	Dermal	—	●	●	♦
Air	Inhalation	♦	♦	●	●
Groundwater	Ingestion	—	♦	—	—
	Inhalation	—	—	—	—
	Dermal	—	●	—	—
Plants and Animals	Beef cattle	—	—	—	—
	Game	—	—	♦	♦
	Garden/poultry	—	—	—	—
	Wood/fuel	—	—	—	—
	Wild plants	—	♦	♦	♦

F1.1-3 / SANDIA CANYON SAP / 032698

♦ Primary exposure pathway

— Pathway not evaluated

● Secondary exposure pathway (quantitatively evaluated only if sample data or modeling indicate that significant exposure may occur)

Figure 1.1-3. Conceptual model for upper Sandia Canyon.

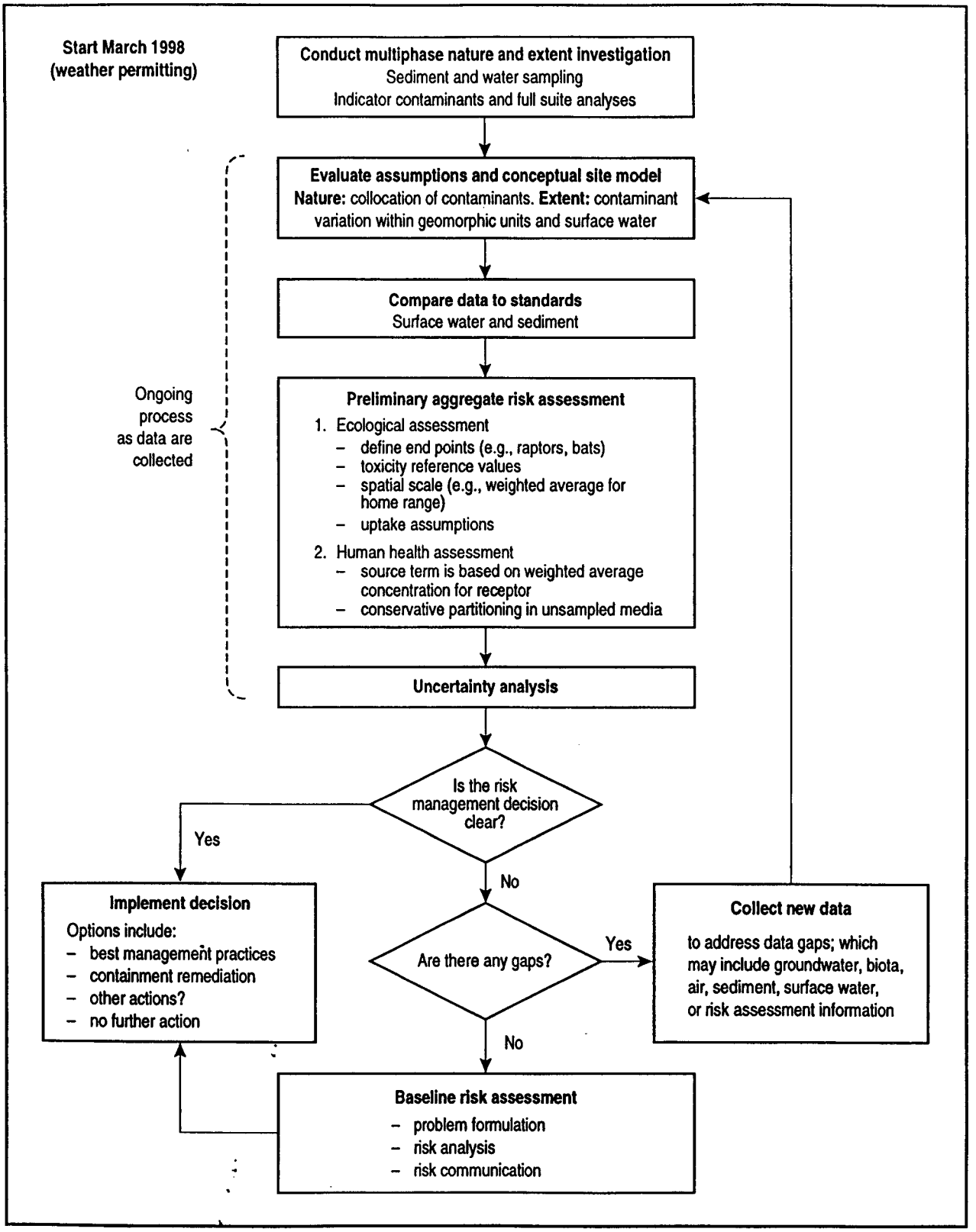
To help establish the data needs for the upper Sandia Canyon investigation, a data-use decision logic was developed (Figure 1.1-4). This decision flow chart shows how the phased characterization will be used to evaluate data, determine the need for additional data, or prepare a baseline risk assessment. A key component of the data assessment strategy is the use of a preliminary risk assessment to evaluate data in an ecological and human-health risk context. The first step in the preliminary risk assessment is an evaluation of the key assumptions used to develop the sampling approach, including the conceptual site model. The preliminary assessment will be based on realistic estimates of the contaminant source term and conservative assumptions to estimate contaminant concentrations in unsampled media (e.g. biota and air). The source term will be calculated based on the human health receptor activity being modeled or the home range of the ecological receptor. If, after this preliminary assessment, a decision can be made, then this upper Sandia Canyon investigation is viewed to be complete. Thus, the key question is whether preliminary risk information is adequate for decision-making. This question will be answered by Laboratory representatives in partnership with the appropriate regulatory authorities.

1.2 Site Description

Sandia Canyon originates on LANL property east of Diamond Drive, and the watershed includes portions of Technical Areas (TAs) 3, 60, and 61. PRSs within the upper Sandia Canyon watershed are shown in Figure 1.2-1. Some of these PRSs have been sampled and the existing data are summarized in Section 1.3.

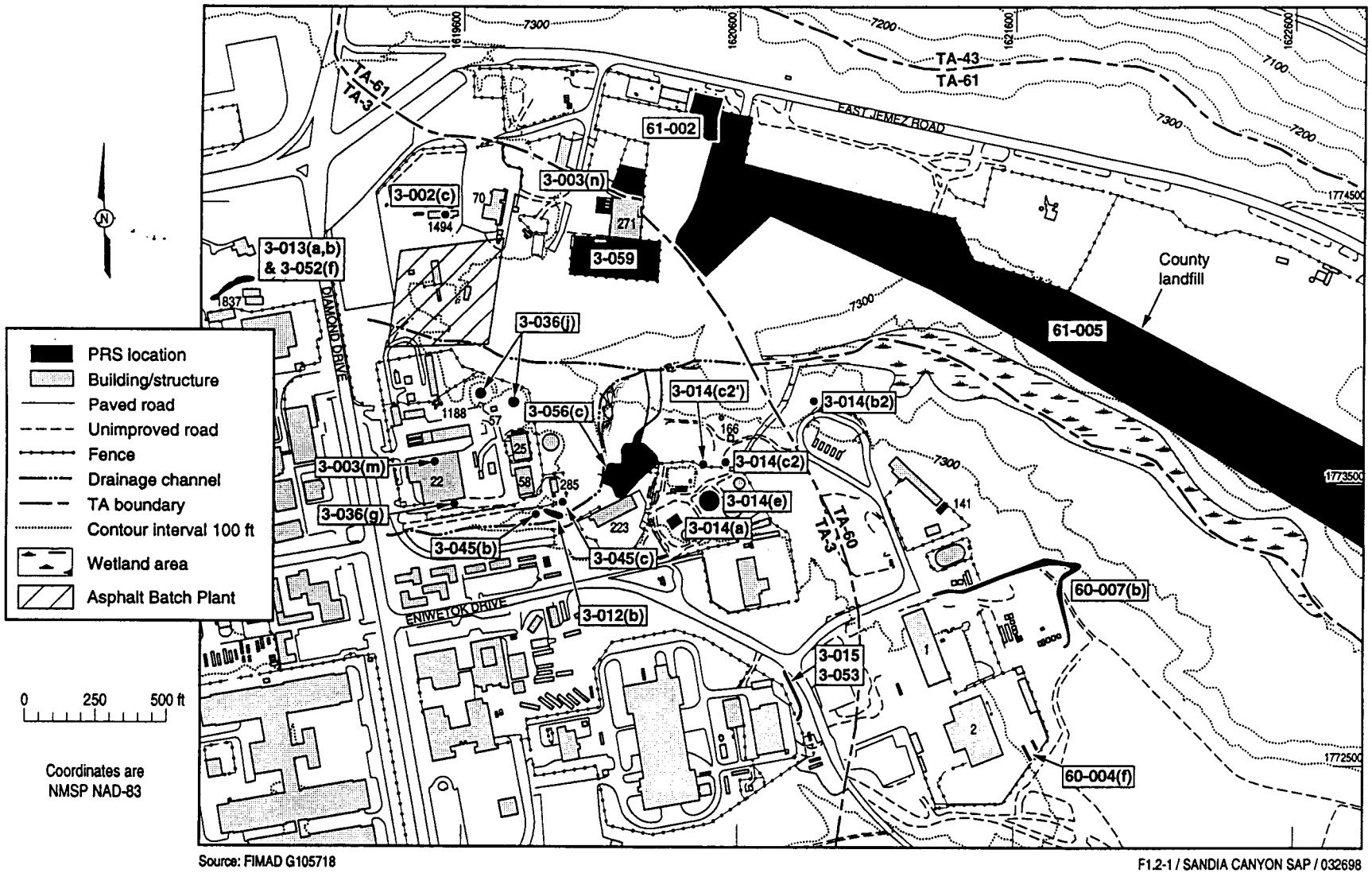
Upper Sandia Canyon is cut into Units 3 and 4 of the Tshirege Member of the Bandelier Tuff, and it includes a north tributary, a south tributary, and a wetlands area. The two tributaries are located east of Diamond Drive, and they join west of a large rubble pile that bridges the canyon. A wetland occupies the canyon bottom immediately east of the rubble pile (Figure 1.2-2). The estimated length of the northern tributary from Diamond Drive to the confluence with the southern tributary is approximately 1080 ft. The estimated length of the southern tributary from Diamond Drive to the western edge of the rubble pile is approximately 1775 ft. The estimated length of the wetland from the eastern edge of the rubble pile to the eastern edge of the wetland is approximately 2275 ft (Figure 1.2-2).

Expansion of the wetland in upper Sandia Canyon from 1958 to 1991 has been estimated by reviewing a sequence of aerial photographs. The wetland changes are illustrated in Figure 1.2-3. Information obtained from the series of aerial photographs will be used to provide information on the source of sediment and the locations of sediment that may contain contaminants.



F1.1-4 / SANDIA CANYON SAP / 032698

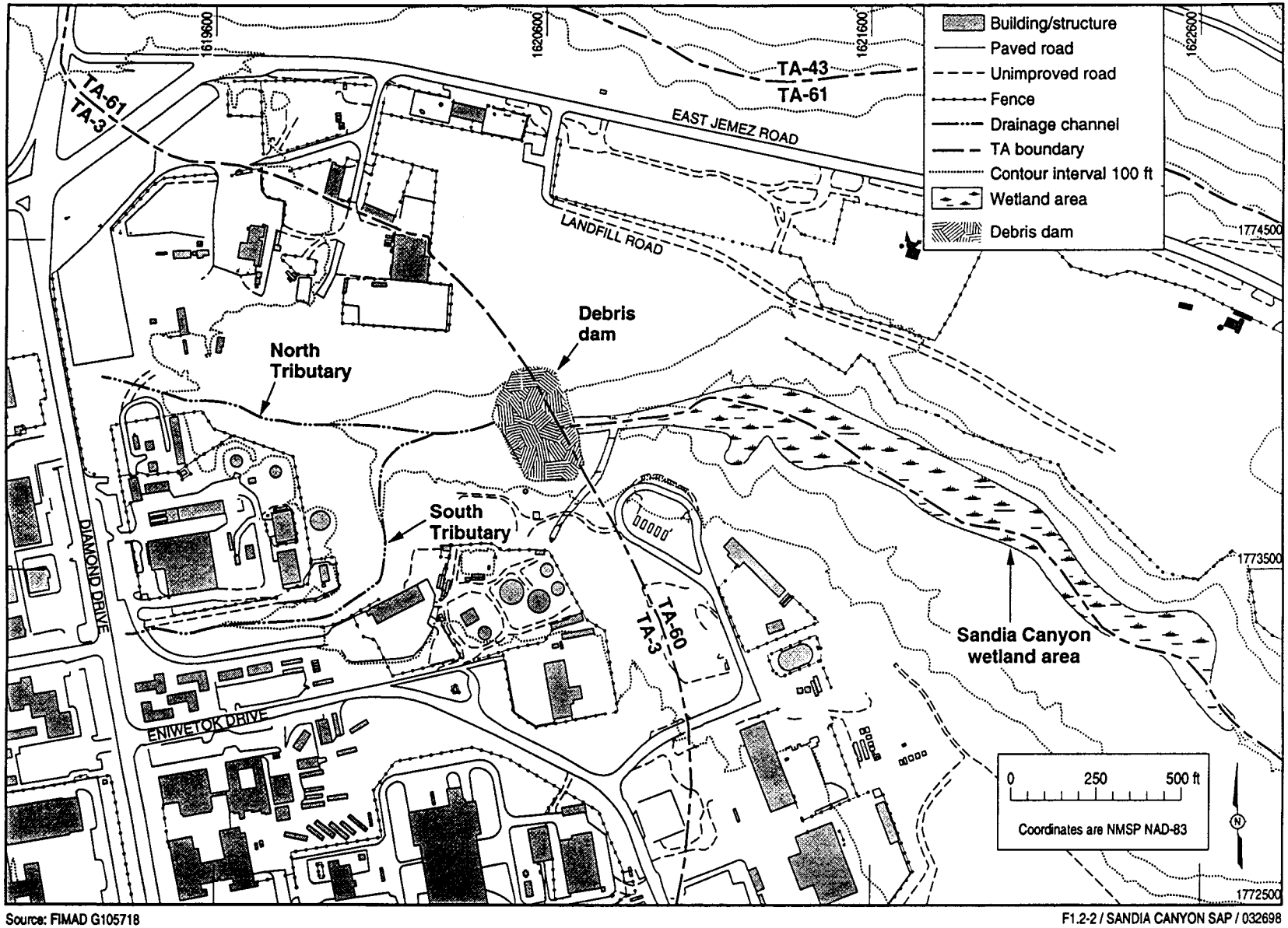
Figure 1.1-4. Upper Sandia Canyon data use decision logic diagram.



Source: FIMAD G105718

F1.2-1 / SANDIA CANYON SAP / 032698

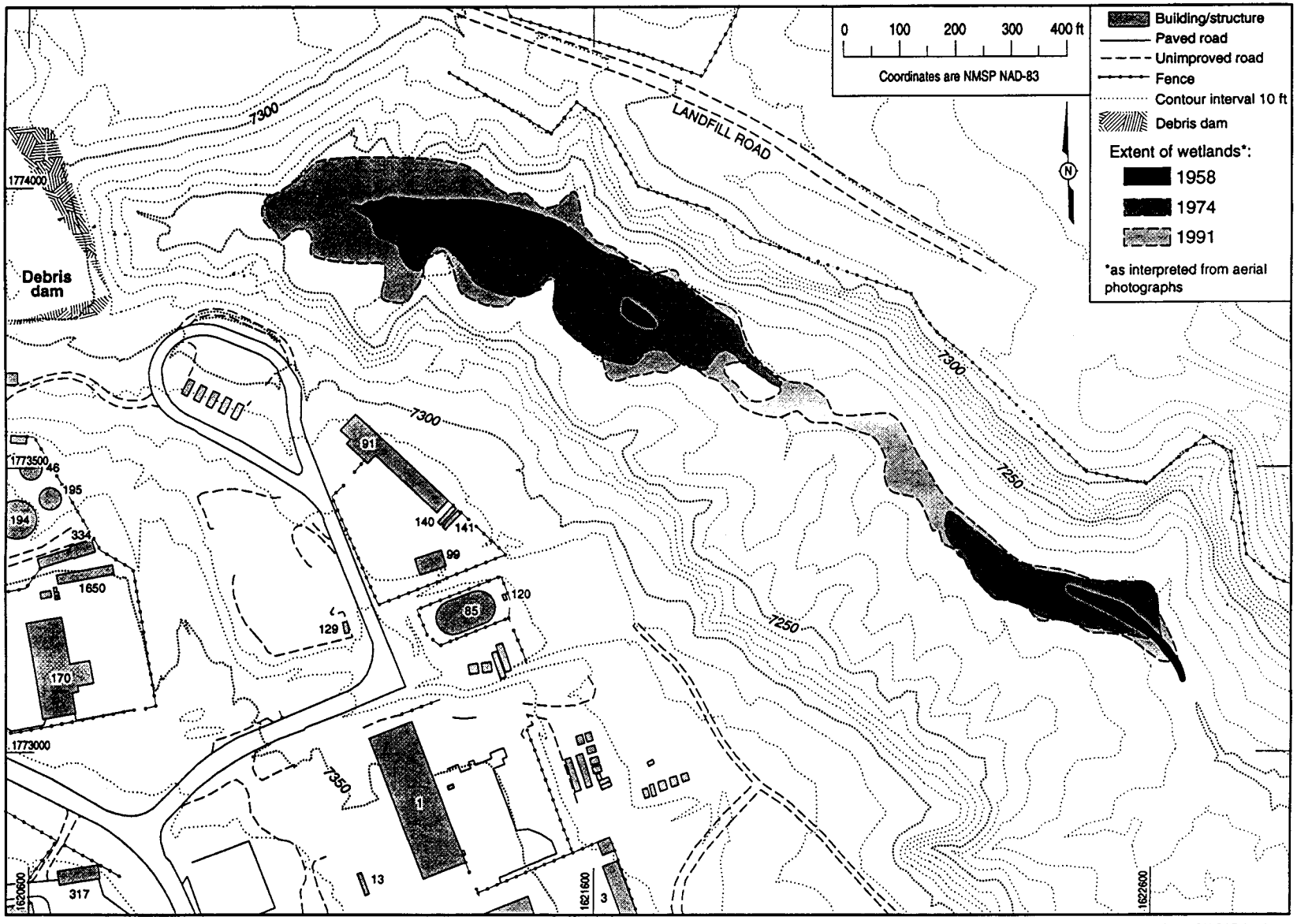
Figure 1.2-1. Locations of PRSs contributing to the watershed at upper Sandia Canyon.



Source: FIMAD G105718

F1.2-2 / SANDIA CANYON SAP / 032698

Figure 1.2-2. Locations of tributaries, wetlands, and other features at upper Sandia Canyon.



Source: FIMAD G105718

F1.2-3 / SANDIA CANYON SAP / 032698

Figure 1.2-3. Approximate extent of wetlands in Sandia Canyon during 1958, 1974 and 1991.

Current and former sources of water for Sandia Canyon include the following waste water treatment plant (WWTP) outfalls, power plant outfalls, and storm drains:

- the former rolling mill outfall (PRS 3-015, National Pollutant Discharge Elimination System [NPDES] permit EPA04A140), which received effluent from janitor sinks, floor drains, and roof drains until early 1993 when the outfall was decommissioned;
- the current TA-46 (via TA-3) WWTP outfall (PRS 3-014[b2], NPDES permit EPASSS01S);
- the TA-3 storm drain outfall for the Johnson Controls Shop Building (TA-3-38) (PRS 3-013[a,b], NPDES permit EPA03A023), which receives storm water from two grated inlets and leads into the head of Sandia Canyon;
- the motor pool drainage area (PRS 60-007[b]), which is a storm drainage ditch located north of the motor pool building (TA-60-1);
- two TA-3 power plant outfalls (PRS 3-012[b], NPDES permit EPA01A001; and PRS 3-045[c], NPDES permit 03A028);
- the former TA-3 WWTP abandoned outfall (PRS 3-014[c2], NPDES permit NM0024210 from 1975 to 1985); and
- the asphalted surfaces of TA-3 west of Diamond Drive, from which storm water drains into the north and south tributaries leading into upper Sandia Canyon.

Details of the site history for each PRS in this list are included in Appendix B of this sampling and analysis plan.

1.3 Existing Data and Historic Information

A variety of data currently exist from within the upper Sandia Canyon watershed, including PRS data, sediment and storm/surface water data, and biological data. These include data from Resource Conservation and Recovery Act (RCRA) facility investigations (RFIs), voluntary corrective actions (VCAs), and LANL's Environment Safety & Health (ESH) monitoring. The existing data were examined to compile the list of chemicals of potential concern (COPCs) for upper Sandia Canyon. The following discussion individually addresses the data from PRS, sediment, surface and storm water, landfill, and biological investigations associated with upper Sandia Canyon.

PRS Investigations. Each point source (PRS) and nonpoint source that historically or currently could be a potential contaminant contributor to the upper Sandia Canyon Wetland is listed in Table 1.3-1. The sites in Table 1.3-1 are either potential current-day major or minor sources of contamination to the wetland, or a past major or minor sources of contamination to the wetland. A brief history of each site listed in Table 1.3-1 is presented in Appendix B of this SAP. The historical information includes discussion of the source of contamination and COPCs for each site, along with the samples collected and contaminants detected. The locations of these sites are shown on Figure 1.2-1.

The contaminants detected from the sites listed in Table 1.3-1 are further evaluated in Table 1.3-2, which includes data that exceeded background upper tolerance limits (UTLs) for metals and radionuclides, and all detected organic constituents.

TABLE 1.3-1

POTENTIAL WETLAND CONTAMINANT SOURCES

Major Sources (COPCs exceeding SAL and/or PCBs exceeding 10 ppm)	Minor Sources (COPCs exceeding background but less than SAL and/or PCBs less than 10 ppm)
Current/Active PRSs	**Current/Active PRSs**
3-012 and 3-045(b): TA-3 Power Plant outfall	3-014(b2): TA-3 WWTP current outfall
3-013(a,b) and 3-052(f): TA-3 storm drain outfall	3-059 and 3-003(n): Former JCI salvage yard
3-014(c2): TA-3 WWTP storm drain outfall 3-014(c2'): TA-3 WWTP abandoned outfall	60-007(b): Motorpool storm drain areas
3-045(c): TA-3 Power Plant outfall	
Historical/Inactive PRSs	**Historical/Inactive PRSs**
3-014(a,e): TA-3 WWTP soil contamination	3-002(c): Former pesticide storage shed
3-003(m): TA-3 Power Plant capacitor banks	3-036(g): TA-3 Power Plant neutralization tank
3-015 and 3-053: TA-3-144 roof/floor drain outfall	3-045(a): TA-3 Power Plant outfall, if removed
3-036(j): TA-3 Power Plant diesel tanks	60-004(f): Motorpool outdoor storage pads
3-056(c): Outdoor transformer storage PCB soil contamination	61-002: TA-61-23 outdoor storage area 3-036(a,c,d,e) and 3-043(a,b,d,f,g,h): TA-3 Asphalt Batch Plant Emulsion Tanks, removed
Other Potential Contaminant Contributors to the upper Sandia Canyon Wetland	
Nonpoint source storm water from TA-3 (east of Diamond Drive). See Table 1.3-5	
Sediment loading from the Los Alamos County Landfill, PRS 61-005	

Using the data from source PRSs listed in Table 1.3-2, a relative toxicity ranking for human health and ecological risk assessment was performed. The objective of this analysis was to provide a ranking of the relative toxicity of the source PRS chemicals. To put the PRS data into context of potential human health effects, the maximum value and weighted average for each chemical were divided by the Laboratory human health screening action levels (SALs). To assess the relative toxicity to ecological receptors, the maximum PRS value and weighted PRS average for each chemical were divided by the minimum ecological screening levels (ESL) expressed in units of mg/kg of soil. The ESLs were calculated for seven ecological receptors (plant, insect, field mouse, shrew, raptor, and fox). These ESL values have not been approved for decision making in the RCRA corrective action process. The ESLs are only provided to give the reader a sense of the relative toxicity of chemicals present in PRS in the upper Sandia Canyon watershed. The weighted average for the source-PRS data was calculated by multiplying the average of detected results by the detection frequency for the chemical. This analysis suggests that PCBs (mixed Aroclors) and carcinogenic polycyclic aromatic hydrocarbons (PAHs) (specifically benzo[a]pyrene and dibenz[a,h]anthracene) represent the risk drivers for potential human health effects, and that chromium (if hexavalent), arsenic, and PCBs (mixed Aroclors) represent the ecological risk drivers (Table 1.3-3). The current Laboratory ESL database lacks information for pesticides, and because of known effects of pesticides on birds, pesticides should be included on the list of potential ecological risk drivers. Many of these chemicals are also bioaccumulators and some other chemicals (e.g. mercury) would be added due to their bioaccumulative potential. Thus, sampling upper Sandia Canyon will determine the presence of PCBs, pesticides, PAHs, and metals as part of the overall nature and extent characteristics. Volatile organic compounds (VOCs) are not expected to remain on sediments during transport and no VOC releases are known to have occurred directly into canyon bottom sediments. Therefore, VOCs are not included in the COPC list for the upper Sandia Canyon investigation. In addition, dioxins are not include on the COPC list because there is no reason to expect them to be present at the site.

TABLE 1.3-2

SUMMARY OF INORGANICS ABOVE BACKGROUND AND DETECTED ORGANICS FOR SAMPLED PRSs IN THE UPPER SANDIA CANYON WATERSHED

									Number of Detects at PRS													
Analyte Code Desc	Std Rptg Units	Number of Results	Number of Detects	Minimum Detect	Maximum Detect	Average of Detects	Weighted Average	PRS ID with Max Detect	03-002(c)	03-012(b)	03-013(a)	03-013(b)	03-014(a)	03-014(b2)	03-014(c2)	03-014(e)	03-015	03-056(c)	03-056(k)	60-004(f)	60-007(b)	61-002
Antimony	mg/kg	77	3	0.69	4.5	2.60	0.10	03-013(a) 03-013(b)			1	1								1		
Arsenic	mg/kg	79	32	0.99	10.1	3.34	1.35	03-012(b)	1	2			2	1	1	2	4		11	8		
Barium	mg/kg	79	61	21	341	112	86.4	03-002(c)	6	2			6	1	8	6	4		11	12	1	4
Cadmium	mg/kg	77	22	0.19	7.3	2.43	0.69	03-014(c2)	1	2			6		6	6				1		
Calcium	mg/kg	64	62	636	16300	3297	3194	03-002(c)	6		5	5	5		10	5			11	12	2	1
Chromium	mg/kg	81	81	2.3	2080	56.1	56.1	03-012(b)	6	5	6	6	6	5	10	6	4		11	12	2	2
Copper	mg/kg	64	54	4	220	42.4	35.8	03-014(a) 03-014(e)	3		5	5	6		8	6			11	6		4
Cyanide, Total	mg/kg	26	25	0.45	33.9	8.34	8.02	03-014(b2)		5			4	5	6	4						1
Lead	mg/kg	79	79	3.4	1550	46.2	46.2	03-014(c2)	6	5	6	6	6	5	10	6	4		11	12	2	
Manganese	mg/kg	70	70	61.6	1410	261	261	03-002(c)	6		6	6	6		10	6			11	12	2	5
Mercury	mg/kg	78	52	0.03	2.6	0.44	0.29	03-014(a) 03-014(e)	1	5	1	1	6	5	7	6	4		2	10		4
Nickel	mg/kg	79	28	3	26.5	9.39	3.33	03-014(c2)	2	2			3		3	3	1		11	3		
Silver	mg/kg	77	26	0.7	110	47.8	16.1	03-014(a) 03-014(e)	1	2			6	2	7	6	1			1		
Zinc	mg/kg	65	65	20.7	160	58.9	58.9	60-004(f)	6		6	6	6		10	6			11	12	2	
Acenaphthene	mg/kg	58	6	12	12	12.0	1.24	03-015									1					5
Acetone	mg/kg	47	1	0.049	0.049	0.05	0.00	03-056(k)											1			
Anthracene	mg/kg	58	8	0.35	22	3.25	0.45	03-015	6	1							1					
Aroclor-1016	mg/kg	173	4	0.0378	3.28	0.75	0.02	03-056(c)										4				
Aroclor-1254	mg/kg	174	52	0.021	10	1.42	0.43	03-056(c)			5	5						41		1		
Aroclor-1260	mg/kg	177	106	0.022	54	4.25	2.55	03-056(c)		4	3	3	5		9	5		65		1		11
Aroclors (Mixed)	mg/kg	30	34	0.021	7.6	1.39	1.58	03-012(b)		1	4	4										25
Benzo(a)anthracene	mg/kg	58	9	4.6	63	24.5	3.80	03-015		1	1	1					1					5
Benzo(a)pyrene	mg/kg	58	5	0.35	57	7.71	0.66	03-015		1	1	1			1		1					
Benzo(b)fluoranthene	mg/kg	58	10	1.7	54	16.2	2.80	03-015		1	1	1			1		1					5
Benzo(g,h,i)perylene	mg/kg	58	3	0.35	40	5.44	0.28	03-015		1					1		1					
Benzo(k)fluoranthene	mg/kg	58	16	0.35	38	4.73	1.31	03-015	6	1	1	1			1		1					5
Benzyl Alcohol	mg/kg	58	1	1.6	1.6	1.60	0.03	03-002(c)	1													
Bis(2-chloroethyl)ether	mg/kg	58	0	0.35	0.41	0.38	0.00	61-002														

TABLE 1.3-2

SUMMARY OF INORGANICS ABOVE BACKGROUND AND DETECTED ORGANICS FOR SAMPLED PRSs IN THE UPPER SANDIA CANYON WATERSHED

									Number of Detects at PRS													
Analyte Code Desc	Std Rptg Units	Number of Results	Number of Detects	Minimum Detect	Maximum Detect	Average of Detects	Weighted Average	PRS ID with Max Detect	03-002(c)	03-012(b)	03-013(a)	03-013(b)	03-014(a)	03-014(b2)	03-014(c2)	03-014(e)	03-015	03-056(c)	03-056(k)	60-004(f)	60-007(b)	61-002
Bis(2-ethylhexyl)phthalate	mg/kg	58	7	0.6	5.3	2.95	0.36	60-007(b)						1							1	5
Butanone[2-]	mg/kg	47	1	0.006	0.006	0.01	0.00	03-056(k)											1			
Butylbenzylphthalate	mg/kg	58	0	0.92	0.92	0.92	0.00	61-002														
Carbon Disulfide	mg/kg	47	2	0.004	0.004	0.00	0.00	03-056(k)											1			1
Chlordane[alpha-]	mg/kg	31	6	0.0047	0.13	0.03	0.01	03-002(c)	6													
Chlordane[gamma-]	mg/kg	31	6	0.0077	0.15	0.04	0.01	03-002(c)	6													
Chloro-3-methylphenol[4-]	mg/kg	58	1	0.81	0.81	0.81	0.01	03-002(c)	1													
Chlorophenol[2-]	mg/kg	58	5	0.35	0.49	0.42	0.04	03-002(c)	5													
Chrysene	mg/kg	58	11	0.35	60	7.32	1.39	03-015	6	1	1	1			1		1					
DDT[4,4'-]	mg/kg	36	3	0.0059	0.22	0.09	0.01	03-002(c)	3													
Dibenz(a,h)anthracene	mg/kg	58	2	0.5	14	7.25	0.25	03-015		1							1					
Dibenzofuran	mg/kg	58	7	0.35	5.6	1.16	0.14	03-015	6								1					
Dichlorobenzene[1,2-]	mg/kg	105	18	0.35	4	1.23	0.21	03-013(a) 03-013(b)	6		6	6										
Dichlorophenol[2,4-]	mg/kg	58	10	0.35	0.49	0.42	0.07	03-002(c)	5													5
Dimethylphenol[2,4-]	mg/kg	58	1	0.41	0.41	0.41	0.01	03-002(c)	1													
Dinitro-2-methylphenol[4,6-]	mg/kg	58	1	2	2	2.00	0.03	03-002(c)	1													
Dinitrophenol[2,4-]	mg/kg	58	1	2	2	2.00	0.03	03-002(c)	1													
Fluoranthene	mg/kg	58	7	0.41	120	24.5	2.96	03-015		2	1	1			1		2					
Fluorene	mg/kg	58	1	10	10	10.0	0.17	03-015									1					
Hexachloroethane	mg/kg	58	0	0.35	0.41	0.38	0.00	61-002														
Indeno(1,2,3-cd)pyrene	mg/kg	58	8	0.66	45	15.8	2.17	03-015		1					1		1					5
Isopropyltoluene[4-]	mg/kg	47	1	0.28	0.28	0.28	0.01	03-014(b2)						1								
Methylene Chloride	mg/kg	47	1	0.062	0.062	0.06	0.00	03-056(k)											1			
Methylphenol[2-]	mg/kg	58	5	0.35	0.49	0.40	0.03	03-002(c)	5													
Methylphenol[4-]	mg/kg	58	10	0.35	0.49	0.42	0.07	03-002(c)	5													5
Naphthalene	mg/kg	95	7	0.35	7.2	1.39	0.10	03-015	6								1					
Nitrophenol[2-]	mg/kg	58	1	0.41	0.41	0.41	0.01	03-002(c)	1													
Nitrophenol[4-]	mg/kg	58	1	2	2	2.00	0.03	03-002(c)	1													

TABLE 1.3-2

SUMMARY OF INORGANICS ABOVE BACKGROUND AND DETECTED ORGANICS FOR SAMPLED PRSs IN THE UPPER SANDIA CANYON WATERSHED

									Number of Detects at PRS													
Analyte Code Desc	Std Rptg Units	Number of Results	Number of Detects	Minimum Detect	Maximum Detect	Average of Detects	Weighted Average	PRS ID with Max Detect	03-002(c)	03-012(b)	03-013(a)	03-013(b)	03-014(a)	03-014(b2)	03-014(c2)	03-014(e)	03-015	03-056(c)	03-056(k)	60-004(f)	60-007(b)	61-002
Pentachlorophenol	mg/kg	58	5	1.7	2.4	2.08	0.18	03-002(c)	5													
Phenanthrene	mg/kg	58	11	0.35	88	11.1	2.11	03-015	6	1	1	1			1		1					
Phenol	mg/kg	58	1	0.41	0.41	0.41	0.01	03-002(c)	1													
Pyrene	mg/kg	58	12	0.35	120	13.1	2.71	03-015	6	1	1	1			1		2					
Sitosterol[gamma-]	mg/kg	8	6	0.45	4.7	2.11	1.58	03-014(b2)		2				4								
Toluene	mg/kg	47	1	0.008	0.008	0.01	0.00	03-014(b2)						1								
Trichlorobenzene[1,2,4-]	mg/kg	95	6	0.35	0.49	0.42	0.03	03-002(c)	6													
Trichlorophenol[2,4,5-]	mg/kg	58	1	2	2	2.00	0.03	03-002(c)	1													
Trichlorophenol[2,4,6-]	mg/kg	58	5	0.35	0.49	0.42	0.04	03-002(c)	5													
Cesium-137	pCi/g	38	38	0.005	2.49	0.29	0.29	03-014(b2)		5			6	5	10	6	4		2			
Plutonium-238	pCi/g	26	26	-0.01	0.207	0.06	0.06	03-014(a) 03-014(e)		1			6		10	6	3					
Plutonium-239/240	pCi/g	26	26	-0.002	0.81	0.12	0.12	03-012(b)		1			6		10	6	3					
Tritium	pCi/g	16	14	-0.002	0.41998	0.09	0.08	03-012(b)		5				5			4					
Uranium-234	pCi/g	41	41	0.472	10.011	1.93	1.93	03-014(a) 03-014(e)		1			6		10	6	3		15			
Uranium-235	pCi/g	43	41	0.011	0.543	0.11	0.11	03-014(a) 03-014(e)		1			6		10	6	3		15			
Uranium-238	pCi/g	41	41	0.407	10.07	2.16	2.16	03-056(k)		1			6		10	6	3		15			

TABLE 1.3-3

ECOLOGICAL AND HUMAN HEALTH SIGNIFICANCE OF CHEMICALS DETECTED AT PRSs IN THE UPPER SANDIA CANYON WATERSHED

Analyte Code Desc	Std Rptg Units	min TRV	HQ of max	% HQ max	HQ weighted mean	% HQ weighted mean	soil max > hawk TRV?	SAL	max to SAL ratio	% max SAL ratio	weighted mean to SAL ratio	% weighted mean to SAL ratio
Antimony	mg/kg	1.7E-01	27.1	0%	0.4	0%	no tox	31	0.1	0%	0.0	0%
Arsenic	mg/kg	1.7E-01	60.4	0%	8.6	0%		0.4	25.3	1%	3.6	5%
Barium	mg/kg	6.8E+00	50.4	0%	12.6	1%		5300	0.1	0%	0.0	0%
Cadmium	mg/kg	2.1E+00	3.6	0%	0.3	0%		38	0.2	0%	0.0	0%
Calcium	mg/kg						no tox			0%		0%
Chromium	mg/kg	4.0E-01	5200.0	11%	138.5	7%	yes	210	9.9	0%	0.3	0%
Copper	mg/kg	4.6E+01	4.8	0%	0.6	0%		2800	0.1	0%	0.0	0%
Cyanide, Total	mg/kg	9.1E+01	0.4	0%	0.1	0%	no tox	1300	0.0	0%	0.0	0%
Lead	mg/kg	5.0E+01	31.0	0%	0.9	0%	yes	400	3.9	0%	0.1	0%
Manganese	mg/kg	1.0E+02	14.1	0%	2.6	0%		3200	0.4	0%	0.1	0%
Mercury	mg/kg	3.1E-02	83.7	0%	8.2	0%	yes	23	0.1	0%	0.0	0%
Nickel	mg/kg	3.0E+01	0.9	0%	0.1	0%		1500	0.0	0%	0.0	0%
Silver	mg/kg	2.0E+00	55.0	0%	6.5	0%	no tox	380	0.3	0%	0.0	0%
Zinc	mg/kg	5.0E+01	3.2	0%	1.2	0%		23000	0.0	0%	0.0	0%
Acenaphthene	mg/kg	7.1E-02	169.0	0%	2.9	0%	no tox	2200	0.0	0%	0.0	0%
Acetone	mg/kg	1.2E+00	0.0	0%	0.0	0%	no tox	2100	0.0	0%	0.0	0%
Anthracene	mg/kg	6.8E+00	3.2	0%	0.1	0%	no tox	18000	0.0	0%	0.0	0%
Aroclor-1016	mg/kg	2.2E-03	1461.2	3%	9.6	0%		0.1	32.8	1%	0.2	0%
Aroclor-1254	mg/kg	3.8E-03	2601.0	6%	123.5	6%		0.1	100.0	4%	4.7	7%
Aroclor-1260	mg/kg	2.2E-03	24057.0	52%	1240.9	64%	no tox	0.1	540.0	24%	27.9	39%
Aroclors (Mixed)	mg/kg	2.2E-03	3385.8	7%	207.1	11%		0.1	76.0	3%	4.6	6%
Benzo(a)anthracene	mg/kg	5.9E-02	1059.7	2%	21.3	1%	no tox	0.61	103.3	5%	2.1	3%
Benzo(a)pyrene	mg/kg	5.6E-02	1015.7	2%	21.3	1%	no tox	0.061	934.4	42%	19.6	27%
Benzo(b)fluoranthene	mg/kg	5.3E-02	1012.7	2%	21.0	1%	no tox	0.61	88.5	4%	1.8	3%
Benzo(g,h,i)perylene	mg/kg	4.9E-02	808.8	2%	15.2	1%	no tox					
Benzo(k)fluoranthene	mg/kg	5.2E-02	735.4	2%	15.8	1%	no tox	6.1	6.2	0%	0.1	0%

TABLE 1.3-3

ECOLOGICAL AND HUMAN HEALTH SIGNIFICANCE OF CHEMICALS DETECTED AT PRSs IN THE UPPER SANDIA CANYON WATERSHED

Analyte Code Desc	Std Rptg Units	min TRV	HQ of max	% HQ max	HQ weighted mean	% HQ weighted mean	soil max > hawk TRV?	SAL	max to SAL ratio	% max SAL ratio	weighted mean to SAL ratio	% weighted mean to SAL ratio
Benzyl Alcohol	mg/kg						no tox	20000	0.0	0%	0.0	0%
Bis(2-chloroethyl)ether	mg/kg						no tox	0.043	9.5	0%	0.8	1%
Bis(2-ethylhexyl)phthalate	mg/kg	6.0E-01	8.8	0%	0.2	0%		32	0.2	0%	0.0	0%
Butanone[2-]	mg/kg	1.9E+02	0.0	0%	0.0	0%	no tox	7100	0.0	0%	0.0	0%
Butylbenzylphthalate	mg/kg	1.0E+01	0.1	0%	0.0	0%	no tox	13000	0.0	0%	0.0	0%
Carbon Disulfide	mg/kg						no tox	7.5	0.0	0%	0.0	0%
Chlordane[alpha-]	mg/kg						no tox	0.34	0.4	0%	0.0	0%
Chlordane[gamma-]	mg/kg						no tox	0.34	0.4	0%	0.0	0%
Chloro-3-methylphenol[4-]	mg/kg	1.1E-01	7.5	0%	0.1	0%	no tox					
Chlorophenol[2-]	mg/kg	4.4E-02	11.1	0%	0.8	0%	no tox	91	0.0	0%	0.0	0%
Chrysene	mg/kg	5.7E-02	1045.2	2%	22.0	1%	no tox	61	1.0	0%	0.0	0%
DDT[4,4'-]	mg/kg						no tox	1.3	0.2	0%	0.0	0%
Dibenz(a,h)anthracene	mg/kg	5.4E-02	260.7	1%	4.7	0%	no tox	0.061	229.5	10%	4.1	6%
Dibenzofuran	mg/kg						no tox	250	0.0	0%	0.0	0%
Dichlorobenzene[1,2-]	mg/kg						no tox	1100	0.0	0%	0.0	0%
Dichlorophenol[2,4-]	mg/kg						no tox	200	0.0	0%	0.0	0%
Dimethylphenol[2,4-]	mg/kg						no tox	1300	0.0	0%	0.0	0%
Dinitro-2-methylphenol[4,6-]	mg/kg						no tox					
Dinitrophenol[2,4-]	mg/kg						no tox	130	0.0	0%	0.0	0%
Fluoranthene	mg/kg	7.7E-01	156.4	0%	3.3	0%	no tox	2600	0.0	0%	0.0	0%
Fluorene	mg/kg	8.7E-01	11.4	0%	0.2	0%	no tox	2300	0.0	0%	0.0	0%
Hexachloroethane	mg/kg						no tox	32	0.0	0%	0.0	0%
Indeno(1,2,3-cd)pyrene	mg/kg	4.7E-02	957.9	2%	17.3	1%	no tox	0.61	73.8	3%	1.3	2%
Isopropyltoluene[4-]	mg/kg						no tox					
Methylene Chloride	mg/kg	5.7E-01	0.1	0%	0.0	0%	no tox	7.8	0.0	0%	0.0	0%
Methylphenol[2-]	mg/kg						no tox	3300	0.0	0%	0.0	0%
Methylphenol[4-]	mg/kg						no tox	330	0.0	0%	0.0	0%

TABLE 1.3-3

ECOLOGICAL AND HUMAN HEALTH SIGNIFICANCE OF CHEMICALS DETECTED AT PRSs IN THE UPPER SANDIA CANYON WATERSHED

Analyte Code Desc	Std Rptg Units	min TRV	HQ of max	% HQ max	HQ weighted mean	% HQ weighted mean	soil max > hawk TRV?	SAL	max to SAL ratio	% max SAL ratio	weighted mean to SAL ratio	% weighted mean to SAL ratio
Naphthalene	mg/kg	3.9E-01	18.6	0%	0.3	0%	no tox	1000	0.0	0%	0.0	0%
Nitrophenol[2-]	mg/kg						no tox					
Nitrophenol[4-]	mg/kg						no tox					
Pentachlorophenol	mg/kg						no tox	2.5	1.0	0%	0.1	0%
Phenanthrene	mg/kg	6.7E-02	1315.9	3%	28.6	1%	no tox					
Phenol	mg/kg	5.7E+00	0.1	0%	0.0	0%	no tox	39000	0.0	0%	0.0	0%
Pyrene	mg/kg	4.6E-01	260.6	1%	5.4	0%	no tox	1900	0.1	0%	0.0	0%
Sitosterol[gamma-]	mg/kg			0%		0%	no tox					
Toluene	mg/kg	2.1E+00	0.0	0%	0.0	0%	no tox	790	0.0	0%	0.0	0%
Trichlorobenzene[1,2,4-]	mg/kg	1.1E-01	4.6	0%	0.3	0%	no tox	570	0.0	0%	0.0	0%
Trichlorophenol[2,4,5-]	mg/kg						no tox	6500	0.0	0%	0.0	0%
Trichlorophenol[2,4,6-]	mg/kg						no tox	40	0.0	0%	0.0	0%
Cesium-137	pCi/g	1.5E+02	0.0	0%	0.0	0%		5.1	0.5	0%	0.1	0%
Plutonium-238	pCi/g	9.1E+01	0.0	0%	0.0	0%		27	0.0	0%	0.0	0%
Plutonium-239/240	pCi/g	9.3E+01	0.0	0%	0.0	0%		24	0.0	0%	0.0	0%
Tritium	pCi/g	1.2E+05	0.0	0%	0.0	0%		260	0.0	0%	0.0	0%
Uranium-234	pCi/g	1.0E+02	0.1	0%	0.0	0%		13	0.8	0%	0.1	0%
Uranium-235	pCi/g	1.1E+02	0.0	0%	0.0	0%		10	0.1	0%	0.0	0%
Uranium-238	pCi/g	1.1E+02	0.1	0%	0.0	0%		67	0.2	0%	0.0	0%

Upper Sandia Canyon Southern Tributary Streambed Sediment Samples. Three grab sediment samples (0–6 in.) were collected during September 1995 in the streambed upstream from the rubble pile, and four grab sediment samples (0–6 in.) were collected during October 1995 downstream from the rubble pile in the streambed of the wetland and analyzed only for PCBs. All samples except one indicated no detectable PCBs. The sample collected approximately 50 ft downstream from the rubble pile culvert on the south side of the stream bank contained a total-PCB concentration of 3.3 mg/kg. Analytical results are presented in Table 1.3-4. Sampling locations are presented in Figure 1.3-1.

TABLE 1.3-4

TRIBUTARY AND WETLAND SEDIMENT SAMPLES RESULTS

Sample Date	Sample Number	Total PCB Concentration (mg/kg)	Location (See Figure 1.3-1)
9/5/95	0103-95-0333	<0.10	S-1
9/5/95	0103-95-0334	<0.10	S-2
9/5/95	0103-95-0335	<0.10	S-3
10/11/95	0103-95-0725	<0.10	S-4
10/11/95	0103-95-0726	<0.10	S-5
10/11/95	0103-95-0727	3.3	S-6
10/11/95	0103-95-0728	<0.10	S-7

Storm Water and Surface Water Base-Flow Samples. In August 1991, LANL's ESH-19 collected storm water samples from storm drains leading into Sandia Canyon. Samples were analyzed for radionuclides, inorganics, VOCs, semivolatile organic compounds (SVOCs), pesticides, and PCBs. The analytical data are summarized in Table 1.3-5. Sampling locations are illustrated in Figure 1.3-1.

In 1996 and 1997, LANL ESH-19 and ER Project representatives collected at a total of seven surface water base-flow samples at various locations both upstream and downstream from the rubble pile in upper Sandia Canyon. Samples were analyzed for PCBs only in 1996 and select metals and PCBs in 1997. The analytical data are presented in Table 1.3-5. Sampling locations are illustrated in Figure 1.3-1.

In summary, metals, PCBs, gross alpha/beta and radium have been detected in surface and storm water samples collected in Upper Sandia Canyon. Methylene chloride and bis(2-ethylhexylphthalate) were also detected in some samples, but are common analytical laboratory contaminants.

Los Alamos County Landfill. Another potential source of degradation for the wetland is PRS 61-005, the Los Alamos County Landfill. Degradation is occurring as a result of sediments moving from the landfill and loading in the wetland. The landfill has always been operated under a special-use permit that specifies that Los Alamos County is responsible for environmental compliance. No sampling has been completed at this site by the ER Project. No RFI sampling is proposed for the active landfill as it is operated under another regulatory authority.

TABLE 1.3-5

SUMMARY OF ANALYTICAL DATA FROM WATER, BASE-FLOW, STORM WATER, AND SEDIMENT SAMPLES FOR UPPER SANDIA CANYON

Associated PRS	Location Description (see Fig. 1.3-1)[a]	Sample Collection Date	VOCs (µg/L)	SVOCs (µg/L)	PCBs (µg/L) (except where noted below)	Inorganics (mg/L)	Radionuclides (pCi/L)
NA[b]	BF-1 (filtered sample)	June 1996	NR[c]	NR	ND[d] in water; 5.41 mg/kg total PCBs in sediment; Aroclor-1254=0.81 mg/kg, Aroclor-1260=4.6 mg/kg	NR	NR
NA	BF-2 (filtered sample)	June 1996	NR	NR	ND in water; 3.16 mg/kg total PCBs in sediment; Aroclor-1254=0.56 mg/kg, Aroclor-1260=2.6 mg/kg	NR	NR
NA	BF-3 (filtered sample)	June 1996	NR	NR	ND in water; 6.33 mg/kg total PCBs in sediment; Aroclor-1254=0.93 mg/kg, Aroclor-1260=5.4 mg/kg	NR	NR
NA	BF-4	March 14, 1997	NR	NR	PCB-1260=0.22	Barium=0.03	NR
NA	BF-5	March 14, 1997	NR	NR	ND	Barium=0.03 Chromium=0.02	NR
NA	BF-6	March 14, 1997	NR	NR	ND	Barium=0.13	NR
NA	BF-7	March 14, 1997	NR	NR	ND	Barium=0.05	NR
60-007(b)	SW-1	August 1, 1991	ND	ND	ND	Oil & Grease=1.0[e] Chromium=0.025 Copper=0.039 Lead=0.047 Zinc=0.31	Gross Alpha=8.4 Gross Beta=16 Radium 226=0.4 Radium 228=1.1

a. Information is from ESH-18. Therefore, sample information is not in FIMAD and there is no sample ID number. Samples were not filtered except BF-1, BF-2, and BF-3.
b. NA = Not available.
c. NR = Not requested.
d. ND = Not detected.
e. Oil and grease are an aggregate organic analysis.

TABLE 1.3-5 (continued)

SUMMARY OF ANALYTICAL DATA FROM WATER, BASE-FLOW, STORM WATER, AND SEDIMENT SAMPLES FOR UPPER SANDIA CANYON

Associated PRS	Location Description (see Fig. 1.3-1)[a]	Sample Collection Date	VOCs (µg/L)	SVOCs (µg/L)	PCBs (µg/L) (except where noted below)	Inorganics (mg/L)	Radionuclides (pCi/L)
60-007(b)	SW-2	August 1, 1991	ND[b]	ND	ND	Arsenic=0.005 Chromium=0.014 Copper=0.023 Lead=0.06 Zinc=0.28	Gross Alpha=5.7 Gross Beta=8.5 Radium 226=1.2 Radium 228=2.3
60-004(f)	SW-3	August 1, 1991	ND	ND	ND	Chromium=0.011 Copper=0.029 Lead=0.018 Zinc=0.12	Gross Alpha=2.5 Gross Beta=9.8 Radium 226=0.1 Radium 228=3.2
60-004(f)	SW-4	August 1, 1991	ND	ND	ND	Chromium=0.017 Copper=0.028 Lead=0.035 Zinc=0.2	Gross Alpha=4.7 Gross Beta=5.5 Radium 226=0.4 Radium 228=0.6
NA[c]	SW-5[d]	August 2, 1991	ND	ND	Heptachlor epoxide=0.11	Copper=0.027 Lead=0.029 Zinc=0.15	Gross Alpha=3.5 Gross Beta=7.9
NA	SW-6[e]	August 2, 1991	ND	ND	ND	Copper=0.027 Lead=0.017 Zinc=0.26	Gross Alpha=4.0 Gross Beta=17 Radium 228=1.5
3-059	SW-7	September 4, 1991	ND	Bis(2-ethylhexylphthalate)=11	ND	Oil & Grease=3.8[f] Cadmium=0.041 Chromium=0.017 Copper=0.16 Iron=2.7 Lead=0.14 Mercury=0.00036 Zinc=0.79	Gross Alpha=1.7 Gross Beta=6.4

a. Information is from ESH-18. Therefore, sample information is not in FIMAD and there is no sample ID number. Samples were not filtered except BF-1, BF-2, and BF-3.
b. NA = Not available.
c. ND = Not detected.
d. Sample is also listed as TA-3-1966 comp.
e. Sample is also listed as TA-3 1966 grab.
f. Oil and grease are an aggregate organic analysis.

TABLE 1.3-5 (continued)

SUMMARY OF ANALYTICAL DATA FROM WATER, BASE-FLOW, STORM WATER, AND SEDIMENT SAMPLES FOR UPPER SANDIA CANYON

Associated PRS	Location Description (see Fig. 1.3-1)[a]	Sample Collection Date	VOCs (µg/L)	SVOCs (µg/L)	PCBs (µg/L) (except where noted below)	Inorganics (mg/L)	Radionuclides (pCi/L)
3-059	SW-8	September 4, 1991	ND[b]	Bis(2-ethylhexylphthalate)=17	ND	Cadmium=0.028 Chromium=0.014 Copper=0.11 Iron=2.8 Lead=0.15 Mercury=0.00034 Zinc=0.55	Gross Alpha=2.1 Gross Beta=8.3 Radium 226=0.3
3-059	SW-9	August 26, 1991	ND	ND	ND	Oil & Grease=1.1[c] Arsenic=0.0065 Cadmium=0.0055 Chromium=0.024 Copper=0.046 Iron=22.6 Lead=0.26 Zinc=0.75	Gross Alpha=7.6 Gross Beta=18 Radium 226=0.6
3-059	SW-10	August 26, 1991	ND	ND	ND	Arsenic=0.012 Beryllium=0.0028 Chromium=0.036 Copper=0.076 Iron=41.6 Lead=0.15 Mercury=0.00025 Zinc=0.39	Gross Alpha=11 Gross Beta=13 Radium 226=1.5 Radium 228=0.2
NA[d]	SW-11	August 26, 1991	ND	ND	ND	Beryllium=0.003 Chromium=0.030 Copper=0.055 Iron=29.4 Lead=0.079 Mercury=0.0021 Zinc=0.53	Gross Alpha=21 Gross Beta=20 Radium 226=0.4 Radium 228=0.4

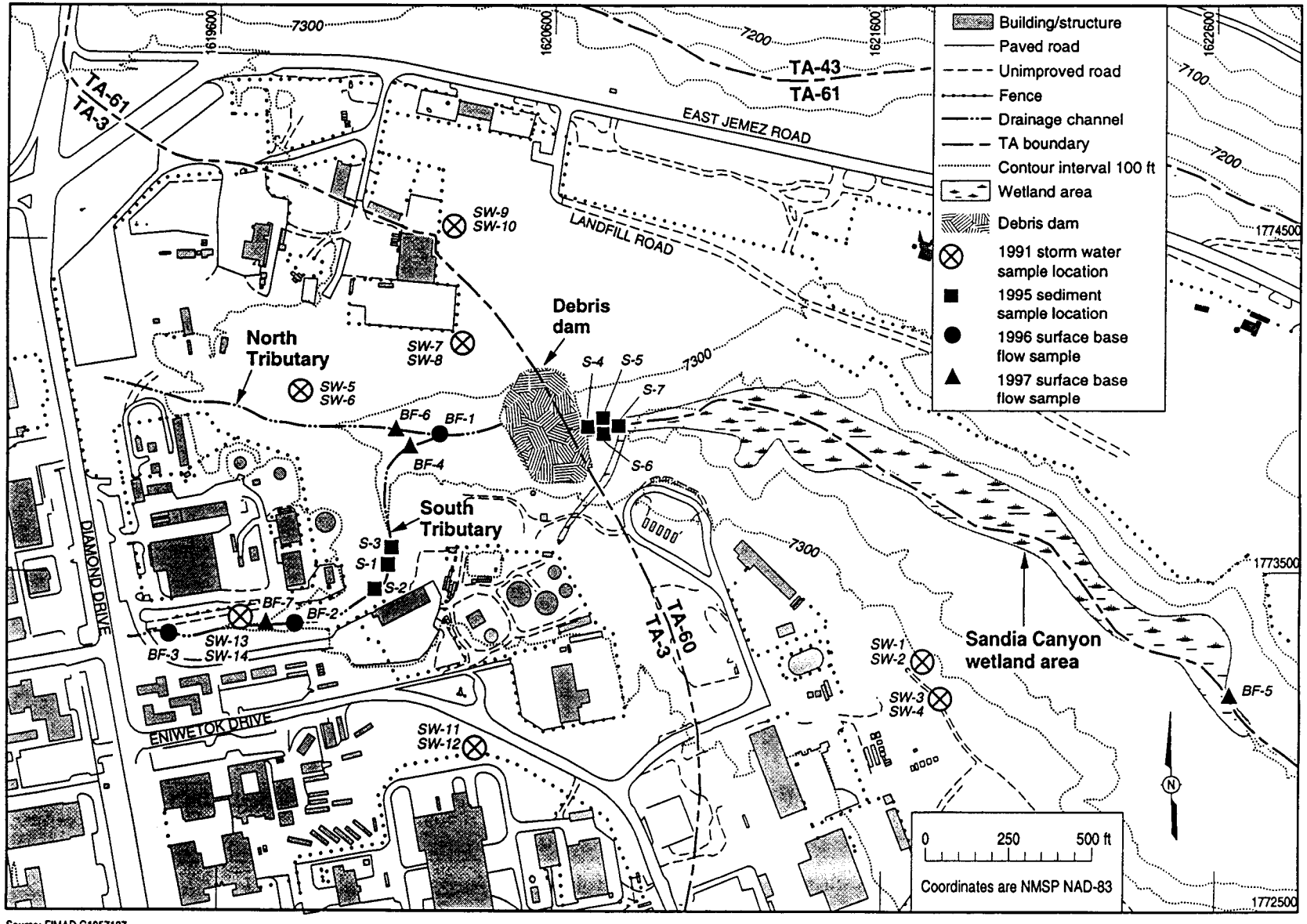
a. Information is from ESH-18. Therefore, sample information is not in FIMAD and there is no sample ID number. Samples were not filtered except BF-1, BF-2, and BF-3.
b. ND = Not detected.
c. Oil and grease are an aggregate organic analysis.
d. NA = Not available.

TABLE 1.3-5 (continued)

SUMMARY OF ANALYTICAL DATA FROM WATER, BASE-FLOW, STORM WATER, AND SEDIMENT SAMPLES FOR UPPER SANDIA CANYON

Associated PRS	Location Description (see Fig. 1.3-1)[a]	Sample Collection Date	VOCs (µg/L)	SVOCs (µg/L)	PCBs (µg/L) (except where noted below)	Inorganics (mg/L)	Radionuclides (pCi/L)
NA[b]	SW-12	August 26, 1991	Methylene chloride=11	ND[c]	ND	Chromium=0.011 Copper=0.025 Iron=12.5 Lead=0.028 Mercury=0.0024 Zinc=0.14	Gross Alpha=7.8 Gross Beta=10 Radium 226=0.8
NA	SW-13	August 26, 1991	Methylene chloride=9.0	ND	ND	Oil & Grease=2.4[d] Chromium=0.010 Copper=0.027 Iron=7.1 Lead=0.018 Zinc=0.12	Gross Alpha=2.2 Gross Beta=10
NA	SW-14	August 26, 1991	Methylene chloride=100	ND	ND	Chromium=0.000 Copper=0.02 Iron=4.4 Lead=0.011 Zinc=0.099	Gross Alpha=1.4 Gross Beta=3.1

a. Information is from ESH-18. Therefore, sample information is not in FIMAD and there is no sample ID number. Samples were not filtered except BF-1, BF-2, and BF-3.
b. NA = Not available.
c. ND = Not detected.
d. Oil and grease are an aggregate organic analysis.



Source: FIMAD G1057187

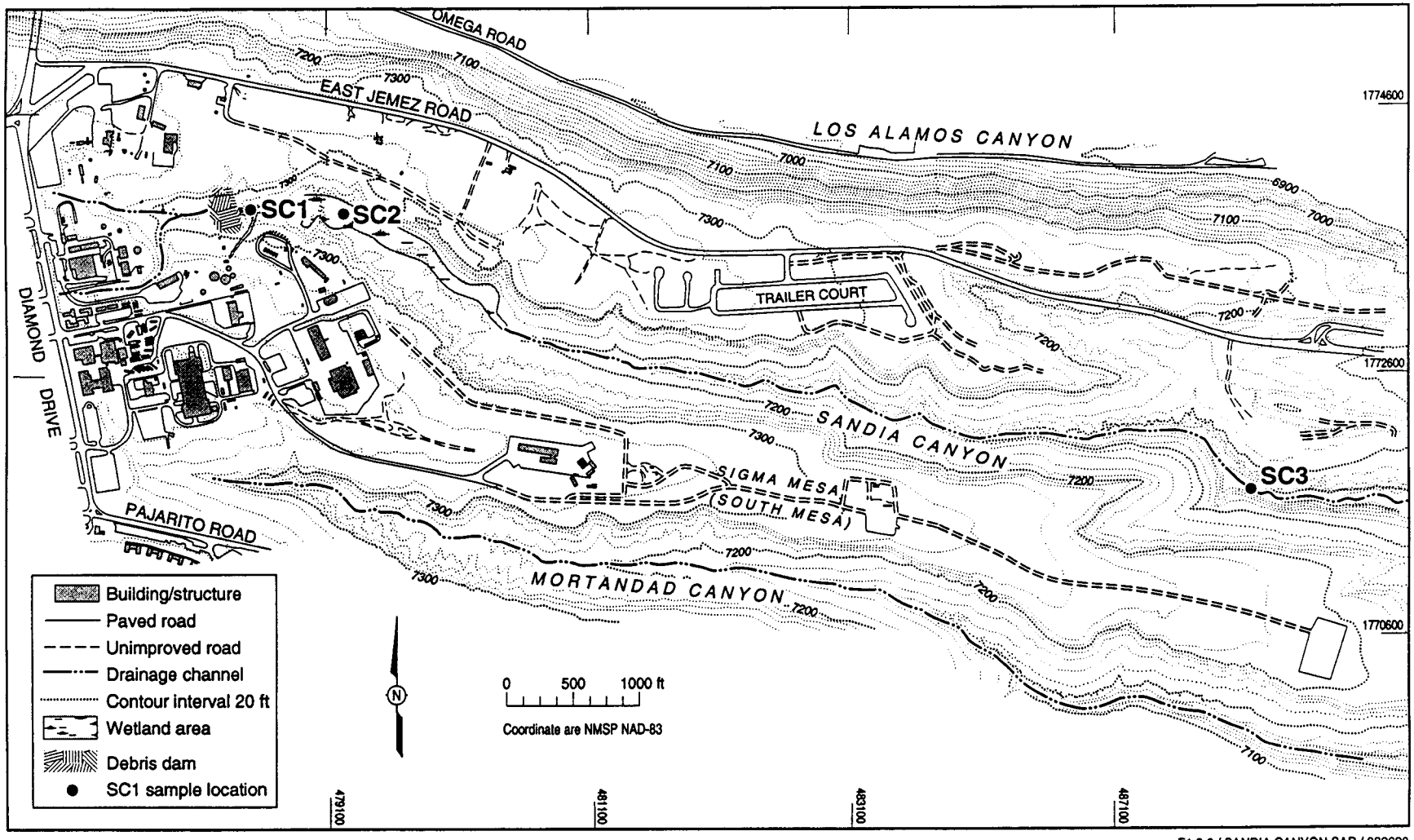
F1.3-1 / SANDIA CANYON SAP / 032698

Figure 1.3-1. Approximate locations of sediment (*S-x*), storm water (*SW-x*), and surface base flow (*SW-x*) samples.

Biological Investigations. Studies of water quality and aquatic invertebrates have been conducted in upper Sandia Canyon since 1990 by the LANL ESH Division. Three locations have been sampled: two in the wetland and one downgradient from the wetland (Figure 1.3-2). These reports state that water quality parameters (dissolved oxygen, pH, temperature, and conductivity) are within ranges that do not cause gross impacts to aquatic invertebrates. However, the number of aquatic invertebrates is lower at the two wetland locations compared to the downstream location. Although not conclusive, the report suggests several factors that could have caused the lower abundance of aquatic invertebrates, including erosion of sediments from the adjacent Los Alamos County Landfill, incision and channelization of water flow in the wetland, naturally-occurring lack of acceptable substrates for aquatic invertebrates, and Laboratory releases from PRSs (see Appendix B for more details) (Cross and Nottelman 1996, ER ID# 57540). More information on the aquatic invertebrate and water quality investigations can be found in the following reports: Bennett (1994, ER ID# 57542), Cross (1994, ER ID# 57544), Cross (1995, ER ID# 57543), and Cross and Nottelman (1996, ER ID# 57540).

During the summer of 1996, aquatic insects were collected within the upper Sandia Canyon wetland area. The insects were submitted for seven PCB Aroclor analyses. No PCBs were detected in the aquatic invertebrates; however, the detection limits did not meet the data quality objective of 100 µg/kg for PCBs (Michael 1997, ER ID# 57497). The results of this investigation have not been published.

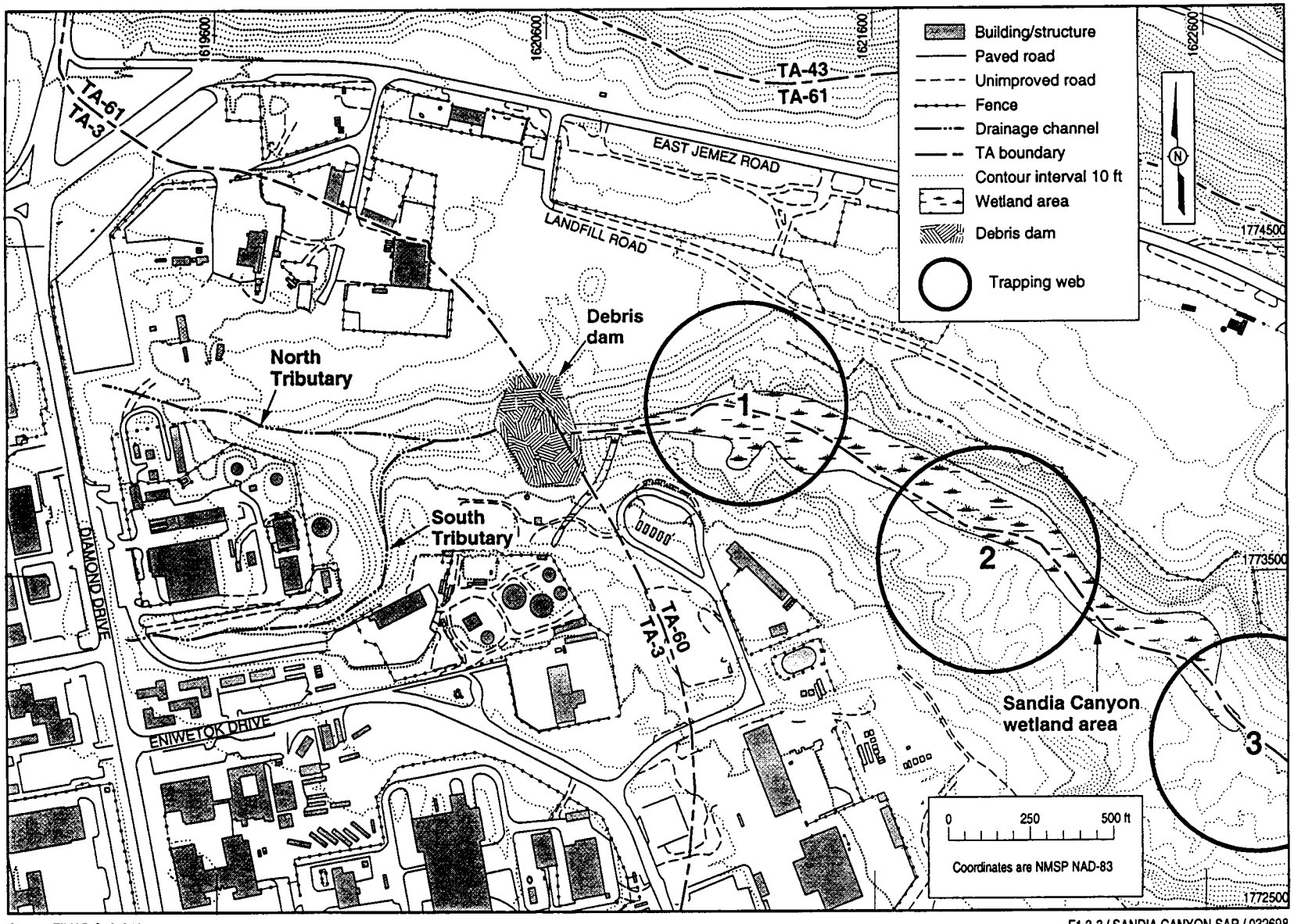
Studies of small mammals have been conducted in upper Sandia Canyon since 1994 by the LANL ESH Division. These studies determined the presence and density of various small mammals in the wetland and an area down-canyon from the wetland. These studies used three live-trapping arrays (webs) at locations similar to the aquatic invertebrate sampling locations. Two locations were within the wetland and the third was down-canyon from the wetland (Figure 1.3-3). These data show that small mammal density is higher in the wetland (where average density was 116 animals per hectare) than in the downstream location (where average density was 24 animals per hectare) (Bennett and Biggs 1996, ER ID# 57541). Species composition also differed. Shrews and voles were found in the wetland but not in the downstream location. In addition to the published report on the 1994 and 1995 small mammal population data for Sandia Canyon, there are unpublished PCB results for 64 samples of animal carcasses sampled in 1995 and 1996. Preliminary analytical data from organ and fat tissue from carcasses sampled in 1995 indicated nine of 30 animal samples had detectable quantities of PCBs (Bennett 1994, ER ID# 57542; Bennett and Biggs 1996, ER ID# 57541). Preliminary analytical data from the 1996 sampling indicated that 16 of 34 animal samples had detectable quantities of Aroclor-1260 which was the only PCB detected in the animal samples PCBs (Bennett 1994, ER ID# 57542; Bennett and Biggs 1996, ER ID# 57541). Figure 1.3-3 shows the location of the animal trapping webs. Aroclor analyses were conducted only on specimens trapped at sites 1 and 2 from Figure 1.3-3. The range of Aroclor-1260 concentrations detected in small mammals for the 1995 and 1996 sampling activities are presented in Table 1.3-6. These preliminary results suggest that Aroclor-1260 is being taken up into the Sandia Canyon food web. However, area baseline data for total or specific PCBs in small mammals is not available for comparison. It should also be noted that the small mammal studies suggest that the wetland harbors more small mammals, and gross population characteristics such as mean body size do not show any differences between trapping grids.



Source: RFI Report for OU 1114, LANL 1993

F1.3-2 / SANDIA CANYON SAP / 032698

Figure 1.3-2. Locations of the 1995 ESH water quality and invertebrate sampling stations within Sandia Canyon.



Source: FIMAD G105718

F1.3-3 / SANDIA CANYON SAP / 032698

Figure 1.3-3. Locations of live trapping webs for small mammals within Sandia Canyon (from Bennett and Biggs 1996, ER ID #57541).

TABLE 1.3-6

SUMMARY OF PRELIMINARY PCB CONCENTRATIONS IN TRAPPED SMALL MAMMALS FROM 1995 AND 1996

Group	Sample Count	Minimum Aroclor-1260 Concentration (mg/kg)	Maximum Aroclor-1260 Concentration (mg/kg))
Mouse	16[a]	0.140	0.920
Vole	45[a]	0.040	2.500
Shrew	3[b]	8.400	19.000

a. Each sample represents one animal.
b. Composite sample of five animals (Bennett 1994, ER ID# 57542; and Bennett and Biggs 1996, ER ID# 57541).

These biological investigations help to suggest which pathways are significant for ecological risk assessment. The existing aquatic data for upper Sandia Canyon suggest that physical impacts of erosion and lack of habitat for aquatic invertebrates may be responsible for the reduction of their density in the wetland. Thus, the aquatic pathway for contaminant uptake from wetland sediments is currently limited by the low density of aquatic invertebrates. However, elevated small-mammal density in the wetland represents a significant food resource for higher trophic levels. The detection of Aroclor-1260 in these animals seems to suggest that bioconcentration from small mammals to carnivores represents a significant pathway that should be evaluated. At this point, neither the aquatic nor terrestrial pathway can be entirely eliminated from further assessment.

1.4 Regulatory Context

This investigation, in coordination with other investigations by the LANL ER Canyons Focus Area, fulfills part of the Hazardous and Solid Waste Amendments (HSWA) requirements of the HSWA Module (EPA 1990,ER ID# 1585). These requirements call for one or more task/site work plans for studies to evaluate the potential impact of contaminants from PRSs on LANL's 19 major drainage areas and canyon systems. The work plans must address whether contamination is present, the potential for movement or transport of contaminants to or within canyon watersheds, and the potential for interaction with alluvial aquifers and the main aquifer. The work plans must also evaluate the potential for off-site exposure through pathways including groundwater, and the possible impact on the Rio Grande. The investigation described in this SAP will integrate with the Canyons Focus Area's ongoing assessments (LANL 1995, 01-0049).

If necessary, remediation action levels for PCBs will be developed according to the Toxic Substance Control Act (TSCA) regulations and RCRA guidelines. Relevant regulations include the PCB spill policy (CFR 761 §120,125). TSCA and RCRA allow for site-specific risk assessments to determine the potential impacts of PCB releases. TSCA policy provides for EPA flexibility for sites that may require a different approach to cleanup because of factors associated with the site that mitigate expected exposure and risks or which make cleanup to the standard requirements impracticable. This provision of TSCA drives the ecological and human health risk assessment of upper Sandia Canyon.

Values reported for surface water collected during this investigation will be compared to New Mexico Environment Department (NMED) Water Quality Control Commission (WQCC) water standards for livestock watering and wildlife habitat (State of New Mexico 1995, 1267). For wildlife habitat, the narrative standard specifies that no discharge "... shall contain any substance, including, but not limited to

selenium, dichlorodiphenyltrichloroethane (DDT), PCBs and dioxin, at a level which, when added to background concentrations, can lead to bioaccumulation to toxic levels in any animal species." For PCBs, the wildlife standard has been interpreted as a value of 0.008 µg/L in unfiltered samples, which is lower than the standard PCB water detection limit. Thus, the analytical quantitation limit of 1 µg/L total PCBs is the nominal quantitative wildlife protection standard (Yanicek 1997, ER ID# 56641).

Implementation of the sampling and analysis plan will be compliant with requirements developed by the Army Corps of Engineers for intrusive activities in wetlands (CFR 33 §325).

2.0 SAP DESIGN

2.1 Project Overview

This investigation will follow the general technical approach and objectives for canyons investigations outlined in the Core Document for Canyons Investigations (LANL 1997, ER ID# 55622). One deviation is the explicit use of a preliminary human health and ecological risk assessment. This preliminary assessment, which is viewed to be the most effective way to provide risk managers with information for making decisions, will emphasize realistic estimates of the contaminant source term. Exposures will be calculated for current-day human health and ecological exposure pathways. A phased investigation approach will be used to help focus on the contaminant risk drivers. Recreational use of upper Sandia Canyon is expected to be appropriate to assess the current-day human health effects. For ecological effects, potential effects through food chain bioconcentration is the primary concern. Thus, predators will be selected as receptors to evaluate current-day ecological impacts. These specific receptors will formally be selected as a part of the problem formulation step of the preliminary ecological risk assessment. For planning purposes, it is assumed that raptors and bats will be selected as receptors to evaluate ecological impacts.

This investigation will include the following phases: 1) geomorphic mapping of canyon bottom sediments with an emphasis on defining the extent of sediment packages deposited after Laboratory operations began (these packages are the most likely to contain contaminants); 2) collection of sediment samples from numerous locations for analysis of PCBs, which are being used as indicator constituents because they are expected to be the most widely distributed contaminants in upper Sandia Canyon and are likely collocated with other potential contaminants (this analysis should confirm the results of geomorphic mapping activities and determine the location and extent of contaminated sediments); 3) collection of sediment samples for an additional suite of analyses (i.e., SVOCs, target analyte list [TAL] metals) (these samples will be collected from locations appropriate for evaluating collocation (i.e. high and low PCB concentrations) and better defining the nature, extent, and inventory of contaminants in specific geomorphic units); and 4) collection of surface water samples to quantify transport of contaminants in the aqueous phase and as suspended solids (these samples will support potential remedial action decisions based on water quality). Additional sampling from PRSs in the Sandia Canyon watershed will not be conducted as part of this investigation.

The preliminary risk assessment step will follow the collection of these data. As indicated in Figure 1.1-4, data uncertainties and needs will be identified, and may result in the collection of air, groundwater, and biota samples. The risk managers may also determine that sufficient data have been collected to implement an action or to propose no further action for upper Sandia Canyon.

2.2 Design Assumptions

Upper Sandia Canyon will be considered as two primary reaches. Each reach has a distinct physiographic and geomorphic setting consisting of an active channel and buried channel deposits, as well as active and abandoned floodplain surfaces and deposits. These geomorphic features provide evidence of processes that result in storage and/or transport of contaminants. This investigation will focus on sediments that were deposited after Laboratory operations were underway within the canyon watershed. The two upper Sandia Canyon reaches are described in Section 2.3.

The initial design assumption for this investigation is that PCBs likely represent the primary contaminants released from PRSs in the upper Sandia Canyon watershed. PCBs are the most significant chemicals in the source PRSs for potential human health or ecological effects (see Section 1.3). Releases from these

PRSs coincide with periods of alluvial deposition in upper Sandia Canyon that post-date Laboratory operations. Based on this information, PCBs are expected to be the most common contaminants in upper Sandia Canyon, and they are expected to be collocated with other potential contaminants. PCBs can, therefore, be used as indicator contaminants in this investigation. The proposed indicator contaminant analysis is further discussed in Section 2.5.

The design of this investigation is based on the assumption that collecting samples initially for indicator contaminants will help determine which geomorphic unit(s) and sediment packages warrant further assessment for contaminant inventory and ecological risk considerations. Based on the results from samples analyzed for indicator contaminants, a subset of the sampled locations will be submitted for additional analyses. These additional analyses are described in Section 2.5.

Data from analysis of indicator and additional constituents will be used to define the nature and extent of contamination and to help locate areas (receptor home ranges) for possible future biological measurements and sampling of additional media. The assumption is that raptor or bat population effects will be the assessment endpoint for the ecological risk assessment, while insects, small mammals, and omnivorous birds will serve as measures of potential effects to raptors. Raptor population was selected as the assessment endpoint because raptors are a threatened and endangered species, and they are more sensitive to environmental changes than other small mammals. Assessment endpoints are the "explicit expressions of the actual environmental value that is to be protected" (EPA 1992, ER ID# 48847). Biological parameters that may be measured include reproductive success, biomarkers, contaminant body burdens, and aquatic insect diversity/abundance.

A geomorphic understanding of the wetland is necessary for this investigation to help identify areas of historic sediment accumulation. The preliminary geomorphic mapping will be based on aerial photographs and canyon walkovers. A schematic diagram showing the types of sedimentary packages likely to contain contaminants is shown in Figure 2.2-1.

The geomorphic mapping will identify sediment packages of different ages and depositional settings (e.g., channel or floodplain), which may contain significantly different concentrations of contaminants. Contaminant concentration may vary based on the release histories of particular PRSs in the upper Sandia Canyon watershed and the affinity of particular contaminants for certain sediment properties. Contaminant concentration may also vary based on the age of sediment deposits and the total organic carbon content and grain size. Total organic carbon and pH are also important for understanding mobility and bioavailability of contaminants and therefore for assessing ecological and human health risk.

The primary design assumption for the surface and storm water investigation is that the primary mechanisms for affecting water quality are geochemical interaction of surface and storm water with contaminated sediments, and physical erosion and transport of contaminated sediments. A ground-water investigation is not currently planned for the wetlands. It is likely that surface water flowing at the east end of the wetland represents, in part, groundwater that recharges to the main channel within and/or at the toe of the wetland. Thus, direct sampling and characterization of surface and storm water will provide insight into the geochemical and physical interactions and help focus potential interim measures or BMPs.

If contamination is identified during the sediment investigation at depths below the lowest occurrence of Laboratory-aged sediments, then the necessity of a ground-water investigation will be evaluated as part of the Canyons Focus Area investigation of Sandia Canyon.

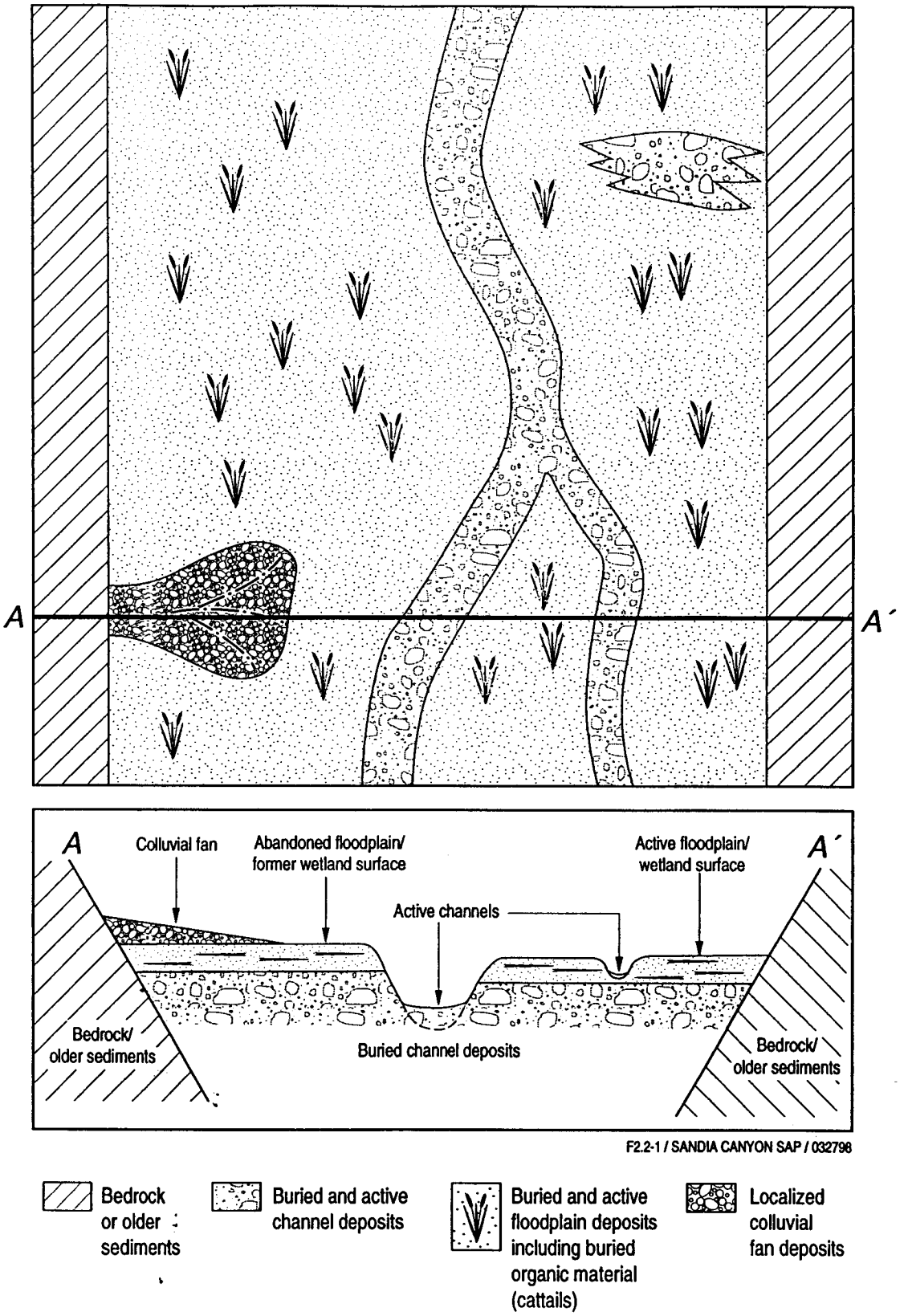


Figure 2.2-1. Schematic map and cross section of Sandia Canyon floor showing generalized geomorphic units and sedimentary deposits likely to contain contamination.

2.3 Sandia Canyon Reach Descriptions

Upper Sandia Canyon will be considered as two primary reaches that will be treated as distinct areas for characterization (Figure 2.3-1). Each reach has a distinct physiographic and geomorphic setting. This setting may consist of an active channel and buried channel deposits, and active and abandoned floodplain surfaces and deposits. These features provide evidence of processes that result in storage and/or transport of contaminants. The investigation will focus on sediments that were deposited after Laboratory operations were underway within the canyon watershed. Sediments deposited prior to initiation of Laboratory operations in the watershed will also be sampled to verify the age determination and that no contamination has migrated into those deposits. The two upper Sandia Canyon reaches are described below.

Reach S-1. Reach S-1 comprises the section of upper Sandia Canyon from Diamond Drive to the west end of the large rubble pile that bridges Sandia Canyon. This reach consists of the two tributary canyons, Reaches S-1 North and S-1 South, that comprise the head of upper Sandia Canyon (Figure 2.3-2). Both tributaries in Reach S-1 are characterized by a narrow canyon with minimal sediment storage largely confined to a narrow zone along the active channel. Most of the PRSs that are potential contaminant contributors to Sandia Canyon are situated within Reach S-1.

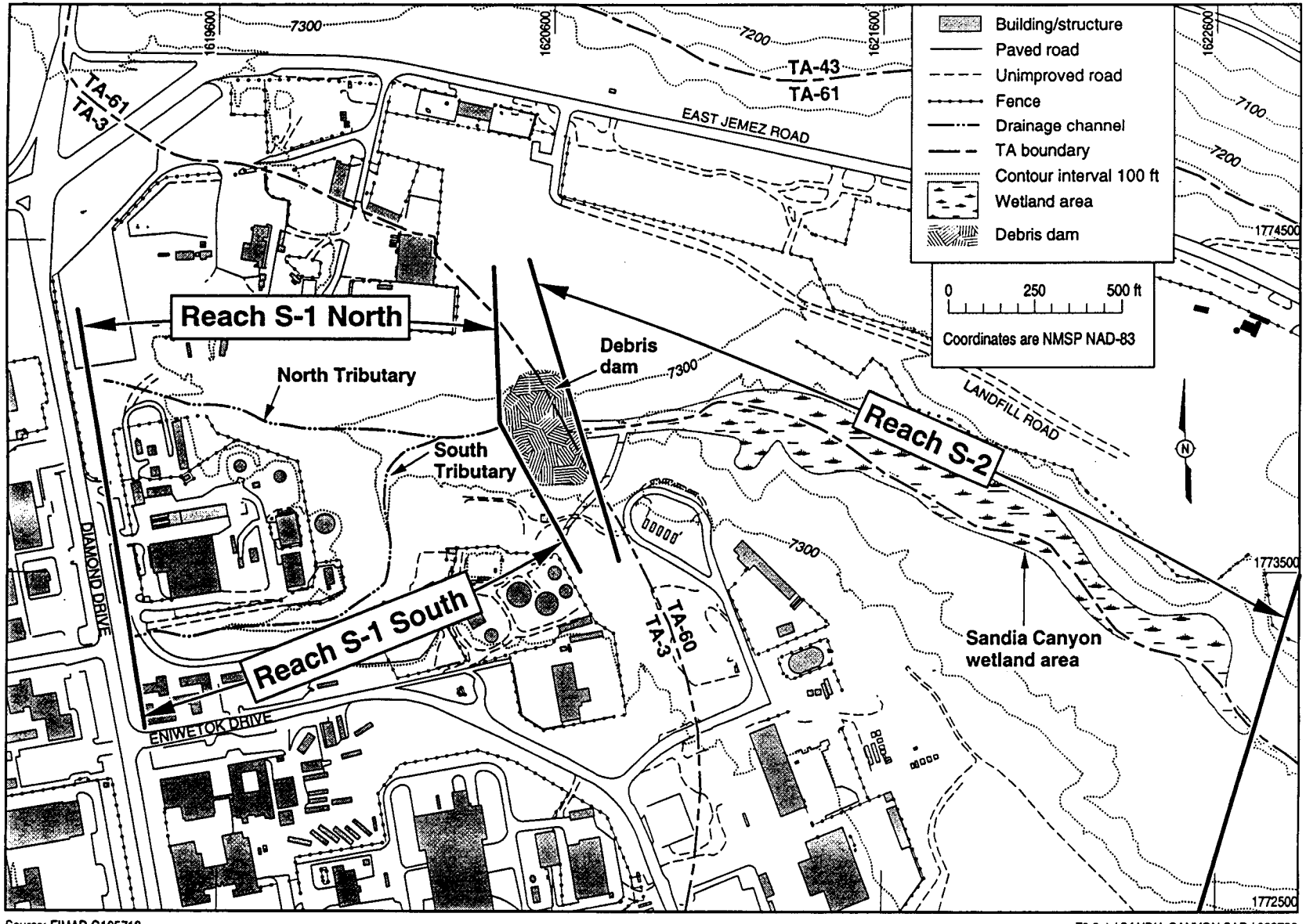
Reach S-2. Reach S-2 comprises the section of upper Sandia Canyon from the east end of the rubble pile to the toe of the wetland area approximately 2 275 ft down-canyon from the rubble pile (Figure 2.3-3). Reach S-2 is characterized by a wide canyon with a low-gradient valley floor. Several channels are present through the reach, with most surface water flow occurring through a single, deeply incised channel. Initial observations suggest that much of the sediment in the wetland has been derived from fill material and/or road aggregate from surrounding TA-3, TA-61 (the Los Alamos County Landfill), and TA-60. Several PRSs [3-014(b2), 60-007(b), and 60-004(f)] could contribute contamination to Reach S-2 in addition to the PRSs within reach S-1.

2.4 Geomorphic Units and Sedimentary Deposits in Sandia Canyon

The following is a description of the major geomorphic units and sedimentary deposits that are expected to contain contaminants in Sandia Canyon. Three primary geomorphic units/sedimentary deposits may be present within each reach: 1) active channel sediments; 2) buried or inactive channel deposits; and 3) active, buried, and abandoned floodplain deposits. Because the fate of contaminants in the upper Sandia Canyon wetland environment is not well known, all types of sedimentary deposits will be evaluated for contamination.

Active Channel Deposits. An active channel contains either intermittent or continuous flow. Sediment in these channels is predominantly coarse sand and gravel. Because heavy metals and most radionuclides discharged from the Laboratory preferentially adsorb to finer-sized sediment particles, and because the active channel sediments are young relative to the period of contaminated discharges, it is expected that active channel sediments will contain the lowest concentrations of contaminants. The sediments in the active channels are the most likely to be transported downstream, both by the relatively frequent storm water discharges and by occasional large floods in the canyons.

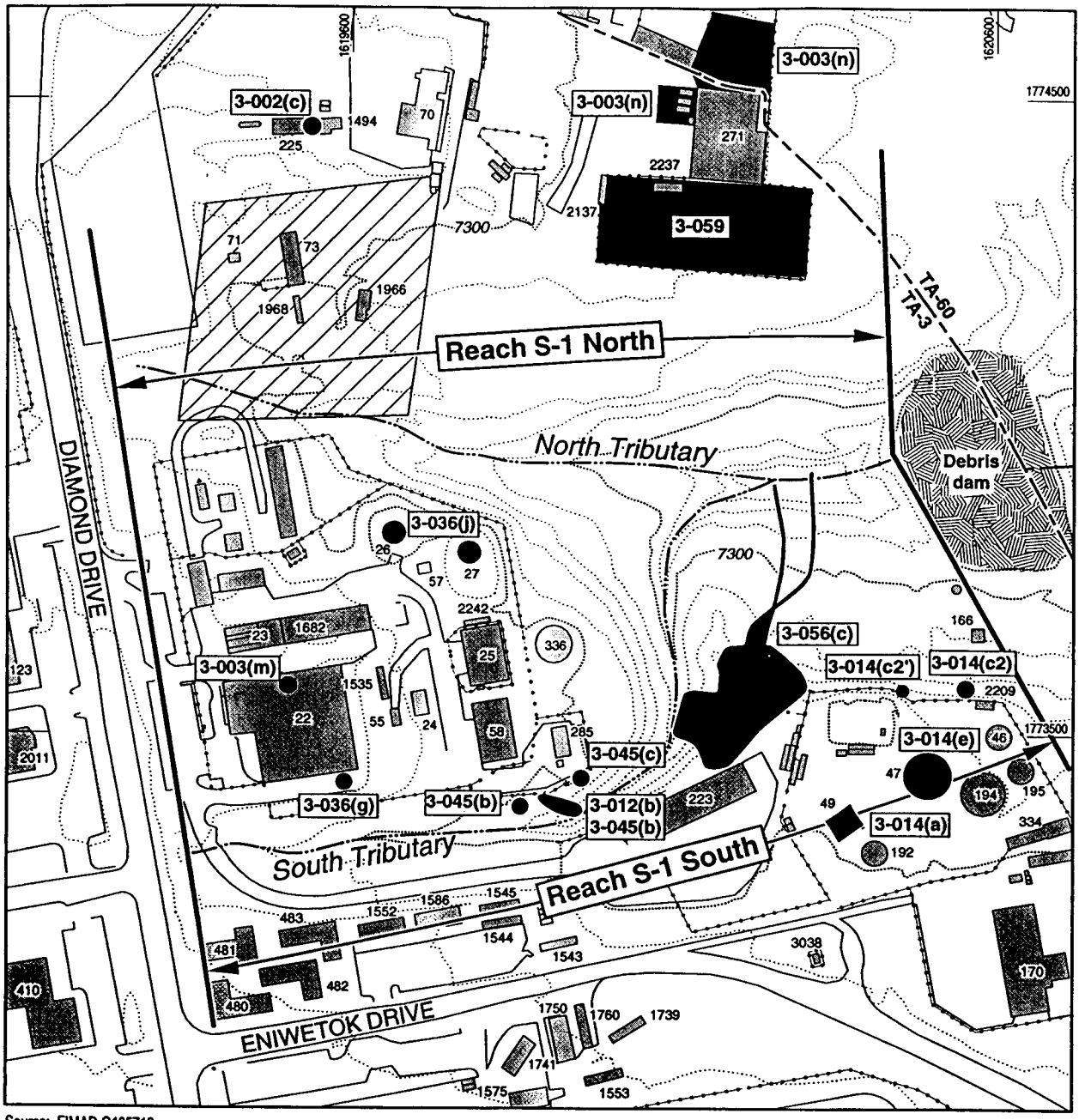
Buried Channel Deposits. Buried channel deposits contain coarse channel sediment (deposited when the channels were active), and often fine sediment (deposited by flooding after the channel was abandoned or by deposition of fines during waning storm water flow). Contaminant concentrations are expected to vary, depending both on the grain size and the age of the deposit, as contaminant input will have varied over time. Available data suggest that buried channel deposits may contain significant concentrations of contaminants that are available for transport farther downstream either by large floods or by lateral erosion of the stream bank.



Source: FIMAD G105718

F2.3-1 / SANDIA CANYON SAP / 032798

Figure 2.3-1. Sandia Canyon reaches.



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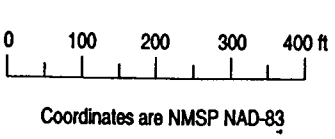
F2.3-2 / SANDIA CANYON SAP / 032798



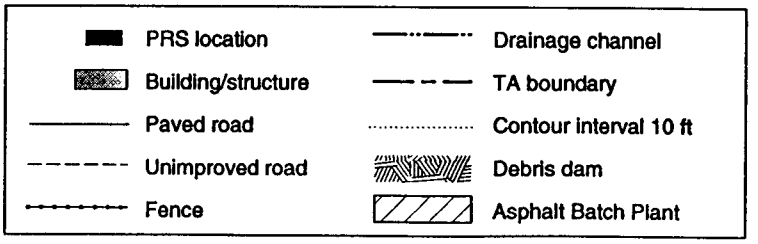
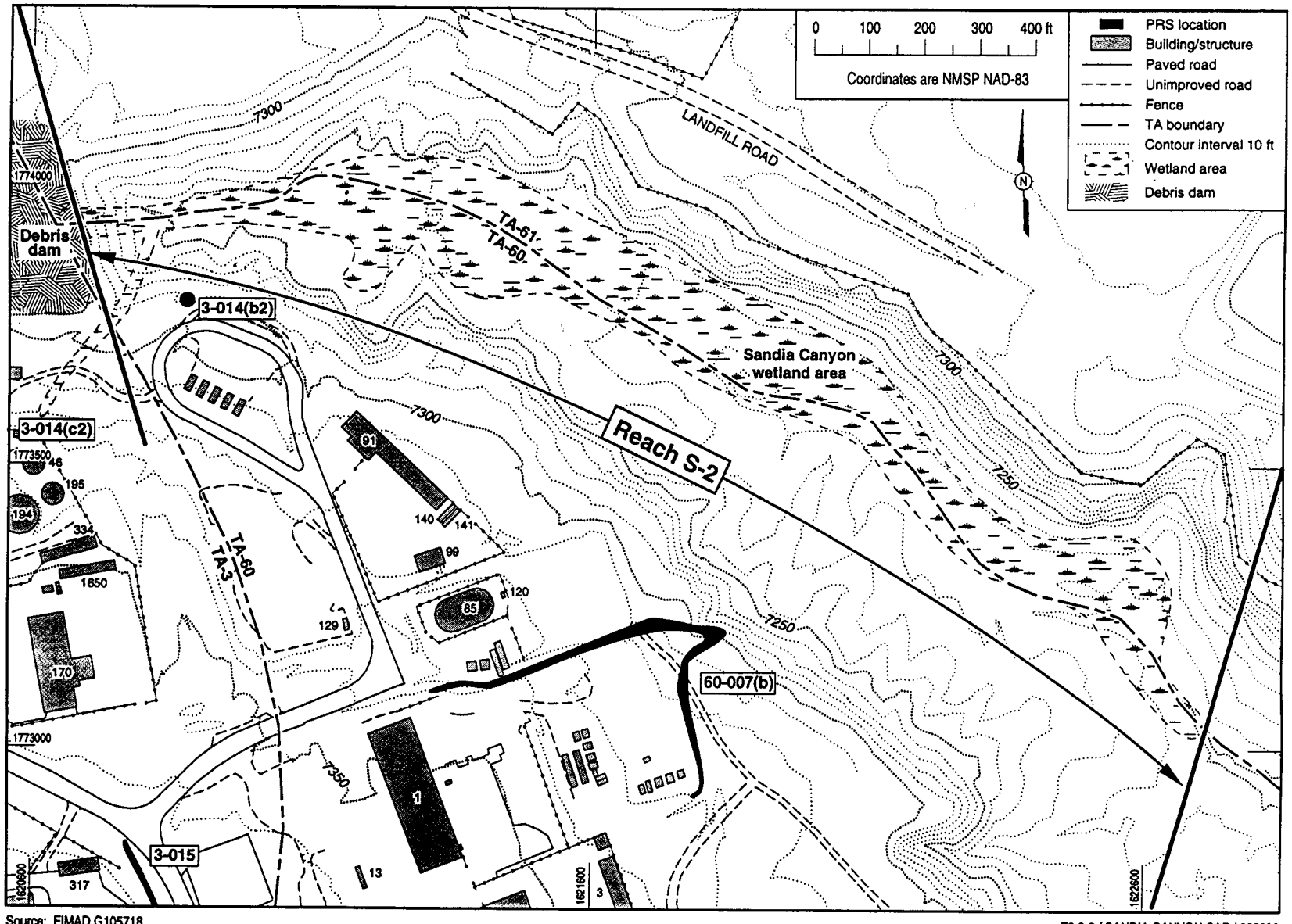


Figure 2.3-2. Sandia Canyon reaches S-1 North and S-1 South.



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F2.3-3 / SANDIA CANYON SAP / 032698

Figure 2.3-3. Sandia Canyon Reach S-2.

Active and Buried Floodplain Deposits. Floodplains are usually located adjacent to stream channels and are often characterized by buried coarse-grained channel deposits overlain by fine-grained sediment deposited from the suspended load of overbank floodwater. In Sandia Canyon, these geomorphic units and deposits may also contain dense cattail growth. Because heavy metals, organic constituents, and most radionuclides preferentially adsorb onto the fine-grained sediment, the contaminant concentrations may be highest in sediments within the floodplain deposits. The contaminant concentrations may vary with the age of the deposit depending on contaminant release history. The sediment in the floodplains may have the longest residence times in the canyons because it probably moves little until mobilized by lateral erosion of the stream bank.

Identifying the historic floodplains will serve to focus the geomorphic surveys within each reach. The boundaries of geomorphic units are commonly marked by distinct topographic breaks, although in places such boundaries may be gradual and more difficult to delineate. Direct visual observation of partially buried objects (e.g. young, live ponderosa pine trees) and debris, especially debris that can be linked to Laboratory activities (e.g., road aggregate containing quartzite cobbles), provide conclusive evidence of post-1942 (i.e. Laboratory-related) sediment deposition and, therefore, the age of some geomorphic units. Further evidence of the age of geomorphic units can be obtained by observing the nature and age of vegetation in different areas of the reach, such as whether the bases of trees are buried by sediment. Flood debris, such as driftwood, may provide additional evidence of the extent of historic flooding and the distribution of over-bank sediment deposition.

2.5 Sediment Investigation

This section discusses the design of the sediment investigation of Sandia Canyon. The two Sandia Canyon reaches will be characterized by photo analysis, geomorphic surveys, mapping, and laboratory analysis of sediment samples.

2.5.1 Field Surveys and Mapping of Upper Sandia Canyon Reaches

Each of the two canyon reaches will be surveyed and mapped using nonintrusive and intrusive techniques. The objective of the surveys is to produce maps of each reach to indicate the location, extent, and nature of key geomorphic features for sampling.

2.5.1.1 Geomorphic Mapping

The objective of the geomorphic mapping task is to identify, describe, and map surficial deposits and landforms that provide evidence for processes that can result in storage and/or transport of contaminants. In particular, the survey will focus on identifying the location and extent of potentially contaminated sedimentary deposits.

The geomorphic survey of each canyon reach will be guided by the conceptual model of the significant geomorphic features and sedimentary deposits illustrated in Figure 2.2-1. Laboratory-related contaminants could occur in any of the geomorphic units, but the greatest concentrations are expected in the active and buried floodplain deposits because of their fine-grained nature.

2.5.1.2 Geodetic Survey

The objectives of the geodetic survey are to provide coordinates for the boundaries of each reach and provide accurate mapping of the field data and sample locations. Licensed surveyors will provide data in the New Mexico state plane coordinate system.

2.5.2 Sediment Sample Collection and Analysis

PCBs are the contaminants most likely associated with historical contaminant releases in upper Sandia Canyon, and they will be used as indicator contaminants in this investigation. Samples will be collected from each geomorphic unit and analyzed for PCBs to determine which sedimentary packages might contain other contaminants. Sedimentary packages with and without detectable PCB contamination will then be analyzed for additional constituents to determine the nature and extent of contamination and to estimate the total contaminant inventory for upper Sandia Canyon.

Defining the COPC inventory will help determine the potential impacts to assessment endpoints in the ecological risk assessment. Ecological risk will be based on whether a pathway to the assessment endpoint exists, the COPC uptake through the food chain to the assessment endpoint, and the probability of adverse effects based on the given uptake. To facilitate risk assessment for terrestrial receptors, the highest prey species concentrations that would yield no effect in predaceous birds for selected chemicals have been calculated (see Table 2.5-1). Other benchmark values for other chemicals and receptors will be developed on an as-needed basis.

TABLE 2.5-1

SELECTED CHEMICAL CONCENTRATIONS IN PREY THAT PRODUCE NO EFFECT IN RED-TAILED HAWKS

Chemical	Highest Prey Species Concentration Yielding No Effect (mg/kg)*
Aroclor 1242	4.2
Aroclor 1254	1.9
Lead (metallic)	40

*Sample1996, ER ID# 57512.

2.5.2.1 Analysis for Indicator Contaminants

Sample analysis will be conducted for PCBs (Aroclor-specific), which will be used as indicator contaminants to identify which sedimentary packages in upper Sandia Canyon contain PCBs. The results of these analyses will guide the selection of sampling locations for additional analyses, and will also provide information on the source term for ecological risk assessment.

2.5.2.2 Analysis for Additional Constituents

The objective of analyzing for additional constituents is to evaluate the collocation hypothesis and further define the nature and extent of contaminants contributing to risk. Sampling for additional constituents (e.g., radionuclides, TAL metals, and SVOCs) will be conducted at locations where the indicator contaminant analyses show the presence of contaminated sediments. Geomorphic units and sediment packages that are believed to be uncontaminated (based on the results of the indicator-constituent analysis) will also be sampled to confirm the presence or absence of additional constituents and the extent of contamination.

Planned data uses include determining the COPC list based on a preliminary ecological risk assessment and making preliminary assessments of the COPC inventory. The preliminary ecological risk assessment will be based on assumptions of contaminant transport and bioavailability that are consistent with the LANL ecological risk conceptual model. Based on this ecological conceptual model, sediment sample results from indicator-constituent analysis will be compared to sediment screening values. Individual COPCs that represent more than 10% of the normalized hazard quotient will be carried forward for analysis of additional constituents.

It is expected that the indicator constituent and additional constituent data, along with the geomorphic data, will support the evaluation of transport potential and human health risk assessment under current conditions.

2.5.2.3 Particle Size Distribution, Total Organic Carbon, and pH Analysis

All samples will be analyzed for particle size distribution. A subset of sediment samples, chosen after analytical results of initial sampling are available, will be analyzed according to particle size to provide information on the association between contaminant concentration and particle size. All sediment samples will be analyzed for pH and total organic carbon to determine the relationship between these parameters and contaminant concentrations. Total organic carbon, in conjunction with pH, may be useful for understanding the bioavailability of contaminants, contaminant migration potential, and mitigating sediment (and contaminant) transport. This information may also be useful for designing remedial and/or waste volume reduction alternatives.

2.6 Storm and Surface Water Investigation

The objective of the storm and surface water investigation in upper Sandia Canyon is to evaluate surface water transport of contaminants in the upper Sandia Canyon system. Surface water in upper Sandia Canyon occurs as baseflow from sources originating in TA-3 including several NPDES-permitted outfalls. The majority of storm water runoff in upper Sandia Canyon originates at TA-3, west of Diamond Drive. This runoff comes from asphalted surfaces and storm drains that enter the north and south tributaries of upper Sandia Canyon.

Surface water and storm water samples will be collected at the mouth of the culvert that runs beneath Diamond Drive in the south tributary of Reach S-1, in the channel immediately west of Diamond Drive in the north tributary of Reach S-1, at locations in the north and south tributaries of Reach S-1 immediately upstream from the confluence of the two tributaries, and at the toe of the wetland area in Reach 2. Samples will be collected at all locations to characterize both base-flow conditions and storm water runoff conditions. Storm and surface water data from the mouth of the culvert below Diamond Drive in Reach S-1 will be used to establish baseline water quality for water entering upper Sandia Canyon. Storm and surface water data for the stations above the confluence of the two tributaries will be used to evaluate potential impact to water quality caused by mesa-edge and hill slope PRSs along Reach S-1 North and Reach S-1 South. Storm and surface water data from Reach S-2 will be compared to water quality data from Reach S-1 to assess the role of the wetland environment in affecting the water quality. Filtered and unfiltered samples will initially be analyzed for a full suite of constituents. Modifications to the suite will be evaluated as data become available.

3.0 SAMPLING AND ANALYSIS PLAN IMPLEMENTATION

3.1 Field Survey Implementation

3.1.1 Geomorphic Survey

Each canyon reach will be investigated according to LANL-ER-SOP-3.08, "Geomorphic Characterization" (LANL 1991, ER ID#21556). Field activities will be documented according to LANL-ER-SOP-03.12, "Field and Laboratory Notebook Documentation for ER Earth Sciences Studies" (LANL, ER ID# 21556).

The geomorphic survey will identify all sedimentary units including those that are likely to contain contaminants and those that are unlikely to contain contaminants. The units that are likely to contain contaminants will be considered candidates for a more focused investigation.

3.1.2 Geodetic Survey

Licensed surveyors will identify state planar coordinates for sample collection locations. All survey data will be submitted to the LANL ER Project's Facility for Information Management, Analysis, and Display (FIMAD). Surveys will be conducted in accordance with LANL-ER-SOP 03.01, "Land Surveying Procedures" (LANL 1991, ER ID#21556).

3.2 Sediment Sampling and Analysis Implementation

Two primary sampling tasks have been defined for the sediment investigation: sample collection for analysis of indicator contaminants, and sample collection for analysis of additional constituents. Analysis for soil pH, particle size distribution, and total organic carbon content will also be conducted on each sample. All samples will be collected according to all applicable LANL ER SOPs.

Each sample location will be marked, surveyed, and assigned a unique ER Project sample location identification number. Before shipment from the Sample Management Office to the analytical laboratory, gross-alpha, gross-beta, and gross-gamma radiation measurements will be performed for each sample for Department of Transportation shipping purposes.

Field duplicate samples will be collected according to ER Project guidance (LANL 1996, ER ID# 55574). These quality control samples are not included in the predetermined number of samples allocated for each canyon reach.

3.2.1 Sample Collection for Indicator-Contaminant Analysis

The number of samples and the locations chosen for collection of samples for PCB analysis as an indicator contaminant will be based on geomorphic criteria and on the statistical sampling design described in Appendix A . The statistical design requires information on the estimated volume of potentially contaminated sediments in each reach and the possible concentration of contaminants in each volume of sediment (see Appendix A). Samples will be submitted for PCB (Aroclor-specific) analysis to identify the location and extent of sedimentary deposits that contain contamination and for use in estimating contaminant inventory. These data will be collected using a phased approach. These data will also be used to assess current ecological risk and to test the assumptions of the geomorphic model. A subset of samples collected for PCB analysis will also be subjected to PCB congener analysis if a qualified laboratory can be identified for this analysis. The congener-specific analysis may provide additional insight into the toxicity of PCB contaminants and may be useful if a baseline risk assessment is conducted for upper

Sandia Canyon. Initially, a small number of samples will be submitted for congener analysis. Additional analysis will depend on assessment of the initial laboratory results and the value added to the investigation.

Table 3.2.1-1 presents the proposed minimum number of samples that will be submitted to provide this information.

TABLE 3.2.1-1

PROPOSED MINIMUM NUMBER OF SAMPLES TO ASSESS CONTAMINANT INVENTORY AND TEST THE ASSUMPTIONS OF THE GEOMORPHIC MODEL

Reach	Minimum Number of Samples for Inventory Estimation (see Appendix A)	Additional Samples to Assess Concentration Variability and Geomorphic Model	Minimum Number of Sediment Samples Planned
S-1 N Tributary	1	5	6
S-1 S Tributary	1	7	8
S-2	30	16	46
		Total	**60**

3.2.2 Sample Collection for Analysis of Additional Constituents

The suite of additional constituents will consist of TAL metals, SVOCs, and radionuclides. Samples will be collected for analysis of these additional constituents from sedimentary deposits where PCB contamination is present. Samples will also be collected from sedimentary deposits where no PCB contamination is found. These samples will be analyzed for the additional contaminant suite to confirm that those units are not contaminated. The number of samples allocated for additional-constituent analysis will be based on information gathered from the indicator-contaminant analyses. The minimum number of samples anticipated is 15. These data will be used to assess current ecological risk. If analytical results indicate the presence of metals that may have an ecological impact, then additional analyses may be required to evaluate the toxicity of these metals (i.e., trivalent chromium, hexavalent chromium 6).

If PCB contamination is not collocated with other contaminants, then the characterization of sedimentary deposits in the wetlands will be conducted without collocation as a guide for further sample site selection.

3.2.3 Sample Collection for Analysis of Soil pH, Particle Size Distribution, and Total Organic Carbon

All sediment samples submitted for laboratory analysis will be sieved in the field to remove the particle fraction greater that 2 mm. This is done to remove the fraction of the sediment that is expected to contain very little contamination compared to the size and surface area of the grains. Some samples will be sieved at a fixed laboratory and each particle size fraction (e.g., silt-sized fraction, fine sand-sized fraction) will be analyzed to provide information on the association between contaminant concentration and particle size. All sediment samples will be analyzed for pH and total organic carbon.

3.2.4 Sediment Sampling Methods

Surface sediment samples will be collected in accordance with LANL-ER-SOP-06.09, "Spade and Scoop Method for Collection of Soil Samples," and LANL-ER-SOP-06.10, "Hand Auger and Thin-Wall Tube Sampler" (LANL, ER ID# 21556). The tools used to collect the sediment samples will depend on the cohesion of the sediment, the collection depth, and the presence of flowing or standing surface water.

All samples will be collected using the applicable ER Project SOPs for the collection, preservation, identification, storage, transport, and documentation of environmental samples, as described in Section 4.4 in Chapter 4 of the IWP (LANL 1996, ER ID# 55574). Decontamination of sampling equipment will be performed in accordance with LANL-ER-SOP-01.08, "Field Decontamination of Drilling and Sampling Equipment" (LANL 1991, ER ID#21556). Wash water and other wastes generated during the sampling operation will be managed and disposed of in accordance with LANL-ER-AP-05.3, "Management of ER Program Wastes" (LANL, ER ID# 21556).

3.2.5 Analytical Methods for Sediment Samples

Sediment samples will be submitted to the Field Support Facility (FSF) for analysis of indicator contaminants (Aroclor-specific PCBs) and additional constituents (TAL metals, SVOCs, total petroleum hydrocarbons [TPH], gamma-emitting radionuclides, strontium-90, tritium, and alpha-emitting radionuclides). The analytical suites and methods are listed in Table 3.2.5-1. All analyses will be performed at a fixed laboratory approved by the LANL ER Project, and will be conducted in accordance with EPA SW-846 protocols (EPA, ER ID#s 31732, 31733, 31734, 8793). Radiochemical analyses will be performed using LANL-approved methods according to the ER Project analytical services statement of work (LANL 1995, ER ID# 49738). The detailed analyte lists, estimated quantitation limits (EQLs), required quality control (QC) procedures, and acceptance criteria are found in the ER Project analytical services statement of work (LANL 1995, ER ID# 49738). A special detection limit of 0.5 mg/kg will be requested for the antimony analysis.

All sediment samples will be homogenized and sieved in the field to remove the particle fraction greater that 2 mm. More detailed analysis for particle size will be performed either at LANL or an off-site facility that uses the following American Society for Testing and Materials (ASTM) Standards: C 136-96a, "Standard Method for Sieve Analysis of Fine and Coarse Aggregates" (ASTM 1997, ER ID# 57501); and D 422-63, "Standard Method for Particle-Size Analysis of Soils" (ASTM 1997, ER ID# 57496). In addition, the soil pH will be performed by ASTM Standard D 4972-95A, "Standard Test Method for pH of Soils" (ASTM 1997, ER ID# 57511); and total organic carbon will be performed by the ASTM Standard D2974-87, "Standard Test Method for Moisture, Ash and Organic Matter of Peat and Other Organic Soils" (ASTM 1997, ER ID# 57500). Other analyses, such as determination of mineralogy, may be performed if needed (e.g., to provide information about sorption of contaminants).

3.3 Surface Base-Flow and Storm Water Runoff Sampling

Surface water samples will be collected quarterly at all locations during both base-flow and storm water runoff (or snowmelt) conditions. Both filtered and unfiltered samples will be analyzed. The amount of total suspended solids will be determined for the filtered samples. The samples will be analyzed for TAL metals, PCBs, total petroleum hydrocarbons (TPH, SVOCs), and radionuclides. Samples will also be analyzed for other key water quality parameters including major anions, dissolved organic carbon (filtered), total organic carbon (unfiltered), and field parameters (turbidity, pH, and conductivity).

TABLE 3.2.5-1

PROPOSED ANALYTICAL SUITES AND METHODS FOR SOIL/SEDIMENT SAMPLES

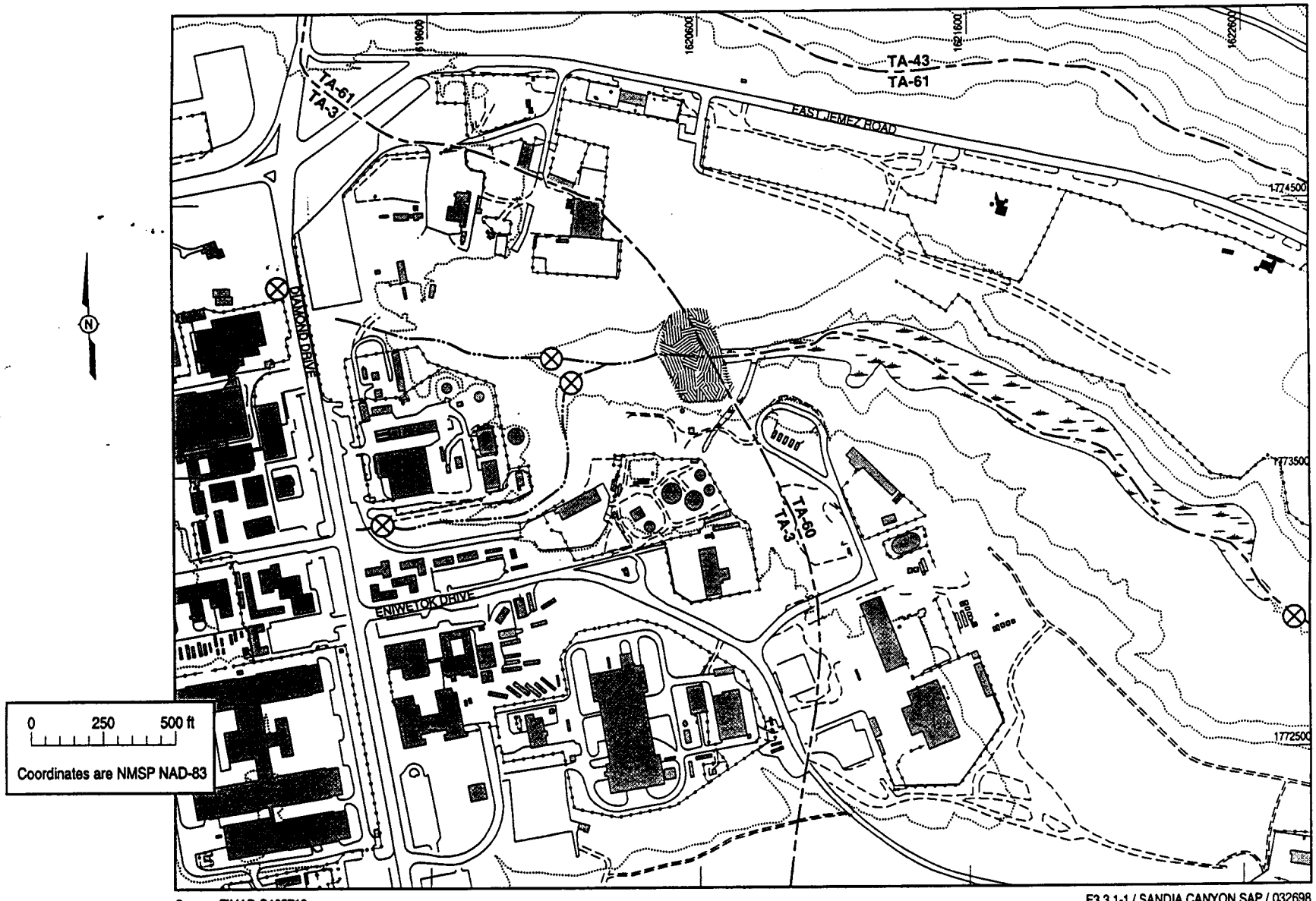
Analyte Suite	Analytical Laboratory Method
Inorganic Constituents	
TAL metals	SW-846 Methods 6010 (inductively coupled plasma emission spectroscopy), 6020 (graphite furnace atomic absorption), 7000 (inductively coupled plasma mass spectrometry), and 7470 (cold vapor atomic absorption)
Organic Constituents	
PCBs/ pesticides	SW-846 Method 8081 (gas chromatography/electron capture detection)
SVOCs (including PAHs)	SW-846 Method 8270 (gas chromatography/mass spectroscopy)
TPH	418.1 Infrared
Radionuclides	
Gamma-emitting radionuclides	Gamma spectroscopy
Strontium-90	Gas proportional counting
Alpha-emitting radionuclides	Alpha spectroscopy
Tritium	Liquid scintillation
Additional Testing	
Particle size	ASTM Standard C 136-96a (1984) (Standard Method for Sieve Analysis of Fine and Coarse Aggregates), and Standard D 422-63 (1963) (Standard Method for Particle-Size Analysis of Soils)
Soil pH	ASTM Standard D 4972-95A (1989) (Standard Test Method for pH of Soils)
Total organic carbon	ASTM Standard D2974-87 (1987) (Standard Test Method for Moisture, Ash and Organic Matter of Peat and Other Organic Soils)

3.3.1 Surface Base-flow Sampling

To characterize base-flow water quality in upper Sandia Canyon, samples will be collected quarterly for a period of one year beginning in the spring of FY98. Base-flow in Sandia Canyon results from effluent discharged from the Sanitary Waste water System Consolidation (SWSC) facility and from NPDES outfalls located within TA-3. Samples will be collected at all stations (see Figure 3.3.1-1). Surface water will be sampled in accordance with LANL-ER-SOP-06.29, "Single-Stage Sampling for Surface Water Runoff" (LANL 1991, ER ID# 21556).

3.3.2 Storm Water Runoff Sampling

To characterize water quality associated with storm water runoff in upper Sandia Canyon, samples will be collected during a minimum of one storm or snowmelt event each quarter for a period of one year beginning in the spring of 1998. During the summer monsoon season, a minimum of three storm events will be sampled. Storm and snowmelt events have the highest potential for mobilizing sediments (and possibly contaminants) stored in the wetland. Collection of samples during a runoff event helps assess the variability in water quality associated with variations in discharge, suspended solids, and dissolved constituents. The sample locations for these samples will be the same as for the base-flow sampling (Figure 3.3.1-1). Samples will be collected from discharges resulting from storm events that are greater than 0.1 inches in magnitude and that occur at least 72 hours from the previously measurable (greater than 0.1 inch rainfall) storm event. Samples will be collected during the rising limb of the storm hydrograph (first flush). Samples will be collected with a continuous sampler for the entire discharge, with each aliquot being separated by a minimum period of three minutes. Storm water runoff will be sampled in accordance with ESH-18 protocols.



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F3.3.1-1 / SANDIA CANYON SAP / 032698

Figure 3.3.1-1. Proposed locations of storm water and surface base flow water samples in upper Sandia Canyon.

3.3.3 Analytical Methods for Water Samples

Base-flow water samples and storm water runoff and snowmelt samples will be sent for the suite of analyses described in Section 3.2.5. The analytical suites and methods are listed in Table 3.3.3-1. All analyses will be performed at a fixed laboratory approved by the LANL ER Project, and will be conducted in accordance with EPA SW-846 protocols (EPA, ER ID#s 31732, 31733, 31734, 8793). Measurement of field parameters will be conducted in accordance with LANL-ER-SOP-06.02, "Field Analytical Measurements of Groundwater Samples" (LANL 1991, ER ID# 21556). The detailed analyte lists, EQLs, required QC procedures, and acceptance criteria are found in the ER Project analytical services statement of work (LANL 1995, ER ID# 49738).

TABLE 3.3.3-1

PROPOSED ANALYTICAL SUITES AND METHODS FOR SURFACE WATER SAMPLES

Analyte Suite	Analytical Laboratory Method
Inorganic Constituents	
TAL metals (filtered and unfiltered)	SW-846 Methods 6010 (inductively coupled plasma emission spectroscopy), 6020 (graphite furnace atomic absorption), 7000 (inductively coupled plasma mass spectrometry), and 7470 (cold vapor atomic absorption)
Organic Constituents	
PCBs/ pesticides (unfiltered)	SW-846 Method 8081 (gas chromatography/electron capture detection)
SVOCs (including PAHs) (unfiltered)	SW-846 Method 8270 (gas chromatography/mass spectroscopy)
TPH (unfiltered)	418.1 Infrared
Radionuclides	
Gamma-emitting radionuclides (filtered and unfiltered)	Gamma spectroscopy
Strontium-90 (filtered and unfiltered)	Gas proportional counting
Alpha-emitting radionuclides (filtered and unfiltered)	Alpha spectroscopy
Tritium (unfiltered)	Liquid scintillation
Additional Testing	
Major anions/cations (filtered and unfiltered)	SW 846 Method 9056
Dissolved Organic Carbon (filtered)	EPA Method 415.1 or SW 846 Method 9060A
Total Organic Carbon (unfiltered)	EPA Method 415.1 or SW 846 Method 9060A
pH (unfiltered)	Field Instruments

3.4 Schedule

Implementation of this SAP is scheduled to begin in April 1998.

4.0 DATA ASSESSMENT

4.1 Verification and Routine Data Validation

All data to be used for site decision-making will be loaded into the ER Project electronic data system (the Oracle database run by FIMAD). These data will include field sample information, geomorphic information, and laboratory results. The analytical data produced by the contract laboratories will use the standard data verification and baseline validation procedures (LANL 1993, ER ID# 38847).

4.2 Data Quality Assessment

Data quality assessment (DQA) for the results from this sampling and analysis plan will use the general framework outlined in Section D1 of the LANL ER Project QAPP (LANL 1996, ER ID# 55574). The DQA for this project will be specialized to meet the needs of the LANL ER Project Canyons Focus Area, and will consist of the following steps: 1) evaluate the design assumptions relating to the geomorphic model, 2) quantify uncertainties associated with the nature and extent of contamination, and 3) quantify uncertainties associated with preliminary risk analyses.

4.2.1 Evaluation of Design Assumptions: Geomorphic Model

The geomorphic model assumes that contaminants will be found only within sediments that were deposited since Laboratory operations were initiated within the watershed and that, in some cases, distinct geomorphic units (sediment packages) may contain distinct concentration ranges and/or analyte suites. For upper Sandia Canyon, the geomorphic model also assumes that PCBs will be collocated with any other contaminants identified within the geomorphic units.

Several contingencies are in place if the geomorphic model is determined to be incorrect. If no discernible geomorphic units can be identified for upper Sandia Canyon based on mapping or analytical results, then the post-Laboratory sediments will be characterized as a single geomorphic unit and samples will be allocated to provide sufficient coverage of surface and subsurface sediments within a single mapping unit. If there are no clear physical criteria that can be used to delineate contaminated post-Laboratory sediments from uncontaminated pre-Laboratory sediments, then additional sampling emphasis will be placed on delineating that boundary with analytical data. If contamination is found below the stratigraphic contact between post-Laboratory sediments (above) and pre-Laboratory sediments (below), as determined by physical criteria, then attempts will be made to determine the vertical extent of contamination in this investigation, and the need for a ground water investigation in the wetlands will be considered for incorporation as part of the Sandia Canyon Work Plan under the Canyons Focus Area.

4.2.2 Uncertainty Associated with the Nature and Extent of Contamination

Uncertainty in the nature and extent of contamination is related to the following data inputs:

- validity of assumptions in conceptual models for human and ecological exposure;
- the validity of the geomorphic model for locating potentially contaminated sediment packages;
- the volume of potentially contaminated sediment in the wetland based on geomorphic mapping units to be determined from aerial photographs, field mapping, and field sediment thickness measurements;

- the concentration of contaminants within geomorphic units to be determined from sample collection and analysis;
- the collocation, or lack thereof, of contaminants detected in the sediment samples in various geomorphic settings; and
- the relationship between the nature of known contaminants sources and the list of contaminants detected in wetlands sediments and surface water samples.

4.2.3 Uncertainty Associated with Preliminary Risk Analyses

Uncertainty in the preliminary risk analyses is related to uncertainty in the inputs to these risk calculations. The key data inputs to the risk calculations include:

- the concentrations of contaminants within the wetland and other sources in the upper Sandia Canyon watershed;
- information on the toxicity of contaminants;
- information on the potential for bioaccumulation of contaminants;
- receptor exposure parameters such as exposure duration and ingestion rate of various contaminated media; and
- models used to estimate concentrations in media not directly sampled in this investigation (for example, using a model to estimate concentration in air based on a concentration in soil).

5.0 ADMINISTRATION

5.1 Project Task Organization

Table 5.1-1 shows the project task organization for the upper Sandia Canyon Phase I investigation.

TABLE 5.1-1

PROJECT TASK ORGANIZATION AND PERSONNEL

Title	Name	Organization
Field Project Management		
Focus Area Leader	Roy Michelotti	EM/ER[a]
Field Operation Manager (FOM)	Lynda Hartman	EM/ER
Field Team Manager (FTM)	Jayne Jones	PMC[b]
Field Team		
Field Team Leader (FTL)	Danny Katzman	PMC
Site Safety Officer (SSO)	Jayne Jones	PMC
Radiation Screening Personnel (RSP)	Danny Katzman	PMC
Geomorphologist	Paul Drakos Danny Katzman	GG[c] PMC
Sampler	Melissa Jackson	EM/ER
Waste Manager (WM)	Rene Evans	RMRS[d]

a. EM/ER = LANL Environmental Management/Environmental Restoration
b. PMC = Program Management Company
c. GG = Glorietta Geosciences
d. RMRS = Rocky Mountain Remediation Services

5.2 Training

All personnel involved with the implementation of the work plan will have fulfilled the required training for applicable roles in accordance with LANL-ER-AP-05.2, R1, "Determination, Completion, and Documentation of Environmental Restoration Worker Training" (LANL 1991, ER ID# 21556). At a minimum, all field team members will have documentation of 40-hour Occupational Safety and Health Act (OSHA) Hazardous Waste Operations (HAZWOPER) training, a current 8-hour annual HAZWOPER refresher (if applicable), LANL Radiological Worker II, LANL General Employee Training, a current medical fit-for-work statement, and employer hazard communication training. Personnel training records will be available for inspection.

5.3 Reporting and Records

A daily activity log will be prepared during active field operations. Each log will describe the specific field activities conducted during the day, any surveys performed, sampling activities (including number and types of samples collected), field monitoring or screening results, and unexpected events. Field records

will also be generated to document sample collection and tracking, health and safety briefings, and monitoring-equipment performance checks. Field records include, but are not limited to the following:

- Sample Collection Log
- Chain of Custody/Request for Analysis Form
- Tailgate Safety Meeting/Attendee Sign-off Sheet
- Daily Safety Inspection Checklist
- PPE Inspection Checklist
- Radiation Monitoring/Performance Check
- Site Access/Exclusion Zone Logbook
- FTL Logbook
- SSO Logbook
- Waste Management Logbook
- Visitors Logbook
- Field Photographic Log

All original documents will be transferred to the LANL ER Project Records Processing Facility (RPF) in accordance with LANL-ER-AP-02.1, R1, "Procedure for LANL ER Records Management" (LANL1991, ER ID# 21556).

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Appendix A

Data Quality Requirements and Statistical Sampling Design

APPENDIX A DATA QUALITY REQUIREMENTS AND STATISTICAL SAMPLING DESIGN

The three requirements of the upper Sandia Canyon data are to: 1) provide a quantitative estimate of the inventory of chemicals of potential concern (COPCs) where the initial target is to estimate total COPC mass to within +/-20% of the estimated median with 75% confidence; 2) provide information for a baseline ecological risk assessment of upper Sandia Canyon, where this risk assessment is performed to evaluate potential remedial actions; and 3) provide data to the Los Alamos National Laboratory (LANL) Environmental Restoration (ER) Project Canyons Focus area for modeling the remainder of Sandia Canyon. Samples will be allocated for analysis of indicator constituents based on a statistical sampling design, which is described below. The statistical design requires information on the expected volume of potentially contaminated sediments in each reach and the possible concentration of contaminants in each volume.

Based on aerial photographs, existing data, and a field survey of upper Sandia Canyon, two distinct reaches have been defined. Table A-1 summarizes the surface area and depth of Laboratory-related sediment deposits in the upper Sandia Canyon reaches. The areas were estimated from maps provided by the LANL ER Project's Facility for Information Management, Analysis, and Display (FIMAD) (see FIMAD plot ID G105441) and should be considered preliminary. The volume of potentially contaminated sediment in each reach was calculated by multiplying the area by the sediment thickness observed during reconnaissance. These volumes are also presented in Table A-1. The estimated total area and volume of upper Sandia Canyon sediments and the fraction that each reach comprises of the total area are also presented in Table A-1. The most important conclusion is that Reach S-2 comprises more than 95% of the area and the volume of sediments located in Sandia Canyon.

TABLE A-1

SUMMARY OF CURRENT AREA, DEPTH, AND VOLUME ESTIMATES FOR UPPER SANDIA CANYON REACHES

Reach	Area (m^2)	Percent of Total Area	Depth (m)	Volume (m^3)	Percent of Total Volume
S-1 N Tributary	642	2.8	0.65	417	1.7
S-1 S Tributary	1082	4.8	0.65	703	2.8
S-2	21,000	92.4	1.13	23,730	95.5
Total Area	22,724		Total Volume	24,851	

One objective of the upper Sandia Canyon investigation is to estimate the inventory of contaminants in sediments. Common sense and simple statistical formulae suggest that half the sampling effort should be directed to a reach that contains half the volume of sediments. The statistical term for reaches is "strata", and the statistical methodology for analyzing reaches is known as stratified random sampling (SRS). (Gilbert 1987, ER ID# 57503) presents the equations used for SRS (see pages 45–57). The simplest SRS allocation is based on the proportion of the total represented by each strata. Thus, the percentage of area and volume presented in Table A-1 represent a simple SRS sample allocation. Another sample allocation consideration is the expected average concentration of contaminants present in each reach.

Historical information on releases from Technical Area (TA) 3 and the existing Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) data for source PRSs suggest that the majority of the PCBs currently located in upper Sandia Canyon originated from releases at Potential Release Site (PRS)

3-056(c). Because of the limited storage of sediments in the two tributaries associated with Reach S-1, polychlorinated biphenyl (PCB) concentrations are expected to be low in these reaches. Most of the stored PCBs are expected to be contained in the wetland proper, which comprises Reach S-2 (see Table A-2). This assumption was made to adjust sample allocation for the expected concentration of contaminants in reach sediments. The optimal allocation suggests that nearly all of the samples should be collected from Reach S-2.

TABLE A-2

ESTIMATED STANDARD DEVIATION OF PCBs AND VOLUME OF REACHES USED FOR SRS OPTIMAL SAMPLE ALLOCATION*

Reach	Estimated Reach Standard Deviation (mg/kg of PCBs)	Volume (m^3)	Sampling Weighting Factor	Percent Allocation to Reach for "Optimal" Number of Samples
S-1 N Tributary	1.0	417	0.017	0.2
S-1 S Tributary	1.0	703	0.028	0.3
S-2	10.0	23,730	9.549	99.5
	Total Volume	24,851		

* The optimal allocation for stratified random sampling designs is based on equation 5.10 presented in (Gilbert 1987, ER ID# 56179). This equation is presented as Eq. 1 below.

$$f_h = \frac{\left(v_h / v_{total}\right) \cdot \sigma_h}{\sum_{h=1}^{L} \left(v_h / v_{total}\right) \cdot \sigma_h}$$

where:
f_h = fraction of samples in the hth reach,
v_h = volume of the hth reach,
v_{total} = total volume, and
σ_h = estimated standard deviation of concentration in the hth reach.

Eq. 1

The next consideration in developing the sample allocation is to establish an adequate number of samples. The stratified random sampling formulae provide an estimate of the expected standard error in the mean concentration as a function of the number of samples. This relationship for the assumptions made for upper Sandia Canyon is presented in Figure A-1. At a value of approximately 30 samples, adding additional samples is reaching a point of diminishing returns. Each additional sample reduces the expected uncertainty in the estimate of the mean PCB concentration but such improvements in the estimate of mean are rapidly diminishing. Thus, 30 samples are proposed as the minimum number of samples needed to establish contaminant inventory in upper Sandia Canyon.

In addition to estimating inventory, samples should be allocated to address specific ecological risk issues as well as test the assumptions of the geomorphic model for upper Sandia Canyon. Table A-3 presents the proposed number of samples to address these other issues.

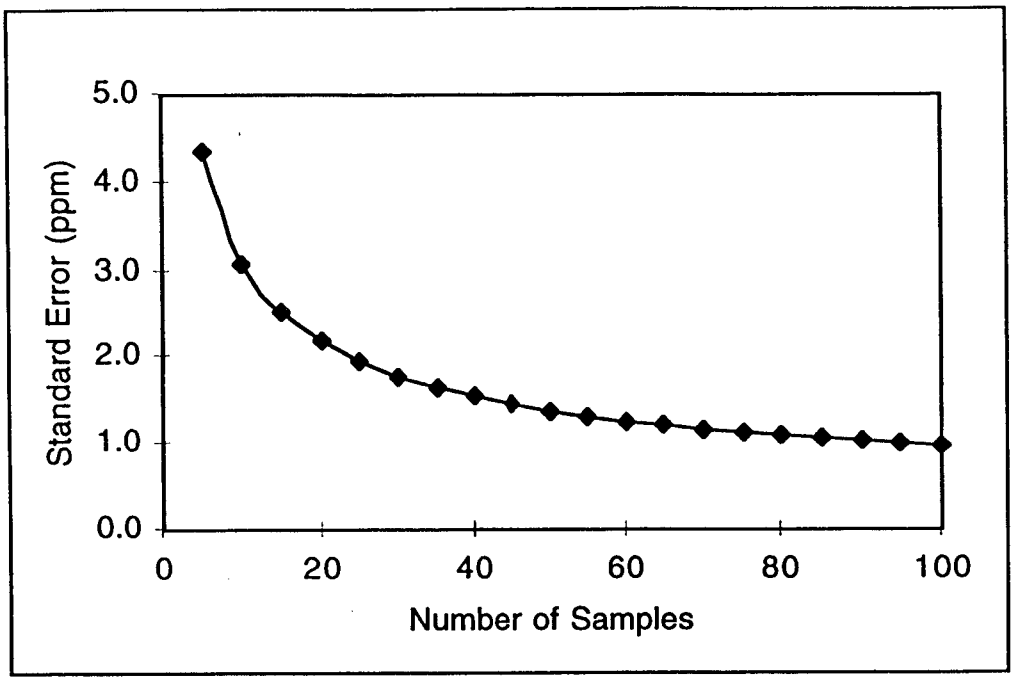

Figure A-1. Relationship between the standard of the estimate of the mean PCB concentration versus the number of samples collected in upper Sandia Canyon.

TABLE A-3

PROPOSED NUMBER OF SAMPLES TO ADDRESS INVENTORY ESTIMATION AND ASSESS THE ADEQUACY OF THE CURRENT GEOMORPHIC MODEL

Reach	Minimum Number of Samples for Inventory Estimation from Eq. 1	Additional Samples to Assess Concentration Variability and Geomorphic Model	Total Number of Sediment Samples Planned
S-1 N Tributary	1	5	6
S-1 S Tributary	1	7	8
S-2	30	16	46

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Appendix B

Existing Data and Historic Information

APPENDIX B EXISTING DATA AND HISTORIC INFORMATION

This appendix describes the existing data and historic information for potential release sites (PRSs) that are the potential sources of contaminants in the wetland in upper Sandia Canyon. Figure 1.2-1 in the body of this sampling and analysis plan (SAP) presents the locations of the PRSs discussed. The discussion is organized on a PRS-by-PRS basis, and the PRSs are grouped as follows:

- Section B-1.0 describes the major current-day contaminant sources (sites where chemicals of potential concern [COPCs] are currently present at levels exceeding screening action levels [SALs] or where polychlorinated biphenyls [PCBs] are present at levels exceeding 10 ppm).
- Section B-2.0 describes the major historical contaminant sources (sites where COPCs were once present at levels exceeding SALs or where PCBs were once present at levels exceeding 10 ppm).
- Section B-3.0 describes the minor current-day contaminant sources (sites where COPCs are currently present at levels less than SALs but exceeding background, or where there are PCBs present at levels less than 10 ppm).
- Section B-4.0 describes the minor current-day contaminant sources (sites where COPCs were once present at levels less than SALs but exceeding background, or where there are PCBs present at levels less than 10 ppm).

B-1.0 MAJOR CURRENT-DAY SOURCES OF WETLAND CONTAMINATION

PRS 3-012(b) and Collocated PRS 3-045(b), Power Plant Outfall. PRSs 3-012(b) and 3-045(b) are collocated and are associated with the power plant outfall (TA-3-22) (see Figure 1.2-1 in the body of this SAP). From 1951 to 1985, the outfall discharged cooling water that originated from treated effluent generated by the former TA-3 waste water treatment plant (WWTP). The outfall discharges to a small tributary of Sandia Canyon south of the power plant. In the past, water from the WWTP was treated with chromates before being used as cooling water at the power plant. The National Pollutant Discharge Elimination System (NPDES) permit number for this outfall is EPA01A001.

PRS 3-045(b) is the outfall from cooling towers TA-3-25 and TA-3-58, which serve the power plant (TA-3-22) (see Figure 1.2-1 in the body of this SAP). The discharge point is identified as NPDES permitted outfall EPA01A001 and is identical to PRS 3-012(b). Cooling tower TA-3-25 was demolished in 1990, and only the concrete basin remains. Cooling tower TA-3-58 remains in operation. Effluent originates from the neutralization tank, the chlorine building, and the cooling tower, and is kept between a pH of six and nine. In addition, reuse water from the Sanitary Wastewater System Consolidation (SWSC) is pumped to and used in the cooling towers and subsequently released to the outfall. Storm water that collects in the concrete foundation of TA-3-25 also flows from this outfall. A one-time release of sulfuric acid was discharged in 1990 and is described in the discussion for PRS 3-036(g).

The sampling approach in the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) Work Plan for Operable Unit (OU) 1114 was designed to determine whether the outfall discharge resulted in any contaminant releases (LANL 1993, ER ID# 20947). The COPCs identified from the past and current operations include chromates used as a water treatment in the cooling towers; PCBs from spills or leaks within the Technical Area (TA) 3 Power Plant yard (these PCBs could have been washed toward the outfall during storm events); and anything that may have found its way into the TA-3 sanitary

WWTP and, as a result, might be present in the treated effluent used as cooling tower water at the TA-3 Power Plant.

During a 1994 sampling campaign, six samples were collected from three locations in the stream channel below the outfall, and five samples were collected from two locations on the soil bank on either side of the outfall pipe. All samples were collected from a depth of 0- to 6-in. Samples were submitted for analysis of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides/PCBs, herbicides, target analyte list (TAL) metals, and radionuclides. The data for radionuclides and inorganics that exceeded background upper tolerance limits (UTLs) and detected organics for each PRS are summarized by analyte in Table 1.3-2 in the body of this SAP. PRSs 3-012(b) and 3-045(b) are recommended for a Phase II investigation during which samples will be collected to provide information on other possible contaminant sources and to define the extent of contamination. For further information, see the RFI Report for 53 PRSs in TA-3, TA-59, TA-60, and TA-61 (LANL 1996, ER ID# 52930).

PRS 3-045(c), Power Plant Outfall. PRS 3-045(c) is an outfall (NPDES permit number EPA03A028) located approximately 55 ft east of PRS 3-012(b). This outfall receives effluent from cooling tower TA-3-285, which serves the generators powering the Laboratory's computer system. This outfall may have received water treated with chromates, as well as water that possibly contained PCBs from past spills within the TA-3 Power Plant yard (such PCBs may have been washed to the storm drain above this outfall). This PRS is discussed in detail in the RFI Report for 53 PRSs in TA-3, TA-59, TA-60, and TA-61 (LANL 1996, ER ID# 52930).

The sampling approach in the RFI Report was designed to determine whether the outfall discharge resulted in the release of any contaminants (LANL 1995, 1291). PRS 3-045(c) is recommended for a Phase I investigation (in conjunction with the Phase II RFI being conducted at PRSs 3-012[b] and 3-045[b]) during which samples will be collected from additional locations (see the RFI Report for 53 PRSs in TA-3, TA-59, TA-60, and TA-61 [LANL 1996, ER ID# 52930]). These new samples will provide information on other possible contaminant sources and will define the extent of contamination.

PRS 3-013(a, b) and Collocated PRS 3-052(f), TA-3 Storm Drain Outfall. PRS 3-013(a) is a 1500-ft long storm drain serving the shop building (TA-3-38) for Johnson Controls-World Services, Inc. (JCI), a Laboratory contractor (see Figure 1.2-1 in the body of this SAP). There are two grated inlets to this storm drain from building TA-3-38; one is located northwest of the building and the other is located at the northeast corner of the building. The majority of the storm drain is an underground corrugated metal pipe that runs south, then east around TA-3-38, and then east along the south side of the Otowi Building (TA-3-261). The storm drain merges with several others before it surfaces in an open, concrete, rock-lined ditch approximately 100 ft east of the Otowi Building. It then passes under streets and sidewalks and surfaces again at a permitted outfall (NPDES permit EPA03A023) located just north of building TA-3-1837. PRS 3-013(b) consists of floor drains in the basement of the JCI shop building (TA-3-38). These floor drains are located in the plasma-burning machine area, metals cutting room, and pipe fabrication shop. They may have been previously routed to the storm drain (PRS 3-013[a]). These floor drains now drain to the sanitary sewer system. PRSs 3-013(a, b) are discussed in detail in the RFI Report for 53 Potential Release Sites in TA-3, TA-59, TA-60, and TA-61 (LANL 1996, ER ID# 52930).

PRS 3-052(f) is an outfall northeast of building TA-3-207. The outfall, which received effluent from drains, sumps, sinks, and water fountains in several buildings at TA-3, discharges to Sandia Canyon. In addition, PCB-containing oils from the Sherwood Building (TA-3-105) may have been discharged to this outfall. PRS 3-052(f) is discussed in detail in the RFI Work Plan for OU 1114, Addendum 1 (LANL 1995, 1291).

The sampling approach in the RFI Work Plan for OU 1114 was designed to determine whether the storm drain discharge at the outfall resulted in the release of contaminants to the drainage ditch (LANL 1993, ER ID# 20947). COPCs identified at these associated PRSs include various organics and PCBs (possibly from discharges from the Sherwood Building floor drains), as well as metals that possibly entered the water waste stream from the NTS shop floor drains. Seven samples were collected in 1994 from five locations at depths ranging from 0- to 8-in. Samples were submitted for analysis of VOCs, SVOCs, PCBs, and TAL metals. The data for inorganics that exceeded background UTLs and detected organics at each PRS are summarized by analyte in Table 1.3-2 in the body of this SAP.

PRS 3-014(c2), WWTP Abandoned Outfall (or, Active Storm Drain Outfall). PRS 3-014(c2) is listed in the SWMU Report (LANL 1990, ER ID# 7511, 7512, 7513, 7514) as the abandoned outfall associated with the former TA-3 WWTP (see Figure 1.2-1 in the body of this SAP). However, the area incorrectly investigated is a storm drain and overflow area from Building TA-3-166. This area is located on the north side of the pump building (TA-3-166). The storm drain has incised a channel up to 3 ft deep. The channel eventually discharges to Sandia Canyon north of the old TA-3 WWTP chlorination chamber. On occasion, soils within the storm drain channel were cleaned out with a backhoe and the removed soil was piled onto the channel bank.

The sampling approach in the RFI Work Plan for OU 1114 was designed to determine whether discharge from the pump house overflow pipe resulted in the release of any contaminants and whether any contaminants were located in the incised channel (LANL 1993, ER ID# 20947). Because effluents were received from many different types of facilities at TA-3, the COPCs identified for this PRS include heavy metals (antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, silver, thallium, and vanadium), radionuclides, cyanide, various organics, pesticides, and herbicides. COPCs are expected to be initially present in the water and then filtered into the sand and gravel sediments below the overflow pipe from Building TA-3-166, as well as in the storm channel. In 1994, 20 samples were collected from nine locations downgradient from Building TA-3-166 at depths ranging from 0- to 18-in. Samples were submitted for analysis of VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, and radionuclides. The data for radionuclides and inorganics that exceeded background UTLs and detected organics are summarized by analyte in Table 1.3-2 in the body of this SAP. PRS 3-014(c2) is recommended for a Phase II investigation to determine the extent of metals; PRS 3-014(c2'), the abandoned outfall, will be sampled to determine whether a release has occurred and to provide information for a baseline risk assessment. For further information, see the RFI Report for 53 PRSs in TA-3, TA-59, TA-60, and TA-61 (LANL 1996, ER ID# 52930).

B-2.0 MAJOR HISTORICAL SOURCES OF WETLAND CONTAMINATION

PRS 3-003(m), Capacitor Banks. PRS 3-003(m) includes two capacitor banks at building TA-3-1188 in a limited-access, fenced area. These capacitor banks were installed in 1973. The two banks consisted of 55 PCB capacitors on wooden poles on minimal topsoil over welded tuff. Over a four-year period during the 1980s, numerous capacitors ruptured. Three capacitors ruptured in 1987, and oil was released onto the rack and the surrounding soil. The capacitor bank was shut down. Cleanup of the area began in 1988. All 55 capacitors and two racks were removed and both racks were washed using the double-wash/double-rinse method. Concrete footings were removed and disposed of, and approximately 357 yd^3 of soil beneath the capacitor banks was excavated until PCB concentrations were below 25 ppm (see Table 1.3-2 in the body of this SAP) (LANL 1989, ER ID# 4050). The area was backfilled in 1989 with clean soil, and new concrete footings, racks, and 55 non-PCB capacitors were installed. Currently, there is a man made channel across the site through the backfill. Sediment runs onto the site from upgradient. There is no visible erosion or movement of sediment off-site. COPCs that have been identified at this site include

PCBs from ruptured capacitors and polycyclic aromatic hydrocarbons (PAHs) from oil released on to the surrounding soil. PRS 3-003(m) is discussed in detail in the RFI Work Plan for OU 1114, Addendum 1 (LANL 1995, 1291).

PRSs 3-014(a,e), WWTP Imhoff Tanks. PRSs 3-014(a,e) are grassy areas surrounding the Imhoff tanks and other structures at the former TA-3 WWTP (see Figure 1.2-1 in the body of this SAP). It is reported that dried sludge and effluent were applied to the grass around the Imhoff tanks as a soil amender.

The sampling approach in the RFI Work Plan for OU 1114 was designed to determine whether any contaminants were released to the environment as a result of sludge application or tank spill-over onto the surrounding soil (LANL 1993, ER ID# 20947). COPCs identified at this site include pesticides, herbicides, radionuclides, and heavy metals (arsenic, barium, cadmium, chromium, lead, mercury, nickel, selenium, silver, and zinc) that may be present in the dried sludge. Twelve samples were collected during a 1994 sampling campaign from five locations around the tanks at depths ranging from 0- to 18-in. Samples were submitted for analysis of VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, and radionuclides. The data for radionuclides and inorganics that exceeded background UTLs and detected organics at each PRS are summarized by analyte in Table 1.3-2 in the body of this SAP. For further information, see the RFI Report for 53 PRSs in TA-3, TA-59, TA-60, and TA-61 (LANL 1996, ER ID# 52930).

PRS 3-015 and Collocated PRS 3-053, Rolling Mill Outfall. The basement area of the rolling mill building (TA-3-141), which is designated PRS 3-053, housed electrochemical and depleted uranium processing facilities (see Figure 1.2-1 in the body of this SAP). Powder characterization, plasma flame spray processing, beryllium processing, and depleted uranium processing are ongoing operations in this building. It is not known whether releases occurred through the basement floor drains formerly connected to the storm water system that leads to the PRS 3-015 outfall.

PRS 3-015 is an outfall that received water from building TA-3-141. The outfall received effluent from janitor sinks and floor and roof drains until early 1993 when the lines to the outfall were decommissioned. The outfall is located northeast of building TA-3-141, outside the security fence and between the fence and the pavement. The outfall area is level and covered with grasses, forming a narrow, highly deteriorated, asphalt-lined channel that drains northeast. The outfall is permitted under NPDES with outfall number EPA04A140.

The sampling approach in the RFI Work Plan for OU 1114 was designed to determine whether any contaminants were released through the outfall (LANL 1993, ER ID# 20947). Because PRS 3-053 was connected to the PRS 3-015 outfall, information from sampling activities at PRS 3-015 applies to PRS 3-053. COPCs identified for these two collocated PRSs are primarily radionuclides (depleted uranium), and heavy metals (mercury and beryllium) from floor drains in TA-3-141. In 1994, six samples were collected from five locations below the outfall from a depth of 0- to 18-in. Samples were submitted for analysis of SVOCs, TAL metals, and radionuclides. The data for radionuclides and inorganics that exceeded background UTLs and detected organics at each PRS are summarized by analyte in Table 1.3-2 in the body of this SAP. For further information on PRS 3-015, see the RFI Report for 53 PRSs in TA-3, TA-59, TA-60, and TA-61 (LANL 1996, ER ID# 52930). For further information on PRS 3-053, see the RFI Work Plan for OU 1114, Addendum 1 (LANL 1995, 1291).

PRS 3-036(j), Aboveground Tanks. PRS 3-036(j) consists of two 150 000-gal. diesel fuel tanks installed in 1954 as backup power for building TA-3-22. The two tanks are connected to a pump house, building TA-3-57, which then connects to building TA-3-22. The only release to the environment from these tanks occurred in 1991. An odor of natural gas was detected and analysis indicated that a fitting on a gas line

needed to be replaced. The backup fuel system was brought on-line and pressurized, and JCI personnel immediately discovered a leak in the underground line connecting buildings TA-3-57 and TA-3-22. Diesel fuel from one of the tanks was discharged onto the ground and entered a storm water channel near PRS 3-045(a) where it drained into a watercourse. JCI operators immediately discovered the spill and shut off the fuel line, ending the discharge. The fuel discharged to a small drainage to Sandia Canyon. The total amount discharged was estimated to be 100 to 200 gal. (LANL 1992, ER ID# 57505). The Laboratory's Emergency Management Office was notified of the diesel spill and subsequently notified the Department of Energy (DOE), New Mexico Environment Department (NMED), and Environmental Protection Agency (EPA) (LANL 1992, ER ID# 57505; Bellows 1991, ER ID# 57499).

The diesel spill was contained in the watercourse within minutes of the spill using absorbent booms and pillows. Pools of diesel fuel were removed using a wet/dry vacuum and absorbents. Contaminated soil was removed, sampled, and properly disposed of. NPDES outfalls located downstream of the spill were controlled by rerouting or stopping their discharges to ensure that the spill was contained (NMED 1992, ER ID# 57505).

COPCs for this PRS are TPH in soil and water that may have entered the watercourse through a small drainage to Sandia Canyon following the diesel fuel spill. The concentrations of TPH in confirmatory samples collected after the cleanup were 1.9 mg/L in water and 511 mg/g in soil. The corrective action was to install a temporary fuel line until JCI designed and installed a permanent replacement (LANL 1992, ER ID# 57505). In addition, water flow in the canyon was continuously monitored for a period of one year, and annual leak testing of the backup fuel systems at all three steam plants was conducted. NMED inspected the site in February 1992 and found that the corrective actions were satisfactory.

The two tanks are structurally sound and have automatic leak detection systems. In addition, no hazardous waste has been managed in either tank. The only historical release on record is the 1991 spill from the pump house line, which was addressed. For further information on this PRS, see the RFI Work Plan for OU 1114, Addendum 1 (LANL 1995, 1291).

PRS 3-056(c), Transformer Storage Area. PRS 3-056(c) was used from 1967 to approximately 1992 as a storage area for electrical equipment such as capacitors and transformers filled with PCB-containing oil, new and used dielectric fluids, and waste solvent (LANL 1993, ER ID# 20947). PRS 3-056(c) is located on the north side of a utilities shop, building TA-3-223 (see Figure 1.2-1 in the body of this SAP), and was decommissioned in 1992). A small portion of this area (located near the fence line north of the northeast corner of TA-3-223) was used as a storage area for electrical equipment with PCB-containing oil. The types of cleaning solvents potentially used and stored at the site include an unknown solvent from 1967 to approximately 1981 and trichloroethane from 1981 to 1990. Since 1990, a nonhazardous, citrus-based solvent has been used to clean electrical equipment. Transclene®, a solvent containing tetrachloroethylene (PCE), was used by an electrical equipment maintenance subcontractor when retrofilling transformers in the field, and it may have been stored at the site. The subcontractor was responsible for the disposal of all waste materials from this activity; hence, no wastes were returned to the PRS 3-056(c) storage area. In 1991, approximately 1 to 2 ft of clean fill was placed on the site and surrounding area to change drainage patterns. COPCs for PRS 3-056(c) are primarily PCBs in soil from leaking capacitors, transformers, and electrical equipment. PRS 3-056(c) is discussed in detail in the RFI Work Plan for OU 1114 (LANL 1993, ER ID# 20947). A 1994 RFI confirmed PCB contamination existed at the site.

Remedial activities (a voluntary corrective action [VCA]) were initiated in August 1995 to remove PCB-contaminated soil. As excavation of the contaminated material progressed, a 10-ft by 10-ft grid was laid

across the site and samples were collected on the nodes of the grid to provide an organized approach to the excavation-guidance sampling. Samples were collected before excavating an area to define the lateral and vertical extent of PCB contamination and after excavating an area to assess the presence and concentrations of any remaining PCBs.

As contaminated soil was excavated and additional excavation-guidance samples were collected, the lateral extent and volume of contaminated soil were observed to be greater than expected. Ultimately, the lateral extent of soil contamination was determined to encompass an area approximately 130 ft long by 70 ft wide, which became known as the west slope. Cleanup of the west slope was completed in December 1995 to the proposed cleanup level of 10 mg/kg by excavating the soil with heavy equipment and using a soil vacuuming technology.

A second excavation area, referred to as the north slope, was located on the north side of the electrical equipment storage area where the mesa edge slopes to the north. As the west slope excavation area increased in a northerly direction along the mesa edge, site characterization samples were collected from the mesa top and north slope. Analytical results of these samples revealed the presence of PCB-contaminated soil on this slope. The north slope was remediated primarily using soil vacuuming technology. Remediation of the north slope to the proposed cleanup level of 10 ppm was completed in January 1996 (except for a few small spots with PCB concentrations ranging from 10 to 60 ppm that were to be removed during slope stabilization).

To verify that the proposed 10 mg/kg cleanup level for PCBs had been met, a verification sample location grid was laid out on both the north and west slopes and divided into four composite zones in accordance with "Verification of PCB Spill Cleanup by Sampling and Analysis" (EPA 1985, ER ID# 8026). Samples from either nine or ten grid locations within each zone were collected and composited before submittal to a fixed laboratory for analysis of PCBs by EPA SW 846 Method 8080.

Analytical results of the composite verification samples collected on the west slope indicated that PCB concentrations in two of the four zones were less than 10 mg/kg. Analytical results for the remaining two zones suggested that the proposed 10 mg/kg cleanup level had not been statistically achieved. Additional sample material was collected at each discrete sample location in these two zones and submitted to a fixed laboratory for analysis. The analytical results indicated that 15 of the 18 sample locations had PCB concentrations below the proposed 10 mg/kg cleanup level. Two of the remaining three locations had PCBs at a concentration of 13 mg/kg. The remaining sample contained PCBs at a concentration of 34 mg/kg.

Analytical results of the composite verification samples collected on the north slope suggested that PCB concentrations in all four of the composite zones were still too high to indicate that the proposed 10 mg/kg cleanup level had been achieved. Discrete samples from each location were then analyzed to isolate those areas that exceeded 10 mg/kg. The analytical results for the discrete samples indicated that 12 of the 38 locations contained PCBs at concentrations greater than 10 mg/kg. A summary of the verification sample analytical results are presented in Table B-1.

Interim measures were taken to prevent storm water flow across the mesa and the north and west slopes of the site by installing Curlex™ erosion control blankets and asphalt and/or soil berms. Measures for final corrective action (further remediating the site to achieve PCB levels below 1 ppm) are pending. The schedule for these activities is outlined in the LANL ER Project baseline.

TABLE B-1

RESULTS OF VERIFICATION GRID SAMPLING AT PRS 3-056(c)

Sample Date	Composite Group	Number of Samples with PCB Concentrations < 10 mg/kg	Sample Numbers and PCB Concentrations > 10 mg/kg[a]
North Slope Verification Sampling			
2/1/96	A	9	0103-96-0100 = 19 0103-96-0096 = 20 0103-96-0077 = 22
2/1/96	B	7	0103-96-0070 = 14 0103-96-0075 = 47
2/1/96	C	6	0103-96-0095 = 12 0103-96-0102 = 12 0103-96-0089 = 13 0103-96-0097 = 30
2/1/96	D	8	0103-96-0106 = 30 0103-96-0103 = 63
3/22/96	na[b]	4	0103-96-0112 = 15 0103-96-0113 = 15
West Slope Verification Samples			
1/15/96	A	8	0103-96-0054 = 34
1/15/96	B	7	0103-96-0058 = 13 0103-96-0064 = 13
12/15/95	C	1[c]	none
12/15/95	D	1[c]	none

a. The proposed PCB clean-up level was 10 mg/kg. Los Alamos National Laboratory (LANL) intends to remove PCBs exceeding 10 mg/kg during site restoration activities

b. These samples were collected after expanding the north slope verification grid in an attempt to establish the extent of the 10 mg/kg contour.

c. The analytical result was for one composite grid sample from this quadrant.

B-3.0 MINOR CURRENT-DAY SOURCES OF WETLAND CONTAMINATION

PRS 3-014(b2), WWTP Current Outfall. PRS 3-014(b2) is the current outfall from the TA-46 WWTP. The outfall discharges from the location of the former TA-3 WWTP outfall point into Sandia Canyon (see Figure 1.2-1 in the body of this SAP). The NPDES permit number of the outfall is EPASSS01S. The outfall discharges at a rocky outcrop on the canyon edge and flows down a steep, rocky channel to the wetland area on the canyon floor. PRS 3-014(b2) is discussed in detail in the RFI Work Plan for OU 1114 (LANL 1993, ER ID# 20947).

The sampling approach in the RFI Work Plan for OU 1114 was designed to determine whether discharge at the outfall resulted in the release of any contaminants (LANL 1993, ER ID# 20947). Because effluents were received from many different types of facilities at TA-3, the COPCs identified for this PRS include heavy metals (antimony, arsenic, barium, beryllium, cadmium, chromium, lead, mercury, nickel, selenium, silver, thallium, and vanadium), radionuclides, cyanide, various organics, pesticides, and herbicides. COPCs are expected to be initially present in the water and then filtered into the sand and gravel sediments below the outfall pipe. During a 1994 sampling campaign, 12 samples were collected from four

locations within the outfall channel at depths ranging from 0- to 18-in. Samples were submitted for analysis of VOCs, SVOCs, pesticides/PCBs, herbicides, TAL metals, and radionuclides. The data for radionuclides and inorganics that exceeded background UTLs and detected organics are summarized by analyte in Table 1.3-2 in the body of this SAP. For further information, see the RFI Report for 53 PRSs in TA-3, TA-59, TA-60, and TA-61 (LANL 1996, ER ID# 52930).

PRSs 3-059 and 3-003(n), Salvage Yard Adjacent to TA-3-271. PRS 3-059, a former salvage yard, includes storage areas north and south of building TA-3-271 (see Figure 1.2-1 in the body of this SAP). LANL support contractors used PRS 3-059 as a salvage yard from the early 1960s through May 1993. Transformers, electrical equipment, batteries, and scrap metal were stored at the site pending sale or re-use. Sections of the salvage yard were paved intermittently with some sections remaining unpaved until the late 1980s. The exact dates of paving are unknown. In 1993, two storm water runoff samples were collected and analyzed for radionuclides, metals, cyanide, total phenols, VOCs, and SVOCs (LANL 1993, ER ID# 57506). A review of the analytical data suggests there were no COPCs in the storm water samples (see the RFI Work Plan for OU 1114, Addendum 1 [LANL 1995, 1291]). As a best management practice, 12 asphalt and soil samples were collected during late 1994 and early 1995 to determine whether PCB concentrations existed in the asphalt or soil surfaces where on-site workers could spread contamination via footwear at the PRS. No PCB concentrations were detected in any of the samples; therefore, no restrictions were placed on workers entering the PRS boundaries.

The RFI Work Plan for OU 1114 describes a detailed Phase I/II sampling plan for PRSs 3-053 and 3-003(n); however, to date, these samples have not been collected (LANL 1995, 1291). The schedule for sampling at this PRS is outlined in the LANL ER Project baseline. COPCs identified for these PRSs include PCBs, various organics, TPH, and heavy metals from leaking electrical equipment, equipment containing hydraulic and lubricating oils, and/or damaged batteries.

PRS 60-007(b), Motor Pool Drainage Areas. PRS 60-007(b) is a storm drainage ditch located north of the motor pool building (TA-60-1) (see Figure 1.2-1 in the body of this SAP). The ditch extends approximately 600 ft from a paved area directly north of building TA-60-1 to the bottom of Sandia Canyon. Two parking lots located east of building TA-60-1 drain to a ditch on the east that joins PRS 60-007(b). There were several potential sources of contamination to PRS 60-007(b), including a steam-cleaning pad that drained to the ditch, a used-oil storage tank that is known to have had several spills, and an oil/water separator that periodically drained to the ditch. Another source of possible contamination was PCB equipment stored on the asphalt area east of building TA-60-1. The area of the ditch visibly affected by these sources was remediated in 1986 by removing the stained soil down to the bedrock channel of the ditch. PRS 60-007(b) is discussed in detail in the RFI Work Plan for OU 1114 (LANL 1993, ER ID# 20947).

The sampling approach in the RFI Work Plan for OU 1114 was designed to determine whether contamination remained in the sediments of PRS 60-007(b) after the soil removal in 1986 (LANL 1993, ER ID# 20947). COPCs identified for this PRS include petroleum compounds from possible spills and PCBs from leaking equipment. Waste motor oil may contain very low concentrations of hazardous metal contaminants, principally copper, chromium, and possibly lead, resulting from corrosion of engine parts. Six samples were collected from four locations along the drainage channel at depths ranging from 0- to 18-in. Samples were submitted for analysis of VOCs, SVOCs, PCBs, and TAL metals. The data for inorganics that exceeded background UTLs and detected organics are summarized by analyte in Table 1.3-2 in the body of this SAP. Samples were not analyzed for TPH because TPH is not a RCRA-regulated waste. For further information on PRS 60-007(b), refer to the RFI Report for 53 PRSs in TA-3, TA-59, TA-60, and TA-61 (LANL 1996, ER ID# 52930).

B-4.0 MINOR HISTORICAL SOURCES OF WETLAND CONTAMINATION

PRS 3-002(c), Former Pesticide Storage Shed. PRS 3-002(c) is the site of a former pesticide storage shed located 100 ft west of the JCI administrative office for roads and grounds (TA-3-70) (see Figure 1.2-1 in the body of this SAP). The 15- by 19-ft wooden pesticide storage shed was formerly designated TA-3-1494. The site includes an unbermed cement pad that was under the center portion of the shed and in place before the shed was erected. Directly east of the shed there is a 12- by 19-ft cement pad with 6-in. high curbing. This pad was used as a secondary containment for pesticide application vehicles. The pad was asphalted in 1989 to level the surface with the top of the curbing.

From the early 1960s through 1984, the shed was used to store drums of liquid and powdered pesticides, and possibly herbicides. It is likely that spills occurred within the shed; the floor of the shed was reported to be permeated with pesticides (Weston 1992, ER ID# 57498). The shed was removed in 1989, and the floor was demolished and disposed of as hazardous waste (Weston 1992, ER ID# 57498). COPCs identified at this site include both pesticides and herbicides. PRS 3-002(c) is discussed in detail in the RFI Work Plan for OU 1114 and the RFI Report for 53 PRSs in TA-3, TA-59, TA-60, and TA-61 (LANL 1993, ER ID# 20947; LANL 1996, ER ID# 52930).

The sampling approach in the RFI Work Plan for OU 1114 was designed to determine whether the storage and transfer of pesticides at the shed resulted in the release of any contaminants (LANL 1993, ER ID# 20947). During a 1994 sampling campaign, six samples were collected from five locations at depths ranging from 0- to 6-in. Samples were submitted for analysis of VOCs, SVOCs, pesticides/PCBs, herbicides, and TAL metals. The analytes that exceeded background UTLs and detected organics are summarized in Table 1.3-2 in the body of this SAP. The RFI Report for 53 PRSs in TA-3, TA-59, TA-60, and TA-61 provides further information for this site (LANL 1996, ER ID# 52930).

PRS 3-029, Inactive Landfill. PRS 3-029 is a 30 x 70 ft inactive landfill located about 300 ft south of TA-3-271 near the rim of Sandia Canyon. The 1986 Comprehensive Environmental Assessment and Response Program (CEARP) survey team noted several inches of liquid in an unlined pit marked "asphalt and sealer accumulation point" (DOE 1987, ER ID#s 8660, 8662). Pits of this type received excess asphalt and clean-out from disposal of the asphalt plant and were later covered with sand. This disposal practice continued for some time; similar pits line the edge of Sandia Canyon. When one pit was full, a new pit was constructed (LANL 1990, 0145). These fills raised and leveled the surface areas at the rim of the mesa. Debris at the PRS appears to be pieces of asphalt, and each piece is less than 1 ft square (Griggs 1992, ER ID# 57503).

On November 2, 1990, the New Mexico Environmental Improvement Division (NMEID) issued LANL a Notice of Violation concerning pieces of asphalt and an oil sheen found in the Sandia Canyon watercourse below TA-3-73. On November 27, 1990, LANL submitted a corrective action plan to NMEID that was subsequently approved December 12, 1990. Cleanup of the drainage and outfall, and stabilization of the landfill area was initiated in early 1991 and continued through early 1993. The corrective action included removing oil pieces of asphalt within the drainage and on the associated slope, regrading the entire watercourse and slope to support vegetation, extending the culvert from the storm drain (SWMU 3-045[g]) approximately 50 ft down the drainage, constructing a concrete berm to prevent additional exposure of asphalt buried in the fill, and seeding and maintaining dense grass cover on all fill slopes and disturbed areas. COPCs identified at this site are PAHs. PRS 3-029 is discussed in detail in the RFI Work Plan for OU 1114 (LANL 1993, ER ID# 20947).

On June 12, 1992, NMED issued a letter to LANL stating that the corrective actions taken by LANL were unsatisfactory (LANL 1992, ER ID# 57504). LANL further discussed the general concept of the cleanup and time schedule to complete the tasks with NMED, and, as a result, the actions were completed in 1993. Water samples were collected from the storm drain and the results indicate that oil, greases, or other compounds typically associated with asphalt plant operations were not present (Nielsen 1991, ER ID# 56848). NMED closed out this site on October 20, 1993 with a conditional approval for water monitoring if erosion or tar reappear in the outfall (NMED 1993, ER ID# 57507).

PRSs 3-036(a,c,d,e) and PRSs 3-043(a,b,d,f,g,h), Asphalt Emulsion Tanks. PRSs 3-036(a,c,d) and PRSs 3-043(a,b,d,f,g,h) are 10 0000 - 30 000 asphalt emulsion tanks that were used to store liquid 85-100 asphalt emulsion. These tanks were removed in 1989. COPCs identified at these PRSs are PAHs. These PRSs are discussed in detail in the RFI Work Plan for OU 1114 (LANL 1993, ER ID# 20947).

PRS 3-036(g), Aboveground Tank. PRS 3-036(g) is an active 5 000-gal., steel, aboveground storage tank located south of building TA-3-22. The tank, installed in 1951, contains sulfuric acid used to neutralize cooling water from building TA-3-22.

Three noncompliance violations occurred at this tank between May 19 and 21, 1990. The first violation was a release of 18 000 gal. of acid water with a pH of 1.4 to 4.9 into NPDES outfall 01A001. This release occurred because of an open valve in the line between the acid tank and the neutralization tank. To correct this violation, the valve was closed and soda ash was added to the effluent to neutralize the release. The second violation was a release of 2 000 gal. of a mixture containing excess sulfuric acid, boiler blow-down, demineralizer discharge, and cooling water to NPDES outfall 01A001. This mixture had a pH of 3.9 to 5.9. This release occurred as a result of uncontrolled discharges from the TA-3 power plant, which caused the neutralization tank to overflow. To correct this violation, the neutralization tank contents were pumped into a cooling water basin and then into portable tuff tanks for neutralization. In addition, soda ash was added to the effluent to neutralize the release. The third violation was a release of 15 000 gal. of a mixture containing excess sulfuric acid, boiler blow-down, demineralizer discharge, and cooling water to NPDES outfall 01A001. This mixture had a pH of 2.2 to 5.9 and 9.1 to 10.1. This release occurred because a valve on the line from the cooling water basin containing the mixture from the previous release would not seal properly, allowing contents to leak to the outfall. To correct this violation, the outlet box from the cooling water basin was sand-bagged and the contents were neutralized. In addition, soda ash was added to the effluent to neutralize the release.

The tank has never managed hazardous waste and has excellent integrity. In addition, secondary containment was installed around the tank after the 1990 noncompliance violations. The NMED approved the spill report on the acid release conditionally, based on completion of corrective actions listed in the report to the EPA (Tiedman 1991, ER ID# 57510). Investigation results indicate that the release was caused primarily by operational problems and communication deficiencies. Operational and administrative changes were initiated to correct these problems and interim physical plant modifications of the neutralization system were completed. These modifications included new pH monitoring equipment and a lock on the discharge valve from the environmental tank (Sneesby 1994, 17-1159). The NMED closed out this incident after the Laboratory paid a fine (NMED 1992, ER ID#57502).For further information regarding PRS 3-036(g), see the RFI Work Plan for OU 1114, Addendum 1 (LANL 1995, 1291).

PRS 60-004(f), Motor Pool Storage Pads. PRS 60-004(f) consists of two unpaved, bermed storage pads used for new product storage (see Figure 1.2-1 in the body of this SAP). These pads are located southeast of the maintenance warehouse (TA-60-2). Both pads have been used to store drums of Stoddard solvent, antifreeze, motor oil, grease, transmission fluids, and window-washing fluid. The

materials were dispensed directly from the storage drums on the pads. Before 1985, neither pad was completely bermed. The pads are discolored and a petroleum odor is evident. Several COPCs were detected in samples collected in 1990 (trichlorotrifluoroethane, methylene chloride, carbon disulfide, naphthalene, and 1,3,5-trimethylbenzene). All drummed liquids were removed from the pads in 1990. PRS 60-004(f) is discussed in detail in the RFI Work Plan for OU 1114 (LANL 1993, ER ID# 20947).

The sampling approach in the RFI Work Plan for OU 1114 was designed to determine whether the drums stored on the unpaved pads released contaminants (LANL 1993, ER ID# 20947). In 1994, 26 samples were collected from eight locations along the drainage channel at depths ranging from 0 to 7 ft. Samples were submitted for analysis of VOCs, SVOCs, PCBs, and TAL metals. The data for inorganics that exceeded background UTLs and detected organics are summarized by analyte in Table 1.3-2 in the body of this SAP. For further information on PRS 60-004(f), refer to the RFI Report for 53 PRSs in TA-3, TA-59, TA-60, and TA-61 (LANL 1996, ER ID# 52930).

PRS 61-002, Radio Repair Shop PCB Storage. PRS 61-002 is a storage area located on East Jemez Road near the Radio Repair Shop (TA-61-23) (see Figure 1.2-1 in the body of this SAP). The area was originally unpaved and was used as a storage yard for PCB-containing drums and equipment; storage was discontinued in 1985. In 1986, surface soil samples were collected and analyzed for PCBs. The results indicated PCB concentrations up to 691 mg/kg. The area was then excavated to a depth of at least 10-in. and resampled. The results of additional sampling indicated that the PCB concentrations had decreased to a maximum of 2.2 mg/kg. The area was then covered with clean fill and asphalted. After the area was asphalted, it was again used to store PCB-containing drums and equipment for a period of time. This practice has been discontinued.

PRS 61-002 includes the area down-gradient of the current asphalted area. This area may have been affected by sediments carried off-site before asphalt application. This area is currently part of the Los Alamos County Landfill and is used for employee parking and equipment storage. COPCs identified for this site continue to be PCBs from possible spills into soil surrounding asphalted storage area. PRS 61-002 is discussed in detail in the RFI Work Plan for OU 1114 (LANL 1993, ER ID# 20947).

The sampling approach in the RFI Work Plan for OU 1114 was designed to determine whether PCBs were present in stains on the asphalt or in the surface soils down-gradient from PRS 61-002 (LANL 1993, ER ID# 20947). In 1994, 16 samples were collected from 14 locations at depths ranging from 0 to 6 in. Samples were submitted for analysis of VOCs, SVOCs, PCBs, and TAL metals. The data for inorganics that exceeded background UTLs and detected organics are summarized by analyte in Table 1.3-2 in the body of this SAP. Only PCBs were present at concentrations exceeding SALs, and the extent of contamination was not defined. Therefore, a Phase II investigation was recommended at PRS 61-002 during which samples were collected from locations along the northern, southern, and eastern edges of the PRS (LANL 1996, ER ID# 52930). Additional data confirmed PCB concentrations of up to 2.5 ppm in two of the samples along the southern boundary of the PRS. Best management practices will either remove the PCB-contaminated soil or cap the area with asphalt depending on pending guidance from the Toxic Substances Control Act (TSCA) branch of EPA Region 6.

C-3-005, 85-100 Oil Spill. C-3-005 is an oil emulsion spill associated with SWMU 3-045(g) that occurred in August 1, 1986 when cleaning an asphalt oil distributor truck with kerosene to remove excess asphalt and oil. The tank valve on the truck was accidentally opened resulting in a discharge of oil emulsion and residual kerosene that flowed through the storm drain (SWMU 3-045(g)) and into Sandia Canyon. After the spill occurred, oil was note din the stream and absorbent booms were placed across the steam to prevent the spread of oil. An earthen berm was then constructed across the drainage channel and the oil

was removed using absorbent pillows, vermiculite, and skimmers. The cleanup was stopped when it was determined that the channel below the pooled oil area was oil-free. COPCs identified at this site are PAHs. This site is discussed in detail in the RFI Work Plan for OU 1114 (LANL 1993, ER ID# 20947).

C-3-016, Used 85-100 Oil Metal Bins. C-3-016 is an oil distributor clean-out bin with a hinged lid. The metal bin measures approximately 4 ft wide x 16 ft long x 3 ft deep, and is buried so that the top is flush with the ground surface. According to JCI Roads and Grounds Staff, the tank was installed in the mid-1970s (Bertino 1994, ER ID# 57508). It contained used asphalt emulsion (85-100) oil, the oil applied to roads before application of asphalt. Aerial photographs from the 1970s and early 1980s and subsequent site visits by LANL Environmental Restoration (ER) Project personnel show extensive stains in the immediate vicinity of the oil distributor cleanout bin (LASL 1974, ER ID 0017267; LASL 1977, ER ID 0017860; LASL 1979; ER ID 1128923; LANL 1983, ER ID0018925; LANL 1984, ER ID 0018929; LANL 1986, ER ID 0019010; LANL 1991, ER ID 0018135). This resulted from splashing of oil emulsion, kerosene, and diesel fuel #2 during cleaning of the oil applicator equipment, and the re-depositing of residual oil from asphalt paving operations into this bin for recycling. During the late 1980s the area around the oil distributor tank was dug up and new fill, (sand and gravel) was put in around the bin; however, staining still occurs because the asphalt distributor machine rollers, when sprayed off, drip residue onto the gravel surrounding the tank as well as into the tank. COPCs identified at this site are PAHs. This site is discussed in detail in the RFI Work Plan for OU 1114 (LANL 1993, ER ID# 20947).

Upper Sandia Canyon Geomorphic Conceptual Model
Application to Sample Site Selection
Draft

3056(c)
60-to 92

1). Contaminants have been (are?) released to the canyon bottom (Reach S-1) for a long period of time (decades?) and, therefore, concentrations near the source of release (and possibly throughout Upper Sandia Canyon) will not be controlled by the age of sedimentary deposits. Distribution and concentrations may be controlled by other parameters such as grain size or geochemical environment.

2) Contaminants were released during a relatively short period of time and highest contaminant concentrations are related to sediments deposited during the period of release. Progressively younger sediments (higher in the stratigraphic section) or younger packages of sediment (i.e., younger geomorphic units) will contain lower contaminant concentrations. Geochemical environment may still affect contaminant concentrations.

The proposed sample locations for the 1st round of sampling address both conceptual models in the following manner:

- Since there is a potential that contaminants were released over the time scale of decades, contaminant concentrations in sediments near the source may not be highest in any specific geomorphic unit. Therefore, all geomorphic units and representative stratigraphic layers near the likeliest source of contamination [3-056(c)] will be sampled. However, redistribution of sediments (and contaminants?) downstream into Reach S-2 could have resulted in different contaminant concentrations associated with geomorphic units of different age.
- It is unknown whether PCBs will have an affinity for any particular physical or geochemical parameter, so all sediment textures will be characterized. (Gravel size fraction will be removed, and if possible, the samples will be sieved to remove the size fraction > 2mm. Large organic fragments (e.g., decayed cattail bulbs, if present) will be left in the sample.
- Near equal coverage in all major geomorphic units in Reach S-2 will allow for a preliminary evaluation of varying contaminant concentrations associated with sediment age. Pairing of sample sites to characterize the difference in contaminant concentration between each geomorphic unit and its associated "ct" unit will serve to evaluate the importance of the geochemical environment on concentrations.
- Sample sites are also being selected to characterize the most immediately mobile sediments in the system (e.g., C1 active channel sediments, and potentially headward eroding C1ct sediments in eastern portion of C2 near boundary of investigation area).

Preliminary Allocation for 1st Round

S-1 North	8 Samples
S-1 South	16 Samples
S-2	48 Samples + 4 = 52.
Total	~~72~~ 76 Samples

Results will be used to confirm either, both or new conceptual models.

Sandia Canyon
Reach S-1 North and S-1 South Combined
Geomorphic Unit Area Calculations

Unit	Area (m^2)	% of Total Area	Ave. Thickness (m)	Volume(m^3)	% of Volume
C1	1021.3	48.5	NA	NA	NA
C1b	37.7	1.8	0.32	12	2
C2	419.3	19.9	0.49	205	36
C3	450.5	21.4	0.68	306	54
F1	177.2	8.4	0.27	48	8
Total	2106	100		572	100

Sandia Canyon
Reach S-2
Geomorphic Unit Area Calculations

Unit	Area (m^2)	% of Total Area	Ave. Thickness (m)	Volume (m^3)	% of Volume
C1	814.0	3.7	NA	NA	NA
C1ct	6667.2	30.0	.40	2667	21
C1b	480.8	2.2	0.16	77	1
C1bct	24.2	0.1	NA	NA	NA
C2	468.1	2.1	0.59	276	2
C2ct	3377.7	15.2	0.82	2770	21
C3	3347.9	15.1	1.11	3716	29
C3ct	6382.9	28.7	0.49	3128	24
F1	393.6	1.8	0.41	161	1
F1ct	260.0	1.2	0.57	148	1
Total	22216.4	100		12943	100