TABLE 4.9.3–1.—*Federal and California Species with Protected or Sensitive Status Known to Occur at the Livermore Site and Site 300 in 2001 and 2002*

	Site		Status	
Common Name	**Livermore Site**	**Site 300**	**Federal Status Code**	**State Status Code**
Plants				
Big tarplant[a]	-	X	-	CNPS List 1 B
Hogwallow starfish	-	X	-	CNPS List 4
Large-flowered fiddleneck	-	X	FE (CH)	CNPS List 1 B
Round-leaved filaree	-	X	-	CNPS List 2
Stinkbells	-	X	-	CNPS List 4
Diamond-petaled poppy	-	X	FSC	CNPS List 1 B
Gypsum rock jasmine	-	X	-	CNPS List 4
Gypsum loving larkspur	-	X	-	CNPS List 4
Invertebrates				
Valley elderberry longhorn beetle	-	X	FT	-
California linderiella fairy shrimp	-	X	FSC	-
Amphibians				
California tiger salamander	-	X	FT (CH not proposed at LLNL)	CASSC
California red-legged frog	X	X	FT (CH proposed)	CASSC
Western spadefoot toad	-	X	FSC	CASSC
Reptiles				
Alameda whipsnake	-	X	FT (CH rescinded)	ST
California horned lizard	-	X	FSC	CASSC
Silvery legless lizard	-	X	FSC	CASSC
San Joaquin coachwhip	-	X	FSC	CASSC

TABLE 4.9.3–1.— *Federal and California Species with Protected or Sensitive Status Known to Occur at the Livermore Site and Site 300 in 2001 and 2002 (continued)*

	Site		Status	
Common Name	**Livermore Site**	**Site 300**	**Federal Status Code**	**State Status Code**
Birds				
Cooper's hawk	X	X	MBTA	CASSC
Sharp-shinned hawk	-	X	MBTA	CASSC
Golden eagle	X	X	MBTA	CASSC
Red-tailed hawk	X	X	MBTA	-
Rough-legged hawk	-	X	MBTA	-
Red-shouldered hawk	X	X	MBTA	-
Ferruginous hawk	-	X	FSC, MBTA	CASSC
Swainson's hawk	-	X	MBTA	ST
Northern harrier	-	X	MBTA	CASSC
White-tailed kite	X	X	MBTA	CASSC
Osprey	-	X	MBTA	CASSC
Bushtit	X	X	MBTA	-
American kestrel	X	X	MBTA	-
Prairie falcon	-	X	MBTA	CASSC
Horned lark	-	X	MBTA	CASSC
Northern shoveler	-	X	MBTA	-
Cinnamon teal	-	X	MBTA	-
Mallard	X	X	MBTA	-
Bufflehead	X	X	MBTA	-
Common goldeneye	-	X	MBTA	-
Pied-billed grebe	X	X	MBTA	-
Common snipe	X	X	MBTA	-
Greater yellowlegs	X	X	MBTA	-

TABLE 4.9.3–1.— *Federal and California Species with Protected or Sensitive Status Known to Occur at the Livermore Site and Site 300 in 2001 and 2002 (continued)*

	Site		Status	
Common Name	**Livermore Site**	**Site 300**	**Federal Status Code**	**State Status Code**
		Birds (cont.)		
Ring-necked duck	X	-	MBTA	-
Coot	X	-	MBTA	-
Great blue heron	-	X	MBTA	-
Green heron	-	X	MBTA	-
Black-crowned night heron	-	X	MBTA	-
Canada goose	X	-	-	-
White-throated swift	-	X	MBTA	-
Great egret	X	X	MBTA	-
Snowy egret	X	-	MBTA	-
Belted king fisher	X	-	MBTA	-
Cedar waxwing	X	X	MBTA	-
Common poorwill	-	X	MBTA	-
Blue-grosbeak	-	X	MBTA	-
Lazuli bunting	-	X	MBTA	-
Killdeer	X	X	MBTA	-
Mourning dove	X	X	MBTA	-
Rock dove	X	X	MBTA	-
Western scrub jay	X	X	MBTA	-
American crow	X	X	MBTA	-
Common raven	X	X	MBTA	-
Greater roadrunner	-	X	MBTA	-
Bell’s sage sparrow	-	X	FSC, MBTA	-
Black-throated sparrow	-	X	MBTA	-

TABLE 4.9.3–1.— *Federal and California Species with Protected or Sensitive Status Known to Occur at the Livermore Site and Site 300 in 2001 and 2002 (continued)*

	Site		Status	
Common Name	**Livermore Site**	**Site 300**	**Federal Status Code**	**State Status Code**
Birds (cont.)				
Rufous crowned sparrow	-	X	MBTA	-
Grasshopper sparrow	-	X	FSC, MBTA	-
Vesper sparrow	-	X	MBTA	-
Lark sparrow	-	X	MBTA	-
California towhee	-	X	MBTA	-
Oregon junco	X	X	MBTA	-
Lincoln’s sparrow	-	X	MBTA	-
Song sparrow	X	X	MBTA	-
Fox sparrow	-	X	MBTA	-
Savannah sparrow	-	X	MBTA	-
Golden-crowned sparrow	X	X	MBTA	-
White-crowned sparrow	X	X	MBTA	-
House finch	X	X	MBTA	-
Lesser goldfinch	X	X	MBTA	-
American goldfinch	X	X	MBTA	-
Cliff swallow	X	X	MBTA	-
Northern rough winged swallow	X	X	MBTA	-
Tree swallow	-	X	MBTA	-
Red-winged blackbird	X	X	MBTA	-
Tricolored blackbird	-	X	FSC, MBTA	CASSC
Brewer’s blackbird	X	X	MBTA	-
Bullock’s oriole	-	X	MBTA	-
Brown-headed cowbird	X	X	MBTA	-
Western meadowlark	X	X	MBTA	-

TABLE 4.9.3–1.— *Federal and California Species with Protected or Sensitive Status Known to Occur at the Livermore Site and Site 300 in 2001 and 2002 (continued)*

	Site		Status	
Common Name	**Livermore Site**	**Site 300**	**Federal Status Code**	**State Status Code**
Birds (cont.)				
Loggerhead shrike	X	X	FSC, MBTA	CASSC
Northern mockingbird	X	X	MBTA	-
California thrasher	-	X	FSC, MBTA	-
California quail	-	X	MBTA	-
Oak titmouse	-	X	FSC, MBTA	-
Yellow-rumped warbler	X	X	MBTA	-
Black-throated gray warbler	-	X	MBTA	-
Yellow warbler	-	X	MBTA	CASSC
Common yellowthroat	-	X	MBTA	CASSC
MacGillivary's warbler	-	X	MBTA	-
Orange-crowned warbler	-	X	MBTA	-
Wilson's warbler	-	X	MBTA	-
Double-crested cormorant	X	X	MBTA	CASSC
Northern flicker	X	X	MBTA	-
Acorn woodpecker	X	X	MBTA	-
Nuttall's woodpecker	X	X	FSC, MBTA	-
Phainopepla	-	X	MBTA	-
Ruby-crowned kinglet	X	X	MBTA	-
Barn owl	X	X	MBTA	-
Burrowing owl	-	X	FSC, MBTA	CASSC
Short-eared owl	-	X	FSC, MBTA	CASSC
Great horned owl	X	X	MBTA	-
Western screech owl	-	X	MBTA	-
Western tanager	-	X	MBTA	-

TABLE 4.9.3–1.— *Federal and California Species with Protected or Sensitive Status Known to Occur at the Livermore Site and Site 300 in 2001 and 2002 (continued)*

	Site		Status	
Common Name	**Livermore Site**	**Site 300**	**Federal Status Code**	**State Status Code**
Birds (cont.)				
Allen's hummingbird	-	X	MBTA	-
Anna's hummingbird	X	X	MBTA	-
Costa's hummingbird	-	X	FSC, MBTA	-
Rufous hummingbird	X	X	FSC, MBTA	-
Rock wren	-	X	MBTA	-
Bewick's wren	X	X	MBTA	-
House wren	-	X	MBTA	-
Hermit thrush	-	X	MBTA	-
Swainson's thrush	-	X	MBTA	-
Varied thrush	-	X	MBTA	-
Mountain bluebird	-	X	MBTA	-
Western bluebird	-	X	MBTA	-
American robin	X	X	MBTA	-
Western wood pewee	X	X	MBTA	-
Willow flycatcher	-	X	MBTA	SE
Pacific-slope flycatcher	-	X	MBTA	-
Ash-throated flycatcher	-	X	MBTA	-
Black phoebe	X	X	MBTA	-
Say's phoebe	X	X	MBTA	-
Western kingbird	-	X	MBTA	-
Cassin's kingbird	-	X	MBTA	-

TABLE 4.9.3–1.— *Federal and California Species with Protected or Sensitive Status Known to Occur at the Livermore Site and Site 300 in 2001 and 2002 (continued)*

	Site		Status	
Common Name	**Livermore Site**	**Site 300**	**Federal Status Code**	**State Status Code**
Mammals				
Pallid bat	-	X	-	CASSC
Long-legged myotis	-	X	FSC	-
Yuma myotis	-	X	FSC	-
San Joaquin pocket mouse	-	X	FSC	-
San Joaquin kit fox[b]	-	-	FE	ST

Sources: Jones and Stokes 2001, CDFG 2002a, CDFG 2002b, LLNL 2003ab, bz, by.

[a] The scientific names of all plant and animal species in this table are provided in Table E.2-1 in Appendix E.

[b] Although the San Joaquin kit fox has not been observed onsite in surveys from 1986 to the present, monitoring efforts continue to watch for the presence of this species onsite, due to confirmed sightings near Site 300.

-: Indicates the absence of a species at the Livermore Site or Site 300.

CASSC: California Species of Special Concern; CH: Critical Habitat (The USFWS may establish critical habitat for threatened or endangered species with the CH consisting of geographic area determined essential for the conservation of the species); CNPS List 1A: Plants presumed extinct in California; CNPS List 1B: Plants rare, threatened, or endangered in California and elsewhere; CNPS List 2: Plants rare, threatened, or endangered in California, but more common elsewhere; CNPS List 3: Plants about which we need more information – a review list; CNPS List 4: Plants of limited distribution – A watch list; FC: federally listed candidate (plant and animal species for which the USFWS has on file sufficient information on biological vulnerability and threat to support issuance of a proposed rule for listing as threatened or endangered); MBTA: *Migratory Bird Treaty Act*; FE: federally listed endangered (any species that is in danger of extinction throughout all or a significant portion of its range); FPT: federally listed proposed threatened (A proposal to list a species as likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range pending release of a final rule); FSC: Federal Species of Concern for Alameda and San Joaquin Counties. May be endangered or threatened. Not enough biological information has been gathered to support listing at this time; FT: federally listed threatened (any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range); ST: state listed threatened; X: Indicates the presence of a species at the Livermore Site or Site 300.

TABLE 4.10.1–1.—*Sources, Potential Health Effects, and Strategies for the Prevention and Control of Air Pollutants*[a]

Examples of Sources	Health and Related Effects[b]	Local Concerns	Prevention and Control Strategies
		Ozone	
Ozone is formed when POCs and nitrogen oxides react in the presence of sunlight. POC sources include any source that burns fuels (e.g., gasoline, natural gas, wood, oil), solvents, petroleum processing and storage, pesticides, and many consumer products (paint, ink, etc.). The greatest source of ozone precursors is the automobile. In the Bay Area, more than 50 percent of the POCs and nitrogen oxides come from cars and trucks.	Breathing difficulties, lung tissue damage, damage to rubber and some plastics. Contributes to visibility reduction.	Ozone is a major concern locally. Both the Bay Area and San Joaquin Valley air basins have been designated as nonattainment for state and Federal ozone standards. San Joaquin has been further ranked as serious, the highest, or most problematic, ranking. After having been designated as attainment for the 1-hour ozone standard, more recently the Bay Area was redesignated to nonattainment (August 1998), but has not yet been further ranked.	Reduce motor vehicle POCs and nitrogen oxide emissions through emissions standards, reformulated fuels, inspections programs, and reduced vehicle use. Limit POC emissions from commercial operations and consumer products. Limit POC and nitrogen oxide emissions from industrial sources such as power plants and refineries. California's automobile emissions control program, together with the district's regulatory controls, has sharply reduced ozone levels.
		Carbon Monoxide	
Any source that burns fuel such as automobiles, trucks, heavy construction equipment and farming equipment, and residential heaters and stoves. Almost 70 percent of the Bay Area's carbon monoxide comes from motor vehicles, and a large fraction of the remainder is from burning wood in fireplaces and woodstoves.	Chest pain in heart patients, headaches, reduced mental alertness, death at very high levels.	Both districts are in attainment of the state and Federal ambient air quality standards. Maximum levels monitored in Livermore are approximately one-third of the standard.	Control motor vehicle and industrial emissions. Use oxygenated gasoline during winter months. Conserve energy.

TABLE 4.10.1–1.—*Sources, Potential Health Effects, and Strategies for the Prevention and Control of Air Pollutants*[a] *(continued)*

Examples of Sources	Health and Related Effects[b]	Local Concerns	Prevention and Control Strategies
	Nitrogen Dioxide		
Automobiles, trucks, heavy construction equipment and farming equipment, and residential heaters and stoves.	Lung irritation and damage. Reacts in the atmosphere to form ozone and acid rain. Contributes to brown haze. At higher concentrations, damage has been noticed in sensitive crops such as beans and tomatoes.	It is a major contributor to ozone formation. Both districts are in attainment of the state and Federal ambient air quality standards; however, at concentrations experienced in the Bay Area, nitrogen dioxide can be seen as a brown haze on days with otherwise good visibility.	Control motor vehicle and industrial combustion emissions.
	Sulfur Dioxide and Sulfates		
Coal- or oil-burning power plants and industries, refineries, and diesel engines.	Increases lung disease and breathing problems, particularly for asthmatics. Reacts in the atmosphere to form acid rain. Sulfates also contribute to reduced visibility. Sulfates and sulfuric acid can damage vegetation and affect the health of both humans and animals.	Both districts are classified attainment of the state and Federal ambient air quality standard for sulfur dioxide and the state ambient air quality standard for sulfates. Maximum levels monitored in Livermore are approximately one-third of the standard. No state or Federal excesses have been recorded at district monitoring stations since 1976.	Limit use of high sulfur fuels (e.g., use low sulfur reformulated diesel or natural gas).

TABLE 4.10.1–1.—*Sources, Potential Health Effects, and Strategies for the Prevention and Control of Air Pollutants*[a] *(continued)*

Examples of Sources	Health and Related Effects[b]	Local Concerns	Prevention and Control Strategies
Particulate Matter			
Coarse particles (referred to as PM_{10}, i.e., particle diameter of 10 microns or less)[c] come from sources such as windblown dust from the desert or agricultural fields and dust kicked up on unpaved roads by vehicle traffic. The major human-generated (anthropogenic) sources in the Bay Area include motor vehicle travel over paved and unpaved roads, demolition and construction activity, and wood burning in fireplaces and stoves. Agricultural operations and burning also contribute significantly to particulate concentrations in rural areas. PM_{10} emissions are expected to increase in future years. Fine particles ($PM_{2.5}$) are generally emitted from activities such as industrial and residential combustion and from vehicle exhaust. $PM_{2.5}$ are also formed in the atmosphere when gases such as sulfur dioxide and nitrogen oxide, and volatile organic compounds, emitted by combustion activities, are transformed by chemical reactions in the air.	PM_{10} can accumulate in the respiratory system and aggravate health problems such as asthma. $PM_{2.5}$ is more likely to be associated with premature death and increased hospital admissions and emergency room visits (primarily with elderly and individuals with cardiopulmonary disease); increased respiratory symptoms and disease (primarily children and individuals with cardiopulmonary disease such as asthma); decreased lung function (particularly in children and individuals with asthma); and alterations in lung tissue and structure and in respiratory tract defense mechanisms. $PM_{2.5}$ is also linked with reduced visibility (e.g., obscures mountains and other scenery) because it scatters and absorbs light, reduces airport safety, and contributes to surface soiling.	The Bay Area air district is classified as nonattainment with respect to California standards, attainment for the annual Federal PM_{10} standard, and unclassified for $PM_{2.5}$ and 24-hour PM_{10} Federal standards. The San Joaquin Valley air district is classified as nonattainment for state standards and as a serious nonattainment area for Federal PM_{10}. The designation for Federal $PM_{2.5}$ standard has not yet been determined.	Reduce combustion emissions from motor vehicles, equipment, industries, and agriculture and residential burning. Precursor controls, like those for ozone, reduce $PM_{2.5}$ formation in the atmosphere. Control dust sources, industrial particulate emissions, and wood burning stoves and fireplaces. Reduce secondary pollutants that react to form PM_{10}.

TABLE 4.10.1–1.—*Sources, Potential Health Effects, and Strategies for the Prevention and Control of Air Pollutants*[a] *(continued)*

Examples of Sources	Health and Related Effects[b]	Local Concerns	Prevention and Control Strategies
	Lead		
Metal smelters, resource recovery, leaded gasoline, deterioration of lead paint.	Learning disabilities and brain and kidney damage.	No specific information. Areas are in attainment of both state and Federal ambient air quality standards.	Control metal smelters, no lead in gasoline. Replace leaded paint with non-lead substitutes.
	Hydrogen Sulfide		
Geothermal power plants, petroleum production and refining, sewer gas.	Nuisance odor (rotten egg smell), headache and breathing difficulties at higher concentrations.	No specific information. Both areas are unclassified with respect to the state ambient air quality standard.	Control emissions from geothermal power plants, petroleum production and refining, sewers, and sewage treatment plants.
	Toxic Air Contaminants		
Cars and trucks, especially diesels; industrial sources such as chrome plating; neighborhood businesses, such as dry cleaners and service stations; and building materials and products. Over 50 percent of the public's total exposure to toxic air contaminants in the Bay Area comes from the carcinogens benzene and 1,3-butadiene, two organic compounds found in automobile exhaust.	Cancer; chronic eye, lung, or skin irritation; and neurological and reproductive disorders.	Within the city of Livermore, there are approximately 20 facilities that must report emissions of toxic air contaminants, i.e., emissions exceeding de minimis levels. The individual excess cancer risk due to average ambient concentrations of toxic air contaminants measured in the Bay Area during 2000 is approximately 170 in a million (See Section 4.10.2.2). Toxic air contaminants are regulated under various state and local programs.	See general discussions under ozone and particulate matter and other pollutant subgroups (lead, hydrogen sulfide, etc.) for control of gaseous and particulate air pollutants.

TABLE 4.10.1–1.—*Sources, Potential Health Effects, and Strategies for the Prevention and Control of Air Pollutants[a] (continued)*

Examples of Sources	Health and Related Effects[b]	Local Concerns	Prevention and Control Strategies
Stratospheric Ozone-Depleting Substances			
Non-POCs include methylene chloride, 1,1,1-trichloroethane, halons and the family of chemicals referred to as freons or chlorofluorocarbons, and chlorine and bromine compounds. Refrigerants, air conditioners, fire suppressants, certain aerosols, and solvents.	Increased incidence of harmful health consequences of ultraviolet radiation, particularly squamous cell carcinomas of the skin.	No additional local concerns stratospheric on ozone depletion.	Substitute formulations with lower ozone-depleting potential. Good maintenance.

Source: See table notes.

[a] Extracted from information provided in multiple sources including: EPA Ozone Depletion and Climate Protection Partnerships Division Websites (EPA 2002b); EPA Revised Particulate Matters Fact Sheet (EPA 1997); CARB Website Fact Sheets on Air Pollution and Air Pollution and Health (CARB 2002a, CARB 2002b); and BAAQMD Website, Attainment Website Status, General Pollutant Information and Toxic Air Contaminant Control Program Annual Report, and CEQA Guidelines for Assessing the Air Quality Impacts of Projects and Plans (BAAQMD 2003, 2002, 2001, 1999); and SJVUAPCD Website Attainment Status (SJVUAPCD 2002).

[b] Although air pollutants can cause health problems for everyone, certain people are especially vulnerable. These "sensitive populations" include children, the elderly, exercising adults, and those suffering from asthma or bronchitis. Of greatest concern are recent studies that link PM_{10} exposure to the premature death of people who already have heart and lung disease, especially the elderly.

[c] One micron (also referred to as a micrometer or μm) = 1×10^{-6} meters.

BAAQMD = Bay Area Air Quality Management District; CARB = California Air Resources Board; CEQA = *California Environmental Quality Act* of 1970; EPA = U.S. Environmental Protection Agency; POC = precursor organic compounds; SAAQS = State Ambient Air Quality Standard

TABLE 4.10.5–1.—*Radionuclide Releases From LLNL, 1998-2002*

Release Location (Operation)	Predominant Radionuclides Released	Curies Emitted per Year (Numbers in parentheses indicate percent contribution to site-wide maximally exposed individual dose from that facility)				
		1998	**1999**	**2000**	**2001**	**2002**
Livermore Site						
Building 612 Yard (Low Level Waste Storage)	H-3	4.6 (35)	4.4 (15)	3.6 (40)	2.0 (48)	2.3 (4.8)
Building 331 Stacks (Tritium R&D + Parts Decontamination)	H-3	110 (53)	276 (72)	39.8 (25)	19.7 (25)	36 (35)
Building 514 Tank Farm (Process Liquid)	H-3, C-14, Sr-90 and others				5.5×10^{-6} (8)	
Southeast Quadrant Diffuse Sources (Resuspension)	Pu-239				DS (5)	
Building 612, Room 102 (Laboratory Analysis)	H-3, C-14, Sr-90 and others				2.0×10^{-6} (4)	1.5×10^{-5} (5)
Building 514 Evaporator (Waste Consolidation)	H-3, P-32, U-238 and others			7.2×10^{-7} (16)	1.0×10^{-7} (3)	9.6×10^{-6} (5)
Outside Building 331 (Contaminated Parts Storage)	H-3	6 (7)	7.3 (5)	5.2 (12)		1.0 (4)
Site 300						
Building 851 Firing Table (Explosive Tests)	U238 U235 U234 H-3		2.4×10^{-2} 3.1×10^{-4} 2.3×10^{-3} 19 (61)	1.5×10^{-2} 3.1×10^{-4} 2.3×10^{-3} 0 (79)	6.2×10^{-2} 3.1×10^{-4} 2.3×10^{-3} 0 (93)	1.5×10^{-2} 2.0×10^{-4} 1.4×10^{-3} 0 (85)
Entire Site (Soil Resuspension)	U238 U235 U234	DS DS DS (22)	DS DS DS (3)	DS DS DS (21)	DS DS DS (7)	DS DS DS (15)
Building 801 Firing Table (Explosive Tests)	U238 U235 U234	7.2×10^{-2} 9.3×10^{-4} 6.8×10^{-3} (70)	4.8×10^{-2} 6.1×10^{-4} 4.4×10^{-3} (36)			

Source: LLNL 1999a, LLNL 2000h, LLNL 2001v, LLNL 2002cc, LLNL 2003l.
Note: Entry of blank curies per year indicates a source that did not contribute to the 90^{th} percentile releases.
DS: Doses from diffuse source are calculated from measured ambient concentrations rather than release rates.

TABLE 4.13.3–1.—*Three-Year Accident Rates for Roads Adjacent to the Livermore Site and Site 300 (1999 through 2001)*

Segment Location	Segment Distance (miles)	No. of Accidents	ADT	3-year Volumes	Vehicle Miles of Travel	Accidents per MVM	Average Statewide Accidents per MVM
S. Vasco Rd (South of I-580 to Las Positas)[a]	0.5	39	30,000	31,455,901	15,727,951	2.48	2.18[a]
S. Vasco Rd (South of Las Positas to Patterson Pass)[a]	0.6	40	26,200	27,471,487	16,482,892	2.43	2.18[a]
S. Vasco Rd (South of Patterson Pass to East Ave)[a]	1.0	7	16,600	17,405,599	17,405,599	0.40	2.18[a]
Greenville Rd (South of I-580 to Las Positas)[a]	0.3	3	15,600	16,357,069	4,907,121	0.61	2.18[a]
Greenville Rd (South of Las Positas to Patterson Pass)[a]	1.2	11	12,000	12,582,361	15,098,833	0.73	1.93[a]
Greenville Rd (South of Patterson Pass to East Ave) [a]	1.1	2	6,500	6,815,445	7,496,990	0.27	1.93[a]
Patterson Pass Rd (East of S. Vasco to West of Greenville)[a]	1.2	6	6,200	6,500,886	7,801,064	0.77	1.93[a]
East Ave (East of S. Vasco to West of Greenville)[a]	1.2	1	7,000	7,339,710	8,807,652	0.11	1.93[a]
Greenville Rd (South of East Ave to Tesla Rd)[a]	1.0	0	3,000	3,145,590	3,145,590	0.00	1.21[a]
Tesla Rd (Greenville to Site 300 Entrance)[a]	13.1	55	4,500	4,718,385	661,810,846	0.89	1.21[a]

Source: CA DOT 1999, CHP 1999, CHP 2000, CHP 2001.
[a] Urban 4-lane divided roadway.
[b] Two- and three-lane urban roadways.
[c] Two-lane rural roadway.
ADT = average daily traffic; MVM = million vehicle miles.

TABLE 4.15.1.1–1.—*Summary of Major Laws, Regulations, and Orders Associated with Materials Management*

Laws, Regulations, and Orders	Description
Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 (42 U.S.C. §11001)	This Act includes emergency planning, notification requirements for unplanned releases of extremely hazardous substances, annual chemical inventory/material safety data sheet reporting, and annual toxic release inventory (TRI) reporting requirements. LLNL does not currently meet the standard industrial code (SIC) criteria that require reporting; however, it has assisted DOE in preparing TRI reports consistent with the directive of Executive Order (EO) 12856, superceded by EO 13148.
Greening the Government through Leadership in Environmental Management (EO 13148)	This EO directs all Federal agencies to develop and implement environmental management systems to support environmental compliance, right-to-know and pollution prevention; reducing toxic chemical releases, reducing use of toxic chemicals, hazardous substances, and other pollutants; reducing ozone depleting substances; and promoting environmentally and economically beneficial landscaping.
Atomic Energy Act (42 U.S.C. §2011)	The *Atomic Energy Act* (AEA) of 1954 makes the Federal government responsible for regulatory control of the production, possession, and use of three types of radioactive material: source, special nuclear, and byproduct (including waste).
29 CFR §§1910.1200, Hazard Communication	This regulation requires employers to keep a list of the hazardous chemicals maintained in the workplace.
40 CFR Part 302, Designation, Reportable Quantities, and Notification; and 40 CFR Part 370, Hazardous Chemical Reporting: Community Right to Know	This regulation requires the reporting of hazardous chemicals in quantities exceeding federally prescribed thresholds to safety and health officials in the state and local community.
California Health and Safety Code Division 20, Section 6.7 and 6.75, Subpart 25280-25299.7	This regulation establishes standards for concentration, maintenance, inspection, and testing of underground storage tanks.
California AB 2185, Hazardous Materials Release Response Plans and Inventory Law	The law covers the management of hazardous and acutely hazardous materials.
DOE O 5480.4, Environmental Protection, Safety, and Health Protection Standards	This order requires DOE facilities to comply with 29 CFR Part 1910, Subpart Z, Toxic and Hazardous Substances.
DOE O 460.2, Departmental Materials Transportation And Packaging Management	This order establishes DOE policies and requirements to supplement applicable laws, rules, regulations, and other DOE orders for materials transportation and packaging operations.
DOE O 460.1A, Packaging and Transportation Safety	This order establishes safety requirements for the proper packaging and transportation of DOE offsite shipments and onsite transfers of hazardous materials and for modal transport. (Offsite is any area within or outside a DOE site to which the public has free and uncontrolled access; onsite is any area within the boundaries of a DOE site or facility to which access is controlled.)

Source: LLNL 2002cc.
CFR = *Code of Federal Regulations*; DOE = U.S. Department of Energy; U.S.C. = *United States Code.*

TABLE 4.15.1.2–1.—*Facilities Managing Radionuclides[a] at LLNL*

Building Number	Radionuclide	Approximate[c] Quantity or Limit (kg, lb, or Ci)	Status[d]
Building 131 High Bay	Natural thorium Depleted uranium	0.5 kg 7,700 kg Inventory maintained below Category 3 thresholds	Radiological facility
Building 132N	Natural uranium Depleted uranium Sealed sources	Inventory maintained below Category 3 thresholds	Radiological facility
Building 132S	Natural uranium Depleted uranium Sealed sources	Inventory maintained below Category 3 thresholds	Radiological facility
Building 151	15 radionuclides	Inventory maintained below Category 3 thresholds. Ratio approximately 0.633[b]	Radiological facility
Building 152	Sealed sources	Inventory maintained below Category 3 thresholds	Radiological facility
Building 154	Sealed sources	Inventory maintained below Category 3 thresholds	Radiological facility
Building 190	Tritium Cobalt-60 Americium-241 Plutonium-238 Plutonium-239	20.0 Ci 1.43×10^{-4} Ci 1.11×10^{-5} Ci 0.027 Ci 1.50 Ci	Radiological facility
Building 191	Depleted uranium	0.008 Ci	Radiological facility
Building 194	Uranium-235 Plutonium-239 Sealed sources	0.192 kg 0.003 kg Inventory maintained below Category 3 thresholds	Radiological facility
Building 231	Natural thorium Natural uranium Depleted uranium Rhenium	0.5 kg 9.5 kg 3,000 kg 60 kg	Radiological facility
Building 231 vault	Natural thorium Uranium-235 Uranium-238	11 kg 3.4 kg 1,700 kg	Radiological facility
Building 232 Fenced Area and 233 Vault	Thorium Low enriched uranium Natural or depleted uranium	150 kg 0.3 kg 4,000 kg	Radiological facility
Building 239	Plutonium, fuel grade equivalent[e] Highly enriched uranium[e] Depleted uranium Tritium	6 kg 25kg/50 kg[f] 500 kg 0.02 kg	Varies; resident inventory maintained below Category 3 thresholds

TABLE 4.15.1.2–1.—*Facilities Managing Radionuclides at LLNL (continued)*

Building Number	Radionuclide	Approximate[c] Quantity or Limit (kg, lb, or Ci)	Status[d]
Building 241	Depleted uranium 5 radionuclides	2,650 kg Inventory maintained below Category 3 thresholds	Radiological facility
Building 251	42-Category 2 radionuclides	Inventory maintained below Category 2 thresholds	Category 2 facility
Building 255E	Sealed sources	Inventory maintained below Category 3 thresholds	Radiological facility
Building 261/262	16 Radionuclides Thorium Natural uranium Depleted uranium	Inventory maintained below Category 3 thresholds 100 lbs (Metal) 100 lb 300 lb	Radiological facility
Building 322	Depleted uranium	30 kg	Radiological facility
Building 327	Depleted uranium	95 kg	Radiological facility
Building 331[g]	Tritium[e] Plutonium-239 Plutonium, fuel-grade equivalent Uranium-235 HEU	0.030kg/0.035 kg[f] 900 g 260 g 700 g 5 kg	Inventory is distributed between two segments; small quantities of other radionuclides may be present but the facility will remain a Category 3 facility
Building 332	Plutonium[e] Enriched uranium[e] Depleted or natural uranium[e]	700kg/1,400 kg[f] 500 kg 3,000 kg	Category 2 facility
Building 334 [g]	Plutonium, fuel grade equivalent[e] Enriched uranium Depleted uranium Tritium	18 kg 100 kg 500 kg 0.0001 kg	Category 3 facility
Building 361	Phosphorus-32 Sulphur-35 Carbon-14 Tritium	0.027 Ci 0.008 Ci 0.131 Ci 0.29 Ci	Radiological facility
Building 362	Carbon-14 Tritium	0.036 Ci 0.006 Ci	Radiological facility
Building 363	Carbon-14 Tritium	0.002Ci 0.001 Ci	Radiological facility
Building 364	Cesium-137 (sealed Source)	3.5×10^3 Ci	Radiological facility
Building 366	Phosphorus-32	0.007 Ci	Radiological facility
Building 378	20 radionuclides (Sealed sources)	Inventory maintained below Category 3 thresholds	Radiological facility
Building 379	20 radionuclides (Sealed sources)	Inventory maintained below Category 3 thresholds	Radiological facility
Building 381	Tritium Sealed sources	8.5 Ci (storage limit – 20 Ci) Inventory maintained below Category 3 thresholds	Radiological facility

TABLE 4.15.1.2–1.—*Facilities Managing Radionuclides at LLNL (continued)*

Building Number	Radionuclide	Approximate[c] Quantity or Limit (kg, lb, or Ci)	Status[d]
RHWM Facilities (Area 514)	Miscellaneous radionuclides	Inventory maintained below Cat 3 thresholds	Radiological facility
RHWM Facilities (Area 612)	Cat 2 radionuclides	See Appendix B for inventory limits	Category 2 facility
DWTF Buildings 695/696S	Cat 3 radionuclides	See Appendix B for inventory limits	Category 3 facility
DWTF Building 693/ 696RWSA	Cat 2 radionuclides	See Appendix B for inventory limits	Category 2 facility
Cargo Container Testing facility (planned)	Depleted or natural uranium Uranium-235 Plutonium-239 Sealed sources	50 kg 1.0 kg (metal), 0.2 kg (oxide) 0.40 kg Inventory maintained below Category 3 thresholds	Radiological facility

Source: LLNL 1999b, g; LLNL 2000d, k, l, o, p; LLNL 2001b,e, f, aw; LLNL 2002ar, cq, co.
[a]Summary information, additional radionuclides may be present in these facilities.
[b]Ratio of activity to Category 3 threshold must be below 0.8 in order for a radiological accident analysis to not be required in a hazard analysis report.
[c]Inventories are snapshots in time. The information is provided to give the reader a degree of scale and is not (unless otherwise stated) a limit.
[d]Category 2 – Hazard analysis shows the potential for significant onsite consequences. Category 3 – Hazard analysis shows the potential for only significant localized consequences. Radiological–Facilities that do not meet or exceed Category 3 threshold criteria but still possess some amount of radioactive material. Category 2 and Category 3 thresholds are defined in DOE Standard DOE-STD-1027-92 (DOE 1997d).
[e]Administrative limit.
[f]Values are included for No Action Alternative and the Proposed Action, respectively.
[g]Materials in Buildings 331 and 334 are within the Superblock Administrative Limits for plutonium and uranium.
Ci = curies; DWTF = Decontamination and Waste Treatment Facility; kg = kilograms; RHWM = radioactive and hazardous waste management; RWSA = radioactive waste storage area.

TABLE 4.15.2–1.—*Livermore Site Waste Management Facilities and Capacities*[a]

Facility	Unit Type	Waste Type	Capacity
Area 612 Facility			
Building 625 CSU	S	H, M, R, TSCA, CT	42,416 gal
Area 612 Tank Trailer Storage Unit	S	CT, H, M, R	5,000 gal
Area 612 Portable Tank Storage Unit	S	CT, H, M, R	10,000 gal
Area 612-1 CSU	S	CT, H, M, R	38,400 ft^3
Area 612-2 CSU	S	CT, H, M, R	10,560 gal
Area 612-4 Receiving, Segregation, and CSU	S	H, M, R, TSCA, CT	NA
Area 612-5 CSU	S	CT, H, M, R	26,900 ft^3
Building 612 Size Reduction Unit	T	CT, H, M, R	250 short tons/yr
Building Lab Packing/Packaging	T	CT, H, M, R	NA
Building Drum/Container Crushing Unit	T	CT, H, M, R	600 short tons/yr
Building 612 CSU	T	CT, H, M, R	7,150 gal
Building 614 West Cells CSU	S	CT, H, M, R	168 gals/cell (4 cells)
Building 614 East Cells CSU	S	CT, H, M, R	880 gals/cell (4 cells)
DWTF Complex			
Building 693 CSU	S	CT, H, M, R	141,240 gal
Building 693 Annex	S	CT, H, M, R	3,060 ft^3
Building 693 Yard—Freezer Storage Unit	S	CT, H, M, R	30 gal
Building 693 Yard—Roll-Off Bin Storage Unit	S	CT, H	2,160 ft^3
Building 695 Airlock	S	H, M	12,000 gal
Building 695 LWPA Waste Blending Station, Tank Blending Unit	T	CT, H, M, R	Part of 695 Tank Farm capacity
Building 695 LWPA Waste Blending Station, Portable Blending Unit	T	CT, H, M, R	Part of 695 Tank Farm capacity
Building 695 LWPA Cold Vapor Evaporation Unit	T	CT, H, M, R	Part of 695 Tank Farm capacity
Building 695 LWPA Centrifuge Unit	T	CT, H, M, R	55,000 gal/yr
Building 695 LWPA Solidification Unit	T	CT, H, M, R	115 short tons/yr
Building 695 LWPA Shredding Unit	T	CT, H, M, R	180 short tons/yr
Building 695 LWPA Filtration Unit	T	CT, H, M, R	2,750 gal/yr
Building 695 LWPA Drum Rinsing Unit, Bulking Station	T	CT, H, M, R	182 short tons/yr
Building 695 LWPA Debris Washer Unit	T	CT, H, M, R	45 short tons/yr
Building 695 LWPA Gas Adsorption Unit	T	CT, H, M, R	0.09 short tons/day
Building 695 LWPA Radwaste Evaporator	T (non RCRA)	R	
Building 695 LWPA Air Lock	(non RCRA)	R	
Building 695 RWPA/SSTL Water Reactor			0.09 short tons/day
Building 695 RWPA/SSTL Pressure Reactor			0.09 short tons/day
Building 695 RWPA/SSTL Amalgamation Reactor			0.09 short tons/day
Building 695 RWPA/SSTL Uranium Bleaching Unit			0.09 short tons/day

TABLE 4.15.2–1.—*Livermore Site Waste Management Facilities and Capacities[a] (continued)*

Facility	Unit Type	Waste Type	Capacity
Small Scale Treatment Laboratory	T	H, M, R	0.04 short tons/day
Reactive Waste Storage Room	S	CT, H, M, R	12,400 gal
DWTF Tank Farm	S, T	CT, H, M, R	45,000 gal (storage), 325,000 gals/yr (treatment)
DWTF Portable Tank Storage Pad	S	CT, H, M, R	22,000 gal
Building 280 (Permitted, never operational)[b]			
Building 280 CSU	S	CT, H, M, R	18,140 ft^3
Area 514 [b]			
Area 514-1 CSU/Treatment Unit Group:	S, T	R, M, TSCA	NA[c]
Area 514-2 CSU	S	R, M, TSCA	NA[c]
Area 514-3 CSU	S	H, R, M, TSCA	NA[c]
Area 514 Wastewater Treatment Tank Farm Unit	T		NA[c]
Building 514 Silver Recovery Unit	Recycle	H	
Building 513 CSU	S	H, M, R	NA[c]
Building 513 Shredding Unit	T	H, M, R	NA[c]
Building 513 Solidification Unit	T	H, M, R	
EWTF-Site 300			
Open Burn Unit -Pan	T	H	150 lb/event
Open Burn Unit -Cage	T	H	260 lb/event
Open Detonation Unit	T	H	350 lb/event
S1	S	H	275 gal
S2	S	H	110 gal
EWSF-Site 300			
Magazine 1	S	H	1,622 lb (net explosive weight)
Magazine 2	S	H	3,209 lb (net explosive weight)
Magazine 3	S	H	5,592 lb (net explosive weight)
Magazine 4	S	H	4,291 lb (net explosive weight)
Magazine 5	S	H	2,744 lb (net explosive weight)
Magazine 816	S	H	9,240 gal (no liquids)
Building 883-Site 300			
Building 883 CSU	S	H	3,300 gal
Building 804-Site 300			
Building 804	Staging and Storage Area	R - only	N/A

[a] Typically an operational limit including a combination of hazardous, radioactive, and mixed waste unless otherwise restricted by permit or LLNL management practice.
[b] Under all alternatives, this facility would undergo RCRA closure and operational capabilities would be transferred to the DWTF.
[C] Values are included with those for B-695 Part B Permit.
CSU = container storage unit; CT = California Toxic (A non-RCRA hazardous waste defined by State of California, pursuant to Title 22, California Code of Regulations); R = radioactive (may include LLW and TRU); S = storage; T = treatment; TSCA = *Toxic Substance Control Act*; H = hazardous; M = mixed; NA = not available; EWTF = Explosive Waste Treatment Facility; ft^3 = cubic feet; gal = gallons; lbs = pounds; N/A = not applicable; SWSF = Solid Waste Storage Facility; RWPA/SSTL = Reactive Waste Packing Area / Small Scale Treatment Laboratory; DWTF = Decontamination and Waste Treatment Facility;LWPA = Liquid Waste Processing Area; RCRA = *Resource Conservation and Recovery Act*.

TABLE 4.15.2.1–1.—*Inspections and Findings of the Livermore Site and Site 300 by External Agencies in 2002 Relevant to Waste Management*

Medium	Description	Agency	Date	Finding
		Livermore Site		
Sanitary sewer	Annual compliance sampling	LWRP	October 7, 8	No violations
	Categorical sampling		October 21	No violations
Waste	Hazardous waste facilities	DTSC	May 22-24, 30 June 4	Received an inspection report and summary of violations. The alleged violations were storage of one container of waste more than 90 days in a 90-day generator area and storage of two waste containers for more than one year in a permitted storage area. The container in the 90-day area was subsequently moved to a permitted storage area and the two stored containers were shipped offsite.
	Medical waste	ACDEH	September 25	No violations
Storage tanks	Compliance with underground storage tank upgrade requirements and operating permits.	ACDEH	October 15, 16	No violations
		Site 300		
Waste	Permitted Hazardous Waste facilities (EWTF, EWSF, B883 CSA), Waste Accumulation Area B883 North, and Generator Areas.	DTSC	November 20, 21	No violations
Storage tanks	Compliance with underground storage tank upgrade requirements and operating permits	SJCEHD	October 17 November 25-27 December 13	Received notification of three minor violations concerning tank alarm and line leak testing documentation and an improperly functioning line leak detector. LLNL addressed these observations by instituting documentation requirements replacing the line leak detectors and conducting line leak testing.

Source: LLNL 2003l.
ACDEH = Alameda County Department of Environmental Health; CSA: Container Storage Area; DTSC: Department of Toxic Substances Control; EWSF: Explosives Waste Storage Facility; EWTF: Explosives Waste Treatment Facility; HW: hazardous waste; LLNL = Lawrence Livermore National Laboratory; LWRP = Livermore Water Reclamation Plant; SJCEHD = San Joaquin County Department of Environmental Health; SOV: Summary of violations.

TABLE 4.15.2.1–2.—*Summary of Permits Active in 2001 and 2002 Relevant to Waste Management*

Type of Permit	Livermore Site	Site 300
Hazardous Waste	EPA ID No. CA2890012584.	EPA ID No. CA2890090002.
	Authorization to mix resin in Unit CE231-1 under conditional exemption tiered permitting. Final closure plan submitted to DTSC for the Building 419 interim status unit (February 2001).	Part B Permit—Container Storage Area (Building 883) and Explosives Waste Storage Facility (issued May 23, 1996).
	Authorizations to construct the permitted units of Building 280, Building 695, and additions to Building 693.	Part B Permit—Explosives Waste Treatment Facility (issued October 9, 1997).
	Authorization under hazardous waste permit to operate 18 waste storage units and 14 waste treatment units.	Docket HWCA 92/93-031. Closure and Post-Closure Plans for Landfill Pit 6 and the Building 829 Open Burn Facility.
	Continued authorization to operate seven waste storage units and eight waste treatment units under interim status. Final closure plans submitted to DTSC for the Building 233 and Building 514 interim status units (May 2000).	Post-Closure Permit Application submitted for Building 829 Open Burn Facility (September 2000). Prepared a Notice of Deficiency (NOD) response document to be submitted to DTSC in February 2002.
	Notified DTSC on 3/31/01 that LLNL will not construct and operate Building 280 as a permitted unit as described in our Hazardous Waste Facility permit.	
Medical Waste	One permit for large quantity medical waste generation and treatment covering the Biology and Biotechnology Research Program, Health Services Department, Forensic Science Center, Medical Photonics Lab, and Tissue Culture Lab, and Chemistry and Materials Science Department.	Limited Quantity Hauling Exemption for small quantity medical waste generator.
Sanitary Sewer	Discharge Permit No. 1250 for discharges of wastewater to the sanitary sewer.	
	Permit 1510-G for discharges of sewerable groundwater from CERCLA restoration activities.	
Storage Tanks	Eight operating permits covering 11 underground petroleum product and hazardous waste storage tanks: 111-D1U2 Permit No. 6480; 113-D1U2 Permit No. 6482; 152-D1U2 Permit No. 6496; 271-D2U1 Permit No. 6501; 321-D1U2 Permit No. 6491; 322-R2U2 Permit No. 6504 (exempted); 365-D1U2 Permit No. 6492; and 611-D1U1, 611-G1U1, 611-G2U1, and 611-O1U1 Permit No. 6505.	One operating permit covering five underground petroleum product tanks assigned individual permit numbers: 871-D1U2 Permit No. 008013; 875-D1U2 Permit No. 006549; 879-D1U1 Permit No. 006785; 879-G3U1 Permit No. 007967; and 882-D1U1 Permit No. 006530.

Source: LLNL 2003l.
HWCA = *California Hazardous Waste Control Act*; DTSC = Department of Toxic Substances Control; EPA = U.S. Environmental Protection Agency; LLNL = Lawrence Livermore National Laboratory.

TABLE 4.15.2.1–3.—*Summary of Major Laws, Regulations, and Orders Relevant to Waste Management*

Laws, Regulations, and Orders	**Description**
Solid Waste Disposal Act of 1976 (42 U.S.C. §6902)	This Act regulates the management of solid waste. Solid waste is broadly defined to include any garbage, refuse, sludge, or other discarded material including solid, liquid, semisolid, or contained gaseous materials resulting from requirements and controls for transport, test procedures, and administrative requirements. Schedules include industrial, commercial, mining, or agricultural activities. Source-special nuclear or by-product material, as defined by the *Atomic Energy Act* (AEA), is specifically excluded as solid waste.
Resource Conservation and Recovery Act of 1976 (42 U.S.C. §6901)	This Act amends the *Solid Waste Disposal Act* and establishes requirements and procedures for the management of hazardous wastes. As amended by the *Hazardous and Solid Waste Amendments* of 1984 (HSWA), RCRA defines hazardous wastes that are subject to regulation and sets standards for generation, treatment, storage, and disposal facilities. The HSWA emphasize reducing the volume and toxicity of hazardous waste. They also establish permitting and corrective action requirements for RCRA-regulated facilities. RCRA was also amended by the *Federal Facilities Compliance Act* (FFCA) in 1992. It requires EPA, or a state with delegated authority, to issue an order for compliance. A Federal facilities compliance order was issued by the Cal-EPA, requiring DOE and LLNL to comply with the FFCA. Compliance with the order is achieved through Site Treatment Plans prepared by DOE.
Underground Storage Tanks (42 U.S.C. §6901, Subtitle I)	Underground storage tanks (USTs) are regulated as a separate program under RCRA, which establishes regulatory requirements for USTs containing hazardous or petroleum materials. Cal-EPA has been delegated authority for regulating LLNL.
Federal Facility Compliance Act of 1992 (42 U.S.C. §6961)	This 1992 Act waives sovereign immunity from fines and penalties for RCRA violations at Federal facilities. However, it postponed the waiver for three years for storage prohibition violations with regard to land disposal restrictions for DOE's mixed wastes. It required DOE to prepare plans for developing the required treatment capacity for each site at which it stores or generates mixed waste. The state or U.S. EPA must approve each plan (referred to as a Site Treatment Plan) after consultation with other affected states, consideration of public comments, and issuance of an order by the regulatory agency requiring compliance with the plan. The Act further provides that DOE will not be subject to fines and penalties for storage prohibition violations for mixed waste as long as it complies with an existing agreement, order, or permit. The FFCA requires that Site Treatment Plans contain schedules for developing treatment capacity for mixed waste for which identified technologies exist. DOE must provide schedules for identifying and developing technologies for mixed waste without an identified existing treatment technology. A Federal Facility Compliance Order was signed in 1997 to address treatment prior to disposal of mixed waste, as well as characterization and disposal of mixed TRU waste.
Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as Amended (42 U.S.C. §9601, et seq.)	This Act, commonly referred to as the CERCLA, or Superfund, establishes liability standards and governmental response authorization to address the release of a hazardous substance or contaminant into the environment. EPA is the regulating authority for the Act. CERCLA was amended by the *Superfund Amendments and Restoration Act* (SARA) in 1986. SARA Title III establishes additional requirements for emergency planning and reporting of hazardous substance releases. These requirements are also known as the *Emergency Planning and Community Right-to-Know Act* (EPCRA), which, due to its unique requirements is discussed separately below. SARA also created liability for damages to or loss of natural resources resulting from releases into the environment and required the designation of Federal and state officials to act as public trustees for natural resources. LLNL is subject to, and required to report releases to the environment under the notification requirements in 40 CFR Part 302 (Designation, Reportable Quantities, and Notification) and EPCRA, as applicable. Pursuant to CERCLA, Section 120, DOE signed a Federal Facility Agreement for LLNL in 1989.

TABLE 4.15.2.1–3.—*Summary of Major Laws, Regulations, and Orders Relevant to Waste Management (continued)*

Laws, Regulations, and Orders	Description
Pollution Prevention Act of 1990 (42 U.S.C. §13101)	This Act sets the national policy for waste management and pollution control that focuses first on source reduction, followed sequentially by environmentally safe recycling, treatment, and disposal. In response, DOE committed to voluntary participation in EPA's 33/50 Pollution Prevention Program, as set forth in Section 313 of SARA.
Toxic Substances Control Act of 1977 (15 U.S.C. §2601)	TSCA, unlike other statutes that regulate chemicals and their risk after they have been introduced into the environment, was intended to require testing and risk assessment before a chemical is introduced into commerce. It also establishes record-keeping and reporting requirements for new information regarding adverse health and environmental effects of chemicals. The Act governs the manufacture, use, storage, handling, and disposal of PCBs; sets standards for cleaning up PCB spills; and establishes standards and requirements for asbestos identification and abatement in schools. It is administered by EPA. Because LLNL's R&D activities are not related to the manufacture of new chemicals, PCBs are LLNL's main concern under the Act. Activities at LLNL that involve PCBs include, but are not limited to, management and use of authorized PCB-containing equipment, such as transformers and capacitors; management and disposal of substances containing PCBs (dielectric fluids, contaminated solvents, oils, waste oils, heat transfer fluids, hydraulic fluids, paints, slurries, dredge spoils, and soils); and management and disposal of materials or equipment contaminated with PCBs as a result of spills. At LLNL, PCB-contaminated wastes are transported offsite for treatment and disposal unless they also have a radioactive component. Nonradioactive wastes containing PCBs are disposed of at an offsite facility that has been approved by EPA for such disposal (provided that strict requirements are met with respect to notification, reporting, record-keeping, operating conditions, environmental monitoring, packaging, and types of wastes disposed). Radioactive PCB waste, typically known as mixed TRU waste or mixed waste, is currently stored at one of LLNL's hazardous waste storage facilities until the Waste Isolation Pilot Project, or other approved facility, accepts this waste for final disposal. LLNL conducts asbestos abatement projects in accordance with OSHA requirements (29 CFR Part 1926), applicable requirements of the *Clean Air Act* and the California Solid Waste Management Regulations.
EO 13148, "Greening the Government through Leadership in Environmental Management"	This EO directs all Federal agencies to develop and implement environmental management systems to support environmental compliance; right-to-know and pollution prevention; reducing toxic chemical releases; reducing use of toxic chemicals, hazardous substances, and other pollutants; reducing ozone-depleting substances; and promoting environmentally and economically beneficial landscaping.
Atomic Energy Act	The AEA of 1954 makes the Federal government responsible for regulatory control of the production, possession, and use of three types of radioactive material: source, special nuclear, and byproduct (includes waste). Regulations promulgated by the U.S. Nuclear Regulatory Commission (NRC) under the AEA establish standards for the management of these radioactive materials (including waste).
Hazardous Waste Control Act (California Health and Safety Code § 25100 et seq.)	This act is the state authorization to implement the state hazardous waste programs pursuant to RCRA.
Hazardous Waste Reduction Act (California Health and Safety Code § 25244.12-24)	This act expands the State of California's hazardous waste source reduction activities to accelerate reduction in hazardous waste generation.

TABLE 4.15.2.1–3.—*Summary of Major Laws, Regulations, and Orders Relevant to Waste Management (continued)*

Laws, Regulations, and Orders	**Description**
Medical Waste Management Act (California Health and Safety Code § 117600-11860)	The *Medical Waste Management Act* establishes a comprehensive program for regulating the management, transport, and treatment of medical wastes that contain substances that may potentially infect humans.
40 CFR Part 260 Series	The implementing regulations established by EPA governing hazardous waste.
California Code of Regulations, Title 22	The implementing regulations established by Cal-EPA for management of hazardous waste.
DOE O 435.1, “Radioactive Waste Management”	DOE O 435.1 establishes the policies, guidelines, and minimum requirements by which DOE and its contractors manage radioactive waste, mixed waste, and contaminated facilities. This order establishes DOE policy that radioactive and mixed wastes be managed in a manner that ensures protection of the health and safety of the public, DOE, contractor employees, and the environment. In addition, the generation, treatment, storage, transportation, and disposal of radioactive wastes, and the other pollutants or hazardous substances they contain, must be accomplished in a manner that minimizes the generation of such wastes across program office functions and complies with all applicable Federal, state, and local environmental, safety, and health laws and regulations and DOE requirements.
DOE O 450.1, “Environmental Protection Program”	This order directs facilities to implement sound stewardship practices that are protective of the air, water, land, and other natural and cultural resources impacted by DOE operations and by which DOE cost-effectively meets or exceeds compliance with applicable environmental, public health, and resource protection laws, regulations, and DOE requirements.

Source: LLNL 2002cc.

4.15.2.2 *Radioactive Waste*

Radioactive waste generated at LLNL includes LLW, MLLW, TRU waste, and mixed TRU waste. LLNL does not manage or generate high-level waste (a highly radioactive material that results from the reprocessing of spent nuclear fuel). LLW, MLLW, and TRU waste are produced primarily in laboratory experiments and component tests. Mixed wastes are discussed in Section 4.15.2.4. See Appendix B for a detailed description of radioactive waste, storage quantities, and treatment quantities.

DOE O 435.1 permits onsite storage of LLW and TRU wastes until appropriate disposal becomes available. Currently, there are no regulatory restrictions on the length of time this waste may be stored onsite, provided that disposal or offsite storage options are being pursued and the waste is stored in accordance with all applicable regulations. LLNL maintains the capability to treat solid radioactive wastes onsite. LLNL has treated liquid radioactive wastes at the Area 514 Tank Farm. The DWTF is replacing Area 514 (LLNL 2002ca). LLNL disposes of solid LLW offsite at the Nevada Test Site. Available storage space for LLW and TRU waste is limited by exposure considerations (i.e., radiation exposure to personnel) at a given storage location. However, radioactive wastes, unlike RCRA-regulated wastes, can be stored at various locations onsite provided that the wastes are properly packaged, labeled, and monitored. Radioactive waste management facilities are listed in Table 4.15.2–1.

As part of the effort to minimize the total quantity of radioactive waste that is generated at LLNL, facilities that generate this type of waste are designated as a Radioactive Materials

TABLE 5.2.8.1–3.—*Summary of Air Pollutant Emission Rates Associated with Project Operation Under the No Action Alternative under Maximum Conditions*

Pollutant	Vehicular Activity	Natural Gas Usage	Diesel Fuel Use	Total Annual	Significant Emission Level [a]	Average Daily [b]	Significant Emission Level [a]
	Emissions in tons per year			Emissions in tons per year		Emissions in pounds per day	
Precursor organic compounds	0.32	0.025	2.3×10^{-3}	0.35	15	2.7	80
Oxides of nitrogen	1.1	0.32	0.034	1.4	15	11	80
Carbon monoxide	6.0	0.054	7.3×10^{-3}	6.1	-	47	-
Sulfur oxides	0.041	1.8×10^{-3}	3.1×10^{-3}	0.046	-	0.35	-
Particulate matter (PM_{10})	0.60	0.032	2.4×10^{-3}	0.64	15	4.9	80
Formaldehyde		3.0×10^{-4}	3.0×10^{-4}	6.0×10^{-4}		4.6×10^{-3}	
Benzene		2.8×10^{-5}	4.8×10^{-5}	7.6×10^{-5}		5.9×10^{-4}	
Polycyclic organic matter			2.3×10^{-7}	2.3×10^{-7}		1.7×10^{-6}	
Arsenic			4.2×10^{-8}	4.2×10^{-8}		3.2×10^{-7}	
Beryllium			2.4×10^{-8}	2.4×10^{-8}		1.9×10^{-7}	
Cadmium			1.0×10^{-7}	1.0×10^{-7}		8.0×10^{-7}	
Hexavalent chromium			2.2×10^{-9}	2.2×10^{-9}		1.7×10^{-8}	
Lead			8.9×10^{-8}	8.9×10^{-8}		6.8×10^{-7}	
Manganese			1.4×10^{-7}	1.4×10^{-7}		1.1×10^{-6}	
Mercury			3.0×10^{-8}	3.0×10^{-8}		2.3×10^{-7}	
Nickel			1.7×10^{-6}	1.7×10^{-6}		1.3×10^{-5}	

[a] BAAQMD has established significant emission levels in response to local pollutant problems. Projects with emissions in excess of these levels must include stringent mitigation. Emissions related to construction and demolition activities are not specifically quantified in keeping with the BAAQMD's guidance for the analysis of construction impacts (discussed in Section 5.1.8.1) which emphasizes implementation of effective and comprehensive control measures rather than detailed quantification of construction emissions. If all of the control measures, as appropriate, depending on the size of the project area, will be implemented, then air pollutant emissions from construction activities would be considered a less than significant impact. Similarly, any demolition, renovation or removal of asbestos-containing building materials would be considered a less than significant impact if the activity complies with the requirements and limitations of district Regulation 11, Rule 2: Hazardous Materials; Asbestos Demolition, Renovation and Manufacturing (BAAQMD 1999).

[b] Average daily emission rate is based on an operating schedule of 5 days per week, 52 weeks per year.

BAAQMD = Bay Area Air Quality Management District.

TABLE 5.2.10.1–1.—*Summary of Input Parameters for Analysis of Community Noise Issues Under the No Action Alternative*

Parameter	Units	Site	Existing Environment	No Action Alternative
Daily vehicle traffic	1,000 vehicles	Livermore	22.0	22.6
		Site 300	0.5	No change.
Explosives testing [a]	Shot frequency (number per year)	Livermore	Shot frequency is not limited. Hundreds of experiments are conducted each year (e.g., 501 shots within the HEAF during FY2002).	Shot frequency would not be limited, but would not change appreciably.
		Site 300	Shot frequency is not limited. Typical activities include about 200 open air tests per year including gun firings and could include about 12 to 25 tests per year in the Contained Firing Facility.	Shot frequency would not be limited, but would not change appreciably. The activity on open air firing tables would continue to far exceed that in the Contained Firing Facility for the foreseeable future.
	Maximum weight in kilograms	Livermore	Shots range from gram level up to kilogram level. The highest weight shot ever fired in the HEAF was 10 kilograms of C4 (13.4-kilograms TNT equivalent) in the 10-kilogram spherical tank.	No change.
		Site 300	Shots range from gram level up to kilogram level. Based on the type of explosive used and constraints imposed by LLNL management to limit the maximum allowable sound pressure level, not to exceed 126 decibels in nearby populated areas.	No change.

[a] LLNL 2003ar.
FY = fiscal year; HEAF = High Explosives Application Facility; LLNL = Lawrence Livermore National Laboratory; TNT = trinitrotoluene.

TABLE 5.2.13.1–1.—*Types of Hazardous Chemicals in Use at the Livermore Site Under the No Action Alternative*

Chemical	Chemical Abstract Number	Existing Conditions Maximum/Average Quantity	No Action Average Maximum/Average Quantity
Paints/Solvents			
Paint (variety)	NA	700,000/320,296 lb	700,000/330,000 lb
Thinner, lacquer	NA	3,000/500 gal	3,000/515 gal
Methylene chloride	75-09-2	2,000/55 gal	2,000/58 gal
Methyl alcohol	67-56-1	1,800/500 gal	1,800/515 gal
Acetone	67-64-1	1,200/740 gal	1,200/760 gal
Metals			
Lead bricks or ingots	NA	1,000,000 lb	1,000,000 lb
Tantalum	7440-25-7	75,000/20,000 lb	75,000/20,600 lb
Cobalt	7440-48-4	16,500/14,000 lb	16,500 lb
Aluminum	7429-90-5	5,000/800 lb	5,000/824 lb
Chrome or chromium	7440-47-3	4,700/1,500 lb	4,700/1,545 lb
Acids/Bases/Oxidizers			
Oxygen, compressed	7782-44-7	870,000/75,000 ft^3	870,000 ft^3
Hydrogen peroxide<52%	7722-84-1	42,000/18,000 gal	42,000 gal
Ammonium hydroxide	1336-21-6	30,000/1,600 lb	30,000/1,650 lb
Sodium hydroxide	1310-73-2	25,500/14,000 lb	25,500 lb
Potassium hydroxide	1310-58-3	15,000/400 lb	15,000/410 lb
Sulfuric acid	7664-93-9	11,000/4,500 lb	11,000 lb
Nitric acid	7697-37-2	7,810/5,000 lb	7,810/5,150 lb
Phosphoric acid	7664-38-2	3,600/1,000 lb	3,600/1,030 lb
Cyanuric acid	108-80-5	2,500/500 lb	2,500/515 lb
Hydrofluoric acid	7664-39-3	1,500/850 lb	1,500 lb
Industrial Gases			
Argon, compressed	7440-37-1	25,000,000/160,000 ft^3	25,000,000/164,800 ft^3
Helium	7440-59-7	5,000,000/300,000 ft^3	5,000,000/310,000 ft^3
Hydrogen, compressed	1333-74-0	1,500,000/50,000 ft^3	1,500,000/52,000 ft^3
Nitrogen, compressed (Liquified, gaseous)	7727-37-9	500,000/130,000 ft^3	500,000/133,000 ft^3
Carbon dioxide	124-38-9	176,000/124,000 ft^3	176,000/128,000 ft^3
Refrigerants			
Freon 113 (1,1,2-Trichloro-1,2,2-trifluoroethane)	76-13-1	170,000/16,000 lb	170,000/16,500 lb
Refrigerant, 123 SUVA, (2,2-Dichloro-1,1,1-trifluoroethane)	306-83-2	35,000/1,500 lb	35,000/1,550 lb
Freon 22 (Chlorodifluoromethane)	75-45-6	9,000/5,000 lb	9,000/5,150 lb
Freon 11 (Trichlorofluoromethane)	75-69-4	10,000/5,000 lb	10,000/5,150 lb
Freon 12 (Dichlorodifluoromethane)	75-71-8	6,300/4,000 lb	6,300/4,120 lb
Freon 14 (Tetrafluoromethane)	75-73-0	2,000/500 ft^3	2,000/515 ft^3

Sources: NNSA 2002c, TtNUS 2003.
Note: Additional chemicals are listed in Appendix B. Numbers are rounded.
ft^3 = cubic feet; lb = pounds; gal = gallons; NA = not available.

TABLE 5.2.13.2–2.—*Planned Projects Under the No Action Alternative and Associated Waste Projections*

Project Title	Project Description[a]	Expected Waste Streams and Quantities
BioSafety Laboratories (multiple projects)	Modifications to Buildings 132, 151, 153, 154, 190, 235, 241, 281, 432, 435, 446, T1527, T8545, and T4352.	No changes to routine waste generation. Construction debris accounted for in 93-200 tons of debris per year estimate. New operation would be expected to generate (total all waste categories 500-1,000 lb/yr, assumed minimum of 1 metric ton, 0.5-1 m^3/metric ton) Hazardous: 0-1 metric tons/yr (including biohazardous) Municipal solid waste: 0-1 metric tons/yr
Terascale Simulation Facility	Computers required to meet Strategic Computing Initiative.	New operation, not expected to generate hazardous, radioactive, or mixed waste.
D&D U325 Cooling Tower	An old LLW cooling tower to be removed.	No changes to routine waste generation. Several tons of debris would be disposed. Building is part of 255,000 ft^2 of excess properties to be removed. Potential for nonroutine TSCA waste.
D&D Building 222	22,000 ft^2 will be removed.	No changes to routine waste generation. 145 tons of debris would be disposed. Building is part of 255,000 ft^2 of excess properties to be removed. Potential for nonroutine TSCA waste.
D&D	Building 177 AVLIS legacy facility; 13,000 ft^2 will be removed.	No changes to routine waste generation. Up to 6,000 tons of debris. More than 5,000 tons would be recycled. D&D work would include a total of 85 tons of debris for disposal. Hazardous: 0-1 metric tons LLW: 10-20 m^3/yr MLLW: 0-1 m^3/yr TRU: 0 Municipal Solid Waste: 13-60 metric tons/yr. Building is part of 255,000-ft^2 of excess properties to be removed. Potential for nonroutine TSCA waste.
Remove and Replace Offices	Modular offices for 100 to 130 personnel removed per year.	No changes to routine waste generation. Assuming 25,000 to 30,000 ft^2 removed, 200 tons of debris would be disposed. Buildings are part of 255,000 ft^2 of excess properties to be removed. Potential for nonroutine TSCA waste. Construction of 25,000 to 30,000 ft^2 building would result in an estimated 50-60 tons of construction debris.
Site 300 Wetlands Enhancement	Mitigation ponds to replace ATA cooling tower.	None. Excess soil will be used in vicinity.
Tritium Facility Modernization	Renovation and modernization of Building 331.	No net change in routine waste generation as increases in programmatic activities are expected to be balanced by consolidation and other improvements. Construction wastes would be expected, approximately 2 tons/1,000 ft^2.
Site 300 Revitalization Project	Convert S300 to Hetch Hetchy.	Only construction debris.
Building 292 Cleanup	Clean up T2 contaminated target and machine rooms.	No changes to routine waste generation. Wastes would be considered nonroutine.

TABLE 5.2.13.2–2.—*Planned Projects Under the No Action Alternative and Associated Waste Projections (continued)*

Project Title	Project Description[a]	Expected Waste Streams and Quantities
Reclassify Building 446 as BSL-2 Facility	Facility Reclassify entire building to BSL-2 standard.	New operation would be expected to generate: Hazardous: 0-1 metric tons/yr (including biohazardous) LLW: 0-1 m^3/yr MLLW: 0-1 m^3/yr TRU: 0 Municipal Solid Waste: 0-1 metric tons/yr
Engineering Technology Complex Upgrade	Modifications to Building 321 to meet seismic standards, improve space utilization, and add new high precision machine and inspection equipment.	Due to modernization and consolidation, routine waste generation would be expected to decrease. Construction wastes would be expected, approximately 2 tons/1,000 ft^2. Upgrade work would be expected to generate: Hazardous 0-2 metric tons/yr (for 3 years) LLW: 12-24 m^3/yr (for 3 years, assumes 0.5 to 1 ton/m^3) MLLW: 1-2 m^3/yr (for 3 years, assumes 0.5 to 1 ton/m^3) TRU: 0 Municipal Solid Waste: 100 metric tons/yr (for 3 years)
Building 298 Roof Replacement	Replace leaking 47,000 ft^2 roof.	No changes to routine waste generation. Assuming 0.5-foot thick roof, 600 tons of debris would be disposed. Potential for nonroutine TSCA waste. Construction of new roof would result in an estimated several tons of construction debris.
Protection of Real Property (roofs)	Reroof Buildings 111, 113, 121, 141, 194, 231, 241, 251, 281, 321, and 332	No changes to routine waste generation. Assuming 840,000 ft^2 of roof, 0.5 foot thick roof, 10,000 tons of debris would be disposed. Potential for nonroutine TSCA waste. Construction of new roofs would result in estimated tens of tons of construction debris.
Central Cafeteria Replacement	Replace existing temporary central cafeteria.	Due to modernization and consolidation, routine waste generation would be expected to decrease. Construction wastes would be expected, approximately 2 tons/1,000 ft^2.
BioSafety Level-3 Facility	1,500 ft^2 building to support biological detection/counter-terrorism.	New operation would be expected to generate: Hazardous: 0-1 metric tons/yr (including biohazardous) Municipal Solid Waste: 0-1 metric tons/yr
International Security Research Facility	64,000 ft^2 building to consolidate national security programs.	Due to modernization and consolidation, routine waste generation would be expected to decrease. Construction wastes would be expected, approximately 120 tons.
Container Security Testing Facility	Two small buildings, location.	No changes to routine waste generation. Construction wastes would be expected, approximately 2 tons/1,000 ft^2.
Site 300 Response Training Facility	Modifying an existing building for assembling and disassembling explosive training devices.	Due to modernization and consolidation, routine waste generation would be expected to decrease. Upgrade construction debris accounted for an estimated 93 to 200 tons of debris per year.

TABLE 5.2.13.2–2.—*Planned Projects Under the No Action Alternative and Associated Waste Projections (continued)*

Project Title	Project Description[a]	Expected Waste Streams and Quantities
National Ignition Facility	Laser system and facility for stockpile stewardship and understanding weapons physics.	Start up of existing capability would be expected to generate the following waste. Hazardous: 15 metric tons per year LLW: 72 m^3/yr MLLW: 6.9 m^3/yr Municipal solid waste: several metric tons/yr
WIPP Mobile Vendor	Ship waste to CCF or WIPP	No changes to routine waste generation.
East Avenue Security Upgrade	Limit access along East Avenue to enhance security of LLNL and SNL/CA.	No changes to routine waste generation.
Superblock Security Upgrade	Add physical barriers.	No changes to routine waste generation. Upgrade construction debris accounted for in 93 to 200 tons of debris per year estimate.
D&D Building 514	Existing EPD waste treatment facility to be replaced by DWTF. D&D after startup of DWTF.	No changes to routine waste generation. Potential for nonroutine TSCA waste, mixed, hazardous, and radioactive waste. Moving permitted capacity to DWTF is considered an administrative action and would not result in changes of routine waste generation.
Extend Fifth Street	Improve traffic circulation with east-west connection.	No changes to routine waste generation. Upgrade construction debris accounted for in 93 to 200 tons of debris per year estimate.
Westgate Drive improvements	Widen Westgate Drive and improve circulation.	No changes to routine waste generation. Upgrade construction debris accounted for in 93 to 200 tons of debris per year estimate.
Deactivation and D&D projects	D&D approximately 255,000 ft^2.	See Table A.2.3–2 waste generation amounts for D&D activities.
Superblock Stockpile Stewardship Program Operations	Several Stockpile Stewardship Programs.	LLW – 460 drums/yr and 10 transportainers/yr TRU – 120 drums/yr and 10 drum overpacks (2/yr) CY 2004 – 20 waste boxes and then 5 waste boxes/yr
Site Utilities Upgrade	Various upgrades to mechanical utilities, compressed air plant, potable water system, transmission lines.	Only construction debris and noncontaminated solid waste.
Plutonium Facility Ductwork Replacement	Replaces 40-year old glovebox exhaust system.	See glovebox exhaust replacement CX.
SNM Tests with Optical Science Laser	Use of the Optical Science Laser laboratory for an ongoing material study.	Use only encapsulated SNM. No appreciable radioactive waste generations.

Source: TtNUS 2003.
[a] Detailed project descriptions are provided in Appendix A.
Note: SNM tests with Optical Science Laser and Site 300 tritium use were considered to be modifications of existing processes and not relevant changes impacting waste generation.
ATA = Advanced Test Accelerator; AVLIS = Advanced Vapor Laser Isotope separation; CCF = Central Characterization Facility; CX = categorical exclusion; D&D = Decontamination and Decommissioning; DWTF = Decontamination and Waste Treatment Facility; EPD = Environmental Protection Department; ft^2 = square feet; GBE = lb/yr = pounds per year; LLW = low-level waste; m^3/yr = cubic meters per year; MLLW = mixed low-level waste; SNM = special nuclear material TRU = transuranic waste; TSCA = *Toxic Substances Control Act*; WIPP = Waste Isolation Pilot Plant.

TABLE 5.3.8.1–1.—*Summary of Input Parameters for Air Quality Analysis Under the Proposed Action*

Parameter	Units	Site	No Action Alternative	Proposed Action
Daily vehicle traffic	1,000 vehicles	Livermore	22.6	23.6
		Site 300	0.5	No change
Air Emission Sources and Facility Status[d]	-	Livermore	The Livermore Site would continue to rank as a mid-sized facility, subject to offset requirements for nonattainment pollutants and employ good controls on POC and NO_x sources; remain a minor source for HAPs under NESHAP; and not a significant source of toxic air pollutants.	No change
		Site 300	Site 300 is a small source per definition of the SJVUAPCD, and remains a minor source for HAPs under NESHAP.	No change

HAP = hazardous air pollutant; NESHAP = National Emission Standards for Hazardous Air Pollutants; NO_x = oxides of nitrogen; POC = precursor organic compounds; SJVUAPCD = San Joaquin Valley Air Pollution Control District.

TABLE 5.3.10.1–1.—*Summary of Input Parameters for Analysis of Community Noise Issues Under the Proposed Action*

<table>
<tr><th>Parameter</th><th>Units</th><th>Site</th><th>No Action Alternative</th><th>Proposed Action</th></tr>
<tr><td rowspan="2">Daily vehicle traffic</td><td rowspan="2">1,000 vehicles</td><td>Livermore</td><td>22.6</td><td>23.7</td></tr>
<tr><td>Site 300</td><td>0.5</td><td>No change</td></tr>
<tr><td rowspan="4">Explosives testing [a]</td><td rowspan="2">Shot frequency (number per year)</td><td>Livermore</td><td>Hundreds of experiments are conducted each year (e.g., 501 shots within the HEAF during FY2002).</td><td>Shot frequency would not change appreciably.</td></tr>
<tr><td>Site 300</td><td>Shot frequency would not be limited, but would not change appreciably from current levels. Typical activities include about 200 open-air tests per year (including gun firings) and could include about 12 to 25 tests per year in the Contained Firing Facility. It is anticipated that the activity on open air firing tables will continue to far exceed that in the Contained Firing Facility for the foreseeable future.</td><td>Shot frequency would not change appreciably.</td></tr>
<tr><td rowspan="2">Maximum weight in kilograms</td><td>Livermore</td><td>Shot weight would continue to range from gram level up to kilogram level.</td><td>No change</td></tr>
<tr><td>Site 300</td><td>Shot weight would continue to range from gram level up to kilogram level. Based on the type of explosive used and constraints imposed by LLNL management to limit the maximum allowable sound pressure level, not to exceed 126 decibels in nearby populated areas.</td><td>No change</td></tr>
</table>

[a] LLNL 2003ar.
FY = fiscal year; HEAF = High Explosive Application Facility; LLNL = Lawrence Livermore National Laboratory.

TABLE 5.3.13.1–1.—*Types of Hazardous Chemicals for Use at the Livermore Site Under the Proposed Action*

Chemical	Chemical Abstract Number	No Action Average Maximum/Average Quantity	Proposed Action Maximum/Average Quantity
Paints/Solvents			
Paint (variety)	NA	700,000/330,000 lb	700,000/352,000 lb
Thinner, lacquer	NA	3,000/515 gal	3,000/550 gal
Methylene chloride	75-09-2	2,000/58 gal	2,000/60 gal
Methyl alcohol	67-56-1	1,800/515 gal	1,800/550 gal
Acetone	67-64-1	1,200/760 gal	1,200/810 gal
Metals (No changes are expected)			
Lead bricks or ingots	NA	1,000,000 lb	1,000,000 lb
Tantalum	7440-25-7	75,000/20,600 lb	75,000/20,000 lb
Cobalt	7440-48-4	16,500/14,300 lb	16,500/14,000 lb
Aluminum	7429-90-5	5,000/824 lb	5,000/800 lb
Chrome or chromium	7440-47-3	4,700/1,545 lb	4,700/1,500 lb
Acids/Bases/Oxidizers			
Oxygen, compressed	7782-44-7	870,000/78,000 ft^3	870,000/83,000 ft^3
Hydrogen peroxide<52%	7722-84-1	42,000/18,600 gal	42,000/20,000 gal
Ammonium hydroxide	1336-21-6	30,000/1,650 lb	30,000/1,800 lb
Sodium hydroxide	1310-73-2	25,500/14,400 lb	25,500/15,000 lb
Potassium hydroxide	1310-58-3	15,000/410 lb	15,000/440 lb
Sulfuric acid	7664-93-9	11,000/4,640 lb	11,000/5,000 lb
Nitric acid	7697-37-2	7,810/5,150 lb	7,810/5,500 lb
Phosphoric acid	7664-38-2	3,600/1,030 lb	3,600/1,100 lb
Cyanuric acid	108-80-5	2,500/515 lb	2,500/550 lb
Hydrofluoric acid	7664-39-3	1,500/890 lb	1,500/930 lb
Industrial Gases			
Argon, compressed	7440-37-1	25,000,000/165,000 ft^3	25,000,000/180,000 ft^3
Helium	7440-59-7	5,000,000/310,000 ft^3	5,000,000/330,000 ft^3
Hydrogen, compressed	1333-74-0	1,500,000/52,000 ft^3	1,500,000/55,000 ft^3
Nitrogen, compressed (Liquified, gaseous)	7727-37-9	500,000/133,000 ft^3	500,000/150,000 ft^3
Carbon dioxide	124-38-9	176,000/128,000 ft^3	176,000/136,000 ft^3
Refrigerants			
Freon 113 (1,1,2-Trichloro-1,2,2-trifluoroethane)	76-13-1	170,000/16,500 lb	170,000/18,000 lb
Refrigerant, 123 SUVA, (2,2-Dichloro-1,1,1-trifluoroethane)	306-83-2	35,000/1,550 lb	35,000/1,700 lb
Freon 22 (Chlorodifluoromethane)	75-45-6	9,000/5,150 lb	9,000/5,500 lb
Freon 11 (Trichlorofluoromethane)	75-69-4	10,000/5,150 lb	10,000/5,500 lb
Freon 12 (Dichlorodifluoromethane)	75-71-8	6,300/4,120 lb	6,300/4,400 lb
Freon 14 (Tetrafluoromethane)	75-73-0	2,000/515 ft^3	2,000/550 ft^3

Source: LLNL 2002m.
Note: numbers are rounded. Additional chemicals are listed in Appendix B.
ft^3 = cubic feet; gal = gallons; lbs = pounds; NA = not available.

TABLE 5.3.13.2–1.—*Routine and Nonroutine Operations Waste Generation Quantities Under the Proposed Action and No Action Alternative*

	Annual Quantities			
	No Action [a]		Proposed Action [b]	
Waste Type	**Routine**	**Nonroutine**	**Routine**	**Nonroutine**
LLW	200 m^3/yr	630 m^3/yr	330 m^3/yr	710 m^3/yr
MLLW	61 m^3/yr	72 m^3/yr	88 m^3/yr	81 m^3/yr
Total Hazardous[c]	390 metric tons	1,500 metric tons	510 metric tons	1,700 metric tons
TRU	50 m^3/yr	55 m^3/yr	50 m^3/yr	60 m^3/yr
Mixed TRU	1.7 m^3/yr	0	2.8 m^3/yr	0
Sanitary solid	4,800 metric tons	Included in Routine	5,100 metric tons	Included in Routine
Wastewater	310,000 gal/day	Included in Routine	330,000 gal/day	Included in Routine

Source: TtNUS 2003.

[a] For nonroutine wastes based on average quantities since 1992 and one standard deviation, expected increase in activity levels, and new operations contributions. No margin was added for nonroutine.

[b] Based on average quantities since 1992 and one standard deviation, expected increase in activity levels (approximately 5 percent), and new operations contributions.

[c] Total Hazardous includes RCRA hazardous, State-Regulated, and TSCA.

gal/day = gallons per day; m^3/yr = cubic meters per year; LLW = low-level waste; MLLW = mixed low-level waste; RCRA = *Resource Conservation and Recovery Act*; TRU = transuranic; TSCA = *Toxic Substance Control Act*.

TABLE 5.3.13.2–2.—*Planned Projects Under the Proposed Action and Associated Waste Projections*

Project Title	Project Description[a]	Expected Waste Streams and Quantities
D&D Building 194 line of flight tube	D&D project	No changes to routine waste generation. Several tons of debris would be disposed. Building is part of 820,000 ft^2 of excess properties to be removed. Potential for nonroutine TSCA waste.
D&D Building 808	D&D project	No changes to routine waste generation. Assuming 1,500 ft^2 removed, 9 tons of debris would be generated. Building is part of 820,000 ft^2 of excess properties to be removed. Potential for nonroutine TSCA waste. It is estimated that only 0.350 metric tons per 1,000 ft^2 would be hazardous. Much of the total debris would be diverted, recycled, or reclaimed (67% would be diverted).
D&D Building 412	D&D project	No changes to routine waste generation. Assuming 29,000 ft^2 removed, 190 tons of debris would be generated. Building is part of 820,000 ft^2 of excess properties to be removed. Potential for nonroutine TSCA waste. It is estimated that only 0.350 metric tons per 1,000 ft^2 would be hazardous. Much of the total debris would be diverted, recycled, or reclaimed (67% would be diverted).
D&D Building 175 North Section	D&D project	No changes to routine waste generation. Assuming 16,000 ft^2 removed, 100 tons of debris would be generated. Building is part of 820,000 ft^2 of excess properties to be removed. Potential for nonroutine TSCA waste. It is estimated that only 0.350 metric tons per 1,000 ft^2 would be LLW, mixed waste, or hazardous. Much of the total debris would be diverted, recycled, or reclaimed (67% would be diverted).
D&D Building 212 ITC Accelerator Building	D&D project	No changes to routine waste generation. Assuming 60,000 ft^2 removed, 360 tons of debris would be generated. Building is part of 820,000 ft^2 of excess properties to be removed. Potential for nonroutine TSCA waste. It is estimated that only 0.350 metric tons per 1,000 ft^2 would be LLW, mixed waste, or hazardous. Much of the total debris would be diverted, recycled, or reclaimed (67% would be diverted).

TABLE 5.3.13.2–2.—*Planned Projects Under the Proposed Action and Associated Waste Projections (continued)*

Project Title	Project Description[a]	Expected Waste Streams and Quantities
D&D Building 251	EPD heavy element handling facility.	No changes to routine waste generation. Assuming 32,000 ft^2 removed, 190 tons of debris would be generated. Building is part of 820,000 ft^2 of excess properties to be removed. Potential for nonroutine TSCA waste. It is estimated that only 0.350 metric tons per 1,000 ft^2 would be LLW, mixed waste, or hazardous. Much of the total debris would be diverted, recycled, or reclaimed (67% would be diverted).
D&D Building 419	EPD materials handling and processing facility.	No changes to routine waste generation. Assuming 8,000 ft^2 removed, 48 tons of debris would be generated. Building is part of 820,000 ft^2 of excess properties to be removed. Potential for nonroutine TSCA waste. It is estimated that only 0.350 metric tons per 1,000 ft^2 would be LLW, mixed waste, or hazardous. Much of the total debris would be diverted, recycled, or reclaimed (67% would be diverted).
D&D Building 171	Storage building.	No changes to routine waste generation. Assuming 9,000 ft^2 removed, 54 tons of debris would be generated. Building is part of 820,000 ft^2 of excess properties to be removed. Potential for nonroutine TSCA waste. It is estimated that only 0.350 metric tons per 1,000 ft^2 would be LLW, mixed waste, or hazardous. Much of the total debris would be diverted, recycled, or reclaimed (67% would be diverted).
Increased administrative limit for plutonium in Superblock	Increase to 1,400 kg fuel-grade Pu, 500 kg enriched uranium, and 3,000 kg depleted and natural uranium.	No changes to routine waste generation.
Energetic Materials Processing Center	Consolidates some existing high explosives operations into modern facility.	Due to modernization and consolidation, routine waste generation would be expected to decrease. Construction wastes would be expected, approximately 2 tons per 1,000 ft^2.
Increased Tritium Facility material limits	Increase MAR to 30 grams tritium and tritium limits to 35 grams.	New operation would be expected to generate: Hazardous: No change LLW: 4 m^3/yr TRU: 0 Municipal Solid Waste: No change D&D work: approximately 2 tons per 1,000 ft^2, 20-40 m^3 LLW

TABLE 5.3.13.2–2.—*Planned Projects Under the Proposed Action and Associated Waste Projections (continued)*

Project Title	Project Description[a]	Expected Waste Streams and Quantities
Increased MAR limit for Plutonium Facility	Increase from 20 kg to 40 kg fuel-grade equivalent plutonium in each of two rooms.	No change to routine waste generation.
Materials Science Modernization Project	Research complex to conduct NNSA program precision fabrication and materials experiments.	Due to modernization and consolidation, routine waste generation would be expected to decrease. Construction wastes would be expected, approximately 2 tons per 1,000 ft^2.
High Explosives Development Center	Replace and modernize chemistry and materials science facilities.	Due to modernization and consolidation, routine waste generation would be expected to decrease. Construction wastes would be expected, approximately 2 tons per 1,000 ft^2.
Berkeley Waste Drums	Transport LBNL mixed TRU waste drums to LLNL for shipment to WIPP.	No changes to routine waste generation.
Projected Increase in Worker Population	Approximately 10 percent increase in workforce across LLNL.	10 percent increase across all categories.
Building Utilities Upgrade	Upgrades to building utilities systems for technological or maintenance reasons.	Construction wastes would be expected, approximately 2 tons per 1,000 ft^2.
Building Seismic Upgrades	Upgrades for buildings seismic deficiencies.	Construction wastes would be expected, approximately 2 tons per 1,000 ft^2.
CBNP Expansion	New technologies for Chemical and Biological Nonproliferation Program.	Very low volumes of chloroform, formaldehyde and biological waste.
Petawatt Laser Prototype	Develop petawatt capability in Building 381.	New operation would be expected to generate. Hazardous: several metric tons per year LLW: 0 TRU: 0 Municipal Solid Waste: several metric tons per year Construction: approximately 2 tons per 1,000 ft^2

TABLE 5.3.13.2–2.—*Planned Projects Under the Proposed Action and Associated Waste Projections (continued)*

Project Title	Project Description[a]	Expected Waste Streams and Quantities
NIF Materials	NNSA proposed experiments with materials.	New operation would be expected to generate: Hazardous: 15 metric tons per year LLW: 191.6 m^3/yr MLLW: 6.9 m^3 per year TRU: none Municipal Solid Waste: several metric tons per year Construction: approximately 2 tons per 1,000 ft^2
NIF Neutron Spectrometer	Add neutron spectrometer to the NIF.	New operation would be expected to generate: Hazardous: none Municipal Solid Waste: (included in site-wide quantities) Construction: approximately 2 tons/1,000 ft^2
Consolidated Security Facility	50K gross square feet facility to house Security Department support staff; currently collocated.	No changes to routine waste generation. Consolidation of existing operations. Construction wastes would be expected, approximately 2 tons per 1,000 ft^2.
Building 696R Mixed Waste Permit	Permit modification to authorize managing hazardous and mixed waste in Building 696 (currently manages TRU wastes only). Replaces capability of Building 280.	No changes to routine waste generation. Consolidation of existing operations.

Source: TtNUS 2003.
[a] Detailed project descriptions are provided in Appendix A.
CBNP = Chemical and Biological National Security; D&D = decontamination and decommissioning; EPD = Envrionmental Protection Department; ft^2 = square foot/feet; K = thousand; kg = kilograms; LBNL = Lawrence Berkley National Laboratory; LLW = low-level waste; LLNL = Lawrence Livermore National Laboratory; m^3/yr = cubic meters per year; MAR = material-at-risk; MLLW = mixed low-level waste; NIF = National Ignition Facility; PSA = project specific analysis; TRU = transuranic; TSCA = *Toxic Control Substance Act*; WIPP = Waste Isolation Pilot Plant.

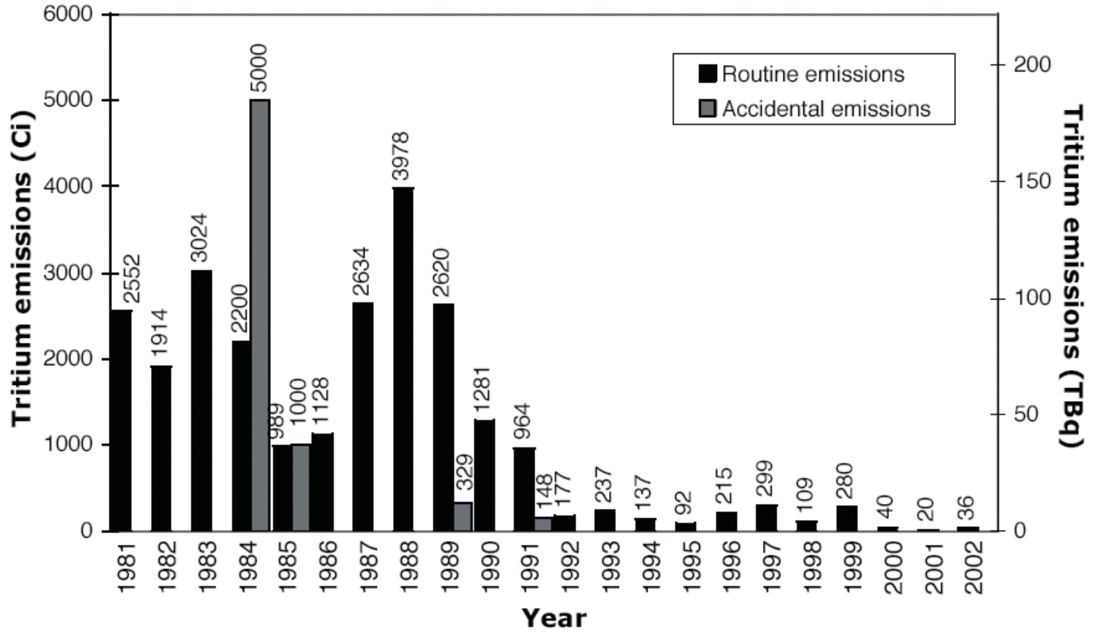
TABLE C.4.1–3.—*Monthly Average Concentrations for Regulated Metals in Lawrence Livermore National Laboratory Sanitary Sewer Effluent (milligrams per liter), 2002*

Month	Ag	As	Cd	Cr	Cu	Hg	Ni	Pb	Zn
Jan	<0.010	0.0029	<0.0050	0.015	0.14	0.00045	0.0057	0.016	0.39
Feb	0.017	0.0042	<0.0050	0.019	0.13	0.00041	0.0063	0.014	0.29
Mar	0.011	0.0022	<0.0050	0.011	0.12	0.00025	0.0051	0.012	0.27
Apr	0.011	0.0027	<0.0050	0.012	0.15	0.00033	<0.0050	0.013	0.30
May	0.012	0.0030	<0.0050	0.016	0.15	0.00027	0.0051	0.024	0.28
Jun	<0.010	0.021	<0.0050	0.020	0.22	<0.00028	0.0058	0.026	0.39
Jul	<0.010	0.0076	<0.0050	0.040	0.24	0.00026	0.0084	0.026	0.41
Aug	0.014	0.0082	<0.0050	0.11	0.24	0.00034	0.0085	0.045	0.045
Sep	0.013	0.0058	<0.0050	0.021	0.20	0.00042	0.0083	0.020	0.38
Oct	0.022	0.0040	<0.0050	0.021	0.19	0.00060	0.0095	0.033	0.38
Nov	0.019	0.0034	<0.0050	0.017	0.18	0.00036	0.0079	0.062	0.42
Dec	0.011	0.0035	<0.0050	0.015	0.11	0.00034	0.0077	0.015	0.34
Median	0.012	0.0038	<0.0050	0.018	0.17	0.00034	0.0070	0.022	0.38
IQR	0.0039	0.0033	—[a]	0.0058	0.063	0.00013	0.0027	0.0027	0.013
EPL	0.20	0.06	0.14	0.62	1.0	0.01	0.61	0.20	3.00
Median fraction EPL	<0.06	0.06	<0.04	0.03	0.15	0.03	0.01	0.10	0.12

Source: LLNL 2003l.
Note: Monthly values are presented with less-than signs (<) when all weekly composite sample results for the month are below the detectable concentration.
[a] Because of the large number of nondetects, the interquartile range cannot be calculated for these metals.
Ag = silver; As = arsenic; Cd = cadmium; Cr = chromium; Cu = copper; EPL = effluent pollutant limit (LLNL Wastewater Discharge Permit 2000-2001 and 2001-2002); Hg = mercury; IQR = Interquartile range; Ni = nickel; Pb = lead; Zn = zinc.

TABLE C.4.1–4.—*Monthly Results for Physical and Chemical Characteristics of the Lawrence Livermore National Laboratory Sanitary Sewer Effluent, 2002*[a]

	Detection Frequency [b]	Minimum	Maximum	Median	IQR
24-Hour Composite Sample Parameter (mg/L)					
Alkalinity (mg/L)					
Bicarbonate alkalinity (as $CaCO_3$)	12 of 12	175	300	250	24.0
Carbonate alkalinity (as $CaCO_3$)	2 of 12	<5	55.0	<5	[c]
Total alkalinity (as $CaCO_3$)	12 of 12	230	300	250	22.5
Anions (mg/L)					
Bromide	10 of 12	<0.1	1.1	0.25	[c]
Chloride	12 of 12	41	114	61	28
Fluoride	10 of 12	<0.05	2.3	0.11	[c]
Nitrate (as N)	1 of 12	<0.1	<1	<0.44	[c]
Nitrate (as NO_3)	1 of 12	<0.04	<4.4	<4.4	[c]
Nitrate plus Nitrite (as N)	2 of 12	<0.1	<1	<1	[c]
Nitrite (as N)	8 of 12	<0.02	0.33	0.19	[c]
Nitrite (as NO_2)	8 of 12	<0.065	1.1	0.63	4.3
Orthophosphate	12 of 12	15	23	20	2.3
Sulfate	12 of 12	12	19	15	
Nutrients (mg/L)					
Ammonia nitrogen (as N)	12 of 12	43	56	47	5.0
Total Kjeldahl nitrogen	12 of 12	49	95	60	11
Total phosphorus (as P)	12 of 12	6.8	14	9.8	2.6
Oxygen demand (mg/L)					
Biochemical oxygen demand	12 of 12	100	810	333	107
Chemical oxygen demand	12 of 12	145	1,780	602	121
Solids (mg/L)					
Settleable solids	12 of 12	4	90	40	11.3
Total dissolved solids	12 of 12	165	413	256	78.5
Total suspended solids	12 of 12	88	650	385	138
Volatile solids	12 of 12	140	913	480	142
Total metals (mg/L)					
Aluminum	12 of 12	0.30	0.80	0.49	0.16
Calcium	12 of 12	15	27	18	2.3
Iron	12 of 12	1.0	2.5	1.6	0.30
Magnesium	12 of 12	2.5	3.0	2.8	0.15
Potassium	12 of 12	19	26	22	2.0
Selenium	2 of 12	<0.002	<0.02	<0.002	[c]
Sodium	12 of 12	35	87	47	15
Total organic carbon	12 of 12	39	56	53	6.3
Tributyltin[d]	1 of 2	<6	10	[e]	[c]



Source: LLNL 2003z.

FIGURE C.4.2.2–1.—*Recent Tritium Emissions From the Tritium Facility, 1981 – 2002*

TABLE C.4.2.2–1.—*Curies of Important Radionuclides Released From Lawrence Livermore National Laboratory*

Site and Type of Radioactive Airborne Effluent Released	Curies Released Annually: No Action Alternative	Curies Released Annually: Proposed Action	Curies Released Annually: Reduced Operation Alternative
Livermore Site			
Tritium			
Building 612 yard	2	2	2
Building 331 stacks	210	210	210
Outside Building 331 (contaminated equipment awaiting storage)	1	1	1
Site 300			
Tritium	194	194	145
Uranium-234	0.0058	0.0058	0.0058
Uranium-235	0.00080	0.00080	0.0008
Uranium-238	0.062	0.062	0.062

TABLE E.1.2.2–5.—*Small Mammal Trapping Results at Site 300 in 2002*

	Vegetative Community and Trapping Period									
	Nonwetland								Seep/Spring Wetland	
	Annual Grassland		Native Grassland		Oak Savannah	Riparian	Coastal Scrub	Grid 1 & Trapline 1	Seep Channel Trapline	Seep Channel Trapline
Species	**6/20-6/22**	**4/17-4/19**	**Post-burn 6/20-6/22**	**Post-burn 7/30-8/1**	**6/20-6/22**	**5/14-5/16**	**5/14-5/16**	**5/17-5/19**	**Post-burn 6/20-6/22**	**Post-burn 7/30-8/1**
Valley pocket gopher		1				1				
California pocket mouse							1			
San Joaquin pocket mouse	2				3					
Heerman's kangaroo rat	4						22			
Western harvest mouse	13					7			4	6
Deer mouse	8	1	4	4	1	7	10	3	3	7
Brush mouse		2				32	10	11		
California vole	1			2		4				
Dusky-footed woodrat						13	20	3		1
House mouse						1				
No. species captured	5	3	1	2	2	7	5	3	2	3
Total captures	28	4	4	6	4	65	63	17	7	14
No. trap-nights	300	300	4	300	300	300	300	300	39	150
Captures/100 trap-nights	9.33	1.33	1.33	2.00	1.33	21.67	21.00	5.67	4.67	9.33

Source: Jones and Stokes 2002b.

TABLE E.2–1.—*Federally and State-Listed Threatened, Endangered, and Other Special Status Plant and Animal Species with Potential to Occur at the Livermore Site and Site 300 in 2001 and 2002*

		Site		Status	
Common Name	**Scientific Name**	**Livermore Site**	**Site 300**	**Federal Status Code**	**State Status Code**
		Plants			
Big tarplant	*Blepharizonia plumosa*	-	X	-	CNPS List 1 B
Hogwallow starfish	*Hesperevax caulescens*	-	X	-	CNPS List 4
Large-flowered fiddleneck	*Amsinckia grandiflora*	-	X	FE (CH)	CNPS List 1 B
Round-leaved filaree	*Erodium macrophyllum*	-	X	-	CNPS List 2
Stinkbells	*Fritillaria agrestis*	-	X	-	CNPS List 4
Diamond-petaled poppy	*Eschscholzia rhombipetala*	-	X	FSC	CNPS List 1 B
Gypsum rock jasmine	*Androsace elongata* ssp. *acuta*	-	X	-	CNPS List 4
Gypsum loving larkspur	*Delphinium gypsophilum* ssp. *gypsophilum*	-	X	-	CNPS List 4
		Invertebrates			
Valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	-	X	FT	-
California linderiella fairy shrimp	*Linderiella occidentalis*	-	X	FSC	-

TABLE E.2–1.—*Federally and State-Listed Threatened, Endangered, and Other Special Status Plant and Animal Species with Potential to Occur at the Livermore Site and Site 300 in 2001 and 2002 (continued)*

		Site		Status	
Common Name	**Scientific Name**	**Livermore Site**	**Site 300**	**Federal Status Code**	**State Status Code**
		Amphibians			
California tiger salamander	*Ambystoma californiense*	-	X	FT (CH not proposed at LLNL)	CASSC
California red-legged frog	*Rana aurora draytonii*	X	X	FT (CH proposed)	CASSC
Western spadefoot toad	*Spea hammondii*	-	X	FSC	CASSC
		Reptiles			
Alameda whipsnake	*Masticophis lateralis euryxanthus*	-	X	FT (CH rescinded)	FT
California horned lizard	*Phrynosoma cornatum frontale*	-	X	FSC	CASSC
San Joaquin coachwhip (whipsnake)	*Masticophis flagellum ruddocki*	-	X	FSC	CASSC
Silvery legless lizard	*Anniella pulchra pulchra*	-	X	FSC	CASSC
		Birds			
Cooper's hawk	*Accipiter cooperii*	X	X	MBTA	CASSC
Sharp-shinned hawk	*Accipiter striatus*	-	X	MBTA	CASSC
Golden eagle	*Aquila chrysaetos*	X	X	MBTA	CASSC
Red-tailed hawk	*Buteo jamaicensis*	X	X	MBTA	-
Rough-legged hawk	*Buteo lagopus*	-	X	MBTA	-
Red-shouldered hawk	*Buteo lineatus*	X	X	MBTA	-
Ferruginous hawk	*Buteo regalis*	-	X	FSC, MBTA	CASSC
Swainson's hawk	*Buteo swainsoni*	-	X	MBTA	ST, MBTA
Northern harrier	*Circus cyaneus*	-	X	MBTA	CASSC
White-tailed kite	*Elanus leucurus*	X	X	MBTA	CASSC
Osprey	*Pandion haliaetus*	-	X	MBTA	CASSC

TABLE E.2–1.—*Federally and State-Listed Threatened, Endangered, and Other Special Status Plant and Animal Species with Potential to Occur at the Livermore Site and Site 300 in 2001 and 2002 (continued)*

		Site		Status	
Common Name	**Scientific Name**	**Livermore Site**	**Site 300**	**Federal Status Code**	**State Status Code**
		Birds			
Bushtit	*Psaltriparus minimus*	-	X	MBTA	-
Horned lark	*Eremophila alpestris*	-	X	MBTA	CASSC
Northern shoveler	*Anas clypeata*	-	X	MBTA	-
Cinnamon teal	*Anas cuamptera*	-	X	MBTA	-
Mallard	*Anas platyryynchos*	X	X	MBTA	-
Bufflehead	*Blucephala albeola*	X	X	MBTA	-
Common goldeneye	*Bucephala clangula*	-	X	MBTA	-
White-throated swift	*Aeronautes saxatalis*	-	X	MBTA	-
Great egret	*Ardea alba*	X	X	MBTA	-
Cedar waxwing	*Bombycilla garrulus*	X	X	MBTA	-
Common poorwill	*Phalaenoptilus nuttallii*	-	X	MBTA	-
Blue-grosbeak	*Guiraca caerulea*	-	X	MBTA	-
Lazuli bunting	*Passerina amoena*	-	X	MBTA	-
Turkey vulture	*Cathartes aura*	X	X	MBTA	-
Killdeer	*Charadrius vociferus*	X	X	MBTA	-
Mourning dove	*Zenaida macroura*	X	X	MBTA	-
Western scrub jay	*Aphelocoma californica*	X	X	MBTA	-
American crow	*Corvus brachyrhynchos*	X	X	MBTA	-
Common raven	*Corvus corax*	X	X	MBTA	-
Greater roadrunner	*Geococcyx californianus*	-	X	MBTA	-
Bell's sage sparrow	*Amphispiza belli*	-	X	FSC, MBTA	-
Black-throated sparrow	*Amphispiza bilineata*	-	X	MBTA	-
Rufous crowned sparrow	*Aimophila ruficeps*	-	X	MBTA	-

TABLE E.2–1.—*Federally and State-Listed Threatened, Endangered, and Other Special Status Plant and Animal Species with Potential to Occur at the Livermore Site and Site 300 in 2001 and 2002 (continued)*

		Site		Status	
Common Name	**Scientific Name**	**Livermore Site**	**Site 300**	**Federal Status Code**	**State Status Code**
		Birds			
Grasshopper sparrow	*Ammodramus savannarum*	-	X	FSC, MBTA	-
Lark sparrow	*Chondestes grammacus*	-	X	MBTA	-
California towhee	*Carpodacus mexicanus*	-	X	MBTA	-
Oregon junco	*Junco hyemalis*	X	X	MBTA	-
Lincoln's sparrow	*Melospiza lincolnii*	-	X	MBTA	-
Song sparrow	*Melospiza melodia*	X	X	MBTA	-
Fox sparrow	*Passerella iliaca*	-	X	MBTA	-
Savannah sparrow	*Passerculus sandwichensis*	-	X	MBTA	-
Golden-crowned sparrow	*Zonotrichia atricapilla*	X	X	MBTA	-
White-crowned sparrow	*Zonotrichia leucophrys*	X	X	MBTA	-
American kestrel	*Falco columbarius*	X	X	MBTA	-
Prairie falcon	*Falca mexicanus*	-	X	MBTA	CASSC
House finch	*Carpodacus mexicanus*	X	X	MBTA	-
Lesser goldfinch	*Carduelis psaltria*	X	X	MBTA	-
Cliff swallow	*Petrochelidon pyrrhonota*	X	X	MBTA	-
Northern rough winged swallow	*Stelgidopteryx serripennis*	X	X	MBTA	-
Tree swallow	*Tachycineta bicolor*	-	X	MBTA	-
Red-winged blackbird	*Agelaius phoeniceus*	X	X	MBTA	-
Tricolored blackbird	*Agelaius tricolor*	-	X	FSC, MBTA	CASSC
Brewer's blackbird	*Euphagus cyanocephalus*	X	X	MBTA	-
Bullock's oriole	*Icterus bullockii*	-	X	MBTA	-
Brown-headed cowbird	*Molothrus ater*	X	X	MBTA	-

TABLE E.2–1.—*Federally and State-Listed Threatened, Endangered, and Other Special Status Plant and Animal Species with Potential to Occur at the Livermore Site and Site 300 in 2001 and 2002 (continued)*

		Site		Status	
Common Name	**Scientific Name**	**Livermore Site**	**Site 300**	**Federal Status Code**	**State Status Code**
		Birds			
Western meadowlark	*Sturnella magna*	X	X	MBTA	-
Loggerhead shrike	*Lanius ludovicianus*	X	X	FSC, MBTA	CASSC
Northern mockingbird	*Mimus polyglottos*	X	X	MBTA	-
California thrasher	*Toxostoma redivivum*	-	X	FSC, MBTA	-
California quail	*Callipepla californica*	-	X	MBTA	-
Oak titmouse	*Baeolphus inornatuss*	-	X	FSC, MBTA	-
Yellow-rumped warbler	*Dendroica coronata*	X	X	MBTA	-
Black-throated gray warbler	*Dendroica nigrescens*	-	X	MBTA	-
Yellow warbler	*Dendroica petechia*	-	X	MBTA	CASSC
Common yellowthroat	*Geothlypis trichas*	-	X	MBTA	CASSC
MacGillivary's warbler	*Oporornis tolmiei*	-	X	MBTA	-
Orange-crowned warbler	*Vermivora bachmanii*	-	X	MBTA	-
Wilson's warbler	*Wilsonia pusila*	-	X	MBTA	-
Double-crested cormorant	*Phalacrocorax auritus*	-	X	MBTA	CASSC
Northern flicker	*Colaptes auratus*	-	X	MBTA	-
Nuttall's woodpecker	*Picoides nuttallii*	X	X	FSC, MBTA	-
Pied-billed grebe	*Podilymbus podiceps*	X	X	MBTA	-
Phainopepla	*Phainopepla nitens*	-	X	MBTA	-
Ruby-crowned kinglet	*Regulus calendula*	X	X	MBTA	-
Common snipe	*Gallinago gallinago*	X	X	MBTA	-
Greater yellowlegs	*Tringa melanoleuca*	X	X	MBTA	-
Burrowing owl	*Athene cunicularia*	X[a]	X	FSC, MBTA	CASSC
Short-eared owl	*Asio flammeus*	-	X	FSC, MBTA	CASSC

TABLE E.2–1.—*Federally and State-Listed Threatened, Endangered, and Other Special Status Plant and Animal Species with Potential to Occur at the Livermore Site and Site 300 in 2001 and 2002 (continued)*

		Site		Status	
Common Name	**Scientific Name**	**Livermore Site**	**Site 300**	**Federal Status Code**	**State Status Code**
		Birds			
Great horned owl	*Bubo virginianus*	-	X	MBTA	-
Western screech owl	*Otus kennicottii*	-	X	MBTA	-
Barn owl	*Tyto alba*	-	X	MBTA	-
Western tanager	*Piranga ludoviciana*	-	X	MBTA	-
Anna's hummingbird	*Calypte anna*	X	X	MBTA	-
Costa's hummingbird	*Calypte costae*	-	X	FSC, MBTA	-
Rufous hummingbird	*Selasphorus rufus*	X	X	FSC, MBTA	-
Rock wren	*Salpinctes obsoletus*	-	X	MBTA	-
Bewick's wren	*Thyothorus ludovicianus*	X	X	MBTA	-
House wren	*Troglodytes aedon*	-	X	MBTA	-
Hermit thrush	*Catharus guttatus*	-	X	MBTA	-
Swainson's thrush	*Catharus ustulatus*	-	X	MBTA	-
Varied thrush	*Ixoreus naevius*	-	X	MBTA	-
Mountain bluebird	*Sialia currucoides*	-	X	MBTA	-
Western bluebird	*Sialia mexicana*	-	X	MBTA	-
American robin	*Turdus migratorius*	X	X	MBTA	-
Pacific-slope flycatcher	*Empidonax difficillis*	-	X	MBTA	-
Willow flycatcher	*Empidonax traillii*	-	X	MBTA	SE
Ash-throated flycatcher	*Myiarchus cinerascens*	-	X	MBTA	-
Black phoebe	*Sayornis nigricans*	-	X	MBTA	-
Say's phoebe	*Sayornis saya*	X	X	MBTA	-
Western kingbird	*Tyrannus verticalis*	-	X	MBTA	-
Cassin's kingbird	*Tyrannus vociferans*	-	X	MBTA	-

TABLE E.2–1.—*Federally and State-Listed Threatened, Endangered, and Other Special Status Plant and Animal Species with Potential to Occur at the Livermore Site and Site 300 in 2001 and 2002 (continued)*

		Site		Status	
Common Name	**Scientific Name**	**Livermore Site**	**Site 300**	**Federal Status Code**	**State Status Code**
		Mammals			
Pallid bat	*Antrozous pallidus*	-	X		CASSC
Long-legged myotis	*Myotis volans*	-	X	FSC	-
Yuma myotis	*Myotis yumaensis*	-	X	FSC	-
San Joaquin pocket mouse	*Perognathus inornatus inornatus*	-	X	FSC	-
San Joaquin kit fox [b]	*Vulpes macrotis mutica*	-	X	FE	ST

Sources: Jones and Stokes 2001, CDFG 2002a, CDFG 2002b, LLNL 2003ab, LLNL 2003by, LLNL 2003ac.
[a] The burrowing owl was observed at the Livermore Site prior to 1998.
[b]Although the San Joaquin kit fox has not been observed in surveys from 1986 to the present, monitoring efforts continue to watch for the presence of this species onsite, due to confirmed sighting near Site 300.
X = Indicates the presence of a species at the Livermore Site or Site 300.
- = Indicates the absence of a species at the Livermore Site or Site 300.
FE = Federal-listed endangered (any species which is in danger of extinction throughout all or a significant portion of its range).
FT = Federal-listed threatened (any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range).
FPT = Federal-listed proposed threatened (a proposal to list a species as likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range pending release of a final rule).
CH = Critical habitat (the USFWS may establish critical habitat for threatened or endangered species consisting of a geographic area determined essential for the conservation of the species).
FSC = Federal species of concern for Alameda and San Joaquin Counties. May be endangered or threatened. Not enough biological information has been gathered to support listing at this time (U.S. Fish and Wildlife Service 1-1-03-SP-0162).
CASSC = California species of special concern.
SE = State-listed endangered.
ST = State-listed threatened.
MBTA = *Migratory Bird Treaty Act.*
CNPS List 1A = Plants presumed extinct in California.
CNPS List 1B = Plants rare, threatened, or endangered in California and elsewhere.
CNPS List 2 = Plants rare, threatened, or endangered in California, but more common elsewhere.
CNPS List 3 = Plants about which we need more information – a review list.
CNPS List 4 = Plants of limited distribution – a watch list.

TABLE M.3.4–1.—*Comparison of Potential Environmental Consequences of the No Action Alternative, Proposed Action, and Reduced Operation Alternative*

SSM PEIS[a]	No Action Alternative	Proposed Action	Reduced Operation Alternative
Land Use and Applicable Plans			
Determined land use for the NIF site.	Land use consistent with LLNL uses	No change to land use around NIF or LLNL	No change to land use around NIF or LLNL
Socioeconomics and Environmental Justice			
<u>Socioeconomics</u>			
330 long-term employees	400 total long-term employees 180 direct employees 220 support personnel	426 total long-term employees 186 direct employees 240 support personnel	367 total long-term employees 172 direct employees 195 support personnel
All new hires	Almost all already employed ~20 new hires	Almost all already employed ~46 new hires	All already employed reduction of 13 employees
	No construction employment	20 temporary construction jobs	No construction employment
No strain on local housing	No impact to local housing	No change to local housing	No change to local housing
One additional teacher One additional doctor	No impact to school or medical services	No change to school or medical services	No change to school or medical services
<u>Environmental Justice</u>			
No disproportionate impacts	No disproportionately high and adverse impacts	Same as No Action Alternative	Same as No Action Alternative
Community Services			
No change in fire or police services. Increased demand for general services	No impact in fire, emergency, police, or security services	No change in fire, emergency, police, or security services	No change in fire, emergency, police, or security services
Projected increase of 6,000 m^3/yr of nonhazardous waste. Represents a 100% increase in LLNL waste generation. (Overly conservative estimate: current site rate is 4,600 m^3/yr; NIF current rate is 380 m^3/yr.)	Most nonhazardous waste already being generated. Total of 400 m^3/yr. The increase of 20 m^3/yr would be ~0.4% of current site waste generation.	Most nonhazardous waste already being generated. Total of 426 m^3/yr. The increase of 46 m^3/yr would be ~1% of site waste generation.	Most nonhazardous waste already being generated. Total of 367 m^3/yr. The decrease of 13 m^3/yr would be ~0.3% of site waste generation.

TABLE M.3.4–1.—*Comparison of Potential Environmental Consequences of the No Action Alternative, Proposed Action, and Reduced Operation Alternative (continued)*

SSM PEIS[a]	No Action Alternative	Proposed Action	Reduced Operation Alternative
Prehistoric and Historic Cultural Resources			
No impacts projected	No impacts projected	No impacts projected	No impacts projected
Aesthetics and Scenic Resources			
Impacts related to construction activities only	No impacts projected	No impacts projected	No impacts projected
Geology			
25 acres disturbed during construction of NIF	No new disturbance	Construction of neutron spectrometer will disturb 176,000 ft^3 of previously disturbed land	No new disturbance
Ecology			
No adverse impact to biological resources from construction of operation of NIF	No adverse impact	No adverse impact	No adverse impact
Air Quality			
Criteria Air Pollutants	% of LLNL		
PM_{10} 0.16 t/yr	PM_{10} 0.0042 t/yr 0.19	Same as No Action Alternative	Same as No Action Alternative
VOC 0.56 t/yr	VOC 1.18 t/yr 15		
CO 0.43 t/yr	CO 0.094 t/yr 1.7		
NO_x 1.79 t/yr	NO_x 0.076 t/yr 0.35		
SO_2 0.03 t/yr	SO_2 0.0017 t/yr 0.68		
Pb Negligible	Pb Negligible		
Hazardous/Toxic Air Pollutants			
No impacts from hazardous chemicals should occur because only minute quantities of hazardous VOCs are expected to be emitted.	Beryllium emissions below Toxic Air Contaminant threshold. No impacts from other hazardous/toxic air emissions	Greater beryllium emissions. Still below Toxic Air Contaminant threshold. No impacts from other hazardous/toxic air emissions	Beryllium emissions below Toxic Air Contaminant threshold. No impacts from other hazardous/toxic air emissions

TABLE M.3.4–1.—*Comparison of Potential Environmental Consequences of the No Action Alternative, Proposed Action, and Reduced Operation Alternative (continued)*

SSM PEIS[a]			No Action Alternative		Proposed Action		Reduced Operation Alternative	
Air Quality (continued)								
Radiological Air Pollutants								
Receptor	**Annual Dose**	**Annual LCF Risk**	**Annual Dose**	**Annual LCF Risk**	**Annual Dose**	**Annual LCF Risk**	**Annual Dose**	**Annual LCF Risk**
MEI	0.1 mrem	6.0×10^{-8}	0.04 mrem	2.4×10^{-8}	0.07 mrem	4.2×10^{-8}	0.03 mrem	1.8×10^{-8}
Population	0.2 person-rem	1.2×10^{-4}	0.26 person-rem	1.6×10^{-4}	0.29 person-rem	1.7×10^{-4}	0.24 person-rem	1.4×10^{-4}

SSM PEIS[a]	No Action Alternative	Proposed Action	Reduced Operation Alternative
Water			
Impacts would be minimal.	Impacts would be minimal.	Impacts would be minimal. Construction of neutron spectrometer would not contaminate groundwater.	Impacts would be minimal.
Noise			
Noise from construction up to 69 dBA to offsite receptor	Noise equivalent to light industrial facility, ~85 dB	Noise equivalent to light industrial facility, ~85 dB Temporary noise during construction of neutron spectrometer	Noise equivalent to light industrial facility, ~85 dB
Traffic and Transportation			
Traffic			
902 new trips daily on local roads from construction and operations employment	Most of employment in place. Less than 0.3 % increase in local traffic	Most of employment in place. Less than 0.4 % increase in local traffic	Slight reduction in current employment. Less than 0.3 % decrease in local traffic
Transportation			
No impacts expected from routine transportation of tritium targets. No detectable levels of radiation outside of transport packages.	No radiation dose to drivers or public from routine transportation	No radiation dose to drivers or public from routine transportation Use of disposable inner containment vessel increases LLW shipments to NTS	No radiation dose to drivers or public from routine transportation
Onsite transportation risks from tritium targets were assumed to be negligible compared to risks from offsite transportation.	No impact from onsite transportation	No impacts from onsite transportation, including movement of inner containment vessel	No impact from onsite transportation

TABLE M.3.4–1.—*Comparison of Potential Environmental Consequences of the No Action Alternative, Proposed Action, and Reduced Operation Alternative (continued)*

SSM PEIS[a]	No Action Alternative	Proposed Action	Reduced Operation Alternative
Utilities and Energy			
Water Use			
152 million L/yr	27.6 million L/yr 3.5% increase in LLNL usage	27.6 million L/yr	Slightly less than 27.6 million L/yr
Energy			
122,640 MWh/yr	131,400 MWh/yr 42% increase in LLNL usage	131,400 MWh/yr	131,400 MWh/yr
Sewer			
18 million L/yr	13.2 million L/yr 5.2% increase in LLNL usage	13.2 million L/yr	Slightly less than 13.2 million L/yr
Natural Gas			
2.03×10^5 therms/yr	2.03×10^5 therms/yr 2.6% increase in LLNL usage	2.03×10^5 therms/yr	Slightly less than 2.03×10^5 therms/yr
Materials and Waste Management			
Materials Management			
Would involve use of radioactive, hazardous, toxic materials including deuterium, tritium, mercury, cleaning fluids, and caustic chemicals.	Would involve use of radioactive, hazardous, toxic materials including tritium, depleted uranium, activated particulates, beryllium, mercury, cleaning fluids, and caustic chemicals.	Would involve use of radioactive, hazardous, toxic materials including tritium, depleted uranium, activated particulates, beryllium, mercury, cleaning fluids, and caustic chemicals. Additional materials would include plutonium, HEU, lithium hydride, and greater amounts of beryllium. Polyvinyl toluene and lead would be used in the neutron spectrometer.	Would involve use of radioactive, hazardous, toxic materials including tritium, depleted uranium, activated particulates, beryllium, mercury, cleaning fluids, and caustic chemicals.

Waste Management (quantities in m^3)

SSM PEIS LLW solid (liquid)	SSM PEIS Mixed solid (liquid)	SSM PEIS Hazardous solid (liquid)	No Action LLW solid (liquid)	No Action Mixed solid (liquid)	No Action Hazardous solid (liquid)	Proposed LLW solid (liquid)	Proposed Mixed solid (liquid)	Proposed Hazardous solid (liquid)	Reduced LLW solid (liquid)	Reduced Mixed Solid (liquid)	Reduced Hazardous solid (liquid)
6.65 (1.6)	0.9 (5.0)	8.0 (4.6)	70 (1.6)	1.8 (5.1)	8.5 (6.3)	190 (1.6)	1.8 (5.1)	8.5 (6.3)	49 (0.95)	1.6 (3.5)	8.5 (6.3)

TABLE M.3.4–1.—*Comparison of Potential Environmental Consequences of the No Action Alternative, Proposed Action, and Reduced Operation Alternative (continued)*

SSM PEIS[a]	No Action Alternative	Proposed Action	Reduced Operation Alternative
Accidents			
For the bounding radiological accident **Median Meteorology** • Noninvolved worker population not calculated • 0.6 latent cancer fatalities to the offsite population **Unfavorable Meteorology** • Not calculated.	For the bounding radiological accident **Median Meteorology** • 0.00013 latent cancer fatalities to the noninvolved worker population • 0.00012 latent cancer fatalities to the offsite population **Unfavorable Meteorology** • 0.0013 latent cancer fatalities to the noninvolved worker population • 0.0018 latent cancer fatalities to the offsite population	For the bounding radiological accident **Median Meteorology** • 0.00045 latent cancer fatalities to the noninvolved worker population • 0.00033 latent cancer fatalities to the offsite population **Unfavorable Meteorology** • 0.005 latent cancer fatalities to the noninvolved worker population • 0.005 latent cancer fatalities to the offsite population	Same as the No Action Alternative.

Occupational Protection

Radiological Exposure

	SSM PEIS[a]		No Action Alternative		Proposed Action		Reduced Operation Alternative	
Receptor	**Annual Dose**	**Annual LCF Risk**	**Annual Dose**	**Annual LCF Risk**	**Annual Dose**	**Annual LCF Risk**	**Annual Dose**	**Annual LCF Risk**
Involved worker(s)	<10 person-rem	6.0×10^{-3}	<15 person-rem	0 cancers in population (calculated risk = 9×10^{-3})	<19 person-rem	0 cancers in population (calculated value = 1.1×10^{-2})	<10 person-rem	0 cancers in population (calculated risk = 6×10^{-3})
Noninvolved worker(s)	0.2 person-rem	1.2×10^{-4}	1 mrem/yr	6×10^{-7}	1 mrem/yr	6×10^{-7}	1 mrem/yr	6×10^{-7}
Public MEI	0.1 mrem	6.0×10^{-8}	0.24 mrem	1.4×10^{-7}	0.27 mrem	1.6×10^{-7}	0.16 mrem	9.6×10^{-8}
Population Dose	0.2 person-rem	1.2×10^{-4}	0.26 person-rem	1.6×10^{-4}	0.29 person-rem	1.7×10^{-4}	0.24 person-rem	1.4×10^{-4}

TABLE M.3.4–1.—*Comparison of Potential Environmental Consequences of the No Action Alternative, Proposed Action, and Reduced Operation Alternative (continued)*

SSM PEIS[a]	No Action Alternative	Proposed Action	Reduced Operation Alternative
Nonradiological Exposure			
Hazards in the NIF for workers would include chemicals, electrical shock, and industrial accidents.	Hazards in the NIF for workers would include chemicals, beryllium exposure, electrical shock, and industrial accidents.	Hazards in the NIF for workers would include chemicals, beryllium exposure, electrical shock, and industrial accidents.	Hazards in the NIF for workers would include chemicals, beryllium exposure, electrical shock, and industrial accidents.

Source: Original.

[a] DOE 1996b

CO = carbon monoxide; dBA = decibels, A-weighted; ft^3 = cubic feet; HEU = highly enriched uranium; L = liter; LCF= latent cancer fatality; LLNL = Lawrence Livermore National Laboratory; LLW = low-level waste; m^3 = cubic meters; MEI = maximally exposed individuals; mrem – millirem; MWh = megawatt hours; NIF – National Ignition Facility; NO_x = nitrogen oxidizes; Pb = lead; PM_{10} = particulate matter less than10 microns in diameter; SO_2 = sulfur dioxide; SSM PEIS = Stockpile Stewardship Management Programmatic Environmental Impact Statement; t = ton(s); VOC = volatile organic compound; yr = year.

TABLE M.5.2.13.2–2.— *National Ignition Facility Estimated Important Chemical Inventories*

Chemical	Source	Quantity	Exposure Criteria[a]
Acetone	Cleaners, etc.	210 L (165 kg) + OAB 13 L (10 kg)	500 mg/m^3 (ACGIH)
Alcohol, ethyl (ethanol)	Cleaners, etc.	276 L (258 kg) + OAB 10.7 L (10 kg)	1,000 mg/m^3 (ACGIH)
Alcohol, isopropyl	Cleaners, etc.	20.5 L (16.2 kg) + OAB 25.3 L (20 kg) 10 kg (wipes)	400 mg/m^3 (ACGIH)
Argon	Beam tubes	10,100 kg	—
Castor oil (ricinus oil)	Dielectric fluid in capacitors	227,000 L	—
Chloroform	Cleaners, etc.	0.5 L (0.7 kg)	10 mg/m^3 (ACGIH)
Decontamination Acid Bath Nitric acid + phosphoric acid (1 M each)	First wall decontamination	8000 L (10624 kg), 2520 kg as HNO_3, 3920 kg as H_3PO_4	5.2 mg/m^3 HNO_3 (ACGIH) 1 mg/m^3 H_3PO_4 (ACGIH)
Ethylene glycol	PAM coolant	170 kg	127 mg/m^3 (ACGIH)
Mercury, metallic	192 PAM switches	3.5 L[b] (47 kg)	0.025 mg/m^3 (ACGIH)
Methylene chloride	Cleaners, etc.	1 L (1.32 kg)	174 mg/m^3 (ACGIH)
Nitric acid (70% solution)	Supply on hand for replenishing decontamination solution	400 L (540 kg), 420 kg as HNO_3	5.2 mg/m^3 (ACGIH)
Nitrogen	Cleaning propellant, dry box purging, beam tubes, amplifier cooling, cryogen	96,000 kg	—
Phosphoric acid (87% solution)	Supply on hand for replenishing decontamination solution	400 L (691 kg), 639 kg as H_3PO_4	1 mg/m^3 (ACGIH)
Sodium hydroxide (1 M)	Decontamination (caustic bath)	8000 L (8320 kg), 1600 kg as NaOH	2 mg/m^3 (ACGIH)
Sodium hydroxide (50% solution)	Supply on hand for replenishing decontamination solution	400 L (612 kg), 306 kg as NaOH	2 mg/m^3 (ACGIH)
Toluene	Cleaners, etc.	18 L (16 kg)	375 mg/m^3 (NIOSH)
Xylene	Cleaners, etc.	18 L (16 kg)	435 mg/m^3 (NIOSH)

Source: LLNL 2003d.
[a] All criteria are 8-hour time weighted averages, unless otherwise stated.
[b] Single ignitron inventories are approximately 14 pounds (0.125 gallons).
ACGIH = American Conference of Governmental Industrial Hygienists; H_3PO_4 = phosphoric acid; HNO_3 = nitric acid; kg = kilogram; L = liter; M = molar; NaOH = sodium hydroxide; NIOSH = National Institute of Occupational Safety and Health; OAB = optics assembly building; PAM = preamplified module.

TABLE M.5.3.8.4–1.—*Annual Routine Radioactive Airborne Emissions under the Proposed Action (Fission Products)*

Nuclide	Annual Amount Available for Release (Ci/1,200 MJ) [b]	Annual Air Effluents Via Charcoal Filter[a] (Ci/1,200 MJ)
Krypton-83m	1.1×10^{-13}	1.1×10^{-13}
Krypton-85	3.5×10^{-4}	3.5×10^{-4}
Krypton-85m	2.9×10^{-7}	2.9×10^{-7}
Krypton-87	0	0
Krypton-88	2.3×10^{-11}	2.3×10^{-11}
Krypton-89	0	0
Iodine-131	1.9	9.3×10^{-1}
Iodine-132	3.9	1.9×10^{-1}
Iodine-132m	0	0
Iodine-133	1.1	5.6×10^{-2}
Iodine-133m	0	0
Iodine-134	0	0
Iodine-134m	0	0
Iodine-135	6.1×10^{-4}	2.8×10^{-5}
Iodine-136	0	0
Xenon-131	6.1×10^{-3}	6.1×10^{-3}
Xenon-133	5.9	5.9
Xenon-133m	2.1×10^{-1}	2.1×10^{-1}
Xenon-134m	0	0
Xenon-135	4.5×10^{-2}	4.5×10^{-2}
Xenon-135m	9.0×10^{-5}	9.0×10^{-5}
Xenon-137	0	0
Total	1.3×10^{1}	7.3

Source: LLNL 2003d.
[a] The effluents from the cryopumps during regeneration and from the target chamber when bringing to air would be passed through 2-inch-thick charcoal filters to remove iodines, with 99 percent being collected by charcoal bed. Here, only 95 percent is assumed removed for conservatism.
[b] 1.2 gram uranium-235/target: 2×10^{16} Fissions per 20 MJ experiment, 60 experiments per year.
Ci = curies; MJ=megajoules.

TABLE M.5.3.8.4–2.—*Radiological Impacts to the General Public from Airborne Effluent Emissions during Normal Operations (Proposed Action)*

Receptor	Proposed Action		No Action Alternative	
	Dose	Latent Cancer Fatality Risk	Dose	Latent Cancer Fatality Risk
NIF Offsite MEI	0.07 mrem/yr	4.2×10^{-8} /yr of exposure	0.04 mrem/yr	2.4×10^{-8} /yr of exposure
Population Dose	0.29 person-rem/yr	1.7×10^{-4}	0.26 person-rem/yr	1.6×10^{-4}

Source: LLNL 2003d.
MEI = maximally exposed individual; mrem = millirems; yr = year; NIF = National Ignition Facility.

TABLE M.5.3.8.4–1.—*Annual Routine Radioactive Airborne Emissions under the Proposed Action (Fission Products)*

Nuclide	Annual Amount Available for Release (Ci/1,200 MJ)[b]	Annual Air Effluents Via Charcoal Filter[a] (Ci/1,200 MJ)
Krypton-83m	1.1×10^{-13}	1.1×10^{-13}
Krypton-85	3.5×10^{-4}	3.5×10^{-4}
Krypton-85m	2.9×10^{-7}	2.9×10^{-7}
Krypton-87	0	0
Krypton-88	2.3×10^{-11}	2.3×10^{-11}
Krypton-89	0	0
Iodine-131	1.9	9.3×10^{-1}
Iodine-132	3.9	1.9×10^{-1}
Iodine-132m	0	0
Iodine-133	1.1	5.6×10^{-2}
Iodine-133m	0	0
Iodine-134	0	0
Iodine-134m	0	0
Iodine-135	6.1×10^{-4}	2.8×10^{-5}
Iodine-136	0	0
Xenon-131	6.1×10^{-3}	6.1×10^{-3}
Xenon-133	5.9	5.9
Xenon-133m	2.1×10^{-1}	2.1×10^{-1}
Xenon-134m	0	0
Xenon-135	4.5×10^{-2}	4.5×10^{-2}
Xenon-135m	9.0×10^{-5}	9.0×10^{-5}
Xenon-137	0	0
Total	1.3×10^{1}	7.3

Source: LLNL 2003d.
[a] The effluents from the cryopumps during regeneration and from the target chamber when bringing to air would be passed through 2-inch-thick charcoal filters to remove iodines, with 99 percent being collected by charcoal bed. Here, only 95 percent is assumed removed for conservatism.
[b] 1.2 gram uranium-235/target: 2×10^{16} Fissions per 20 MJ experiment, 60 experiments per year.
Ci = curies; MJ=megajoules.

TABLE M.5.3.8.4–2.—*Radiological Impacts to the General Public from Airborne Effluent Emissions during Normal Operations (Proposed Action)*

Receptor	Proposed Action		No Action Alternative	
	Dose	Latent Cancer Fatality Risk	Dose	Latent Cancer Fatality Risk
NIF Offsite MEI	0.07 mrem/yr	4.2×10^{-8} /yr of exposure	0.04 mrem/yr	2.4×10^{-8} /yr of exposure
Population Dose	0.29 person-rem/yr	1.7×10^{-4}	0.26 person-rem/yr	1.6×10^{-4}

Source: LLNL 2003d.
MEI = maximally exposed individual; mrem = millirems; yr = year; NIF = National Ignition Facility.

TABLE M.5.6.1.2–1.—*Possible Additional Bounding Radiological Accident Source Terms under the Proposed Action*

Radionuclide	Quantity Present (Ci)	Release Fraction	Quantity Released (Ci)
Depleted uranium[a]			
Uranium-234	1.7×10^{-5}	1×10^{-3}	1.7×10^{-8}
Uranium-235	7.4×10^{-7}	1×10^{-3}	8.0×10^{-10}
Uranium-238	3.2×10^{-5}	1×10^{-3}	3.2×10^{-8}
Krypton-83m	1.5×10^{-1}	1.0	1.5×10^{-1}
Krypton-85	1.2×10^{-4}	1.0	1.2×10^{-4}
Krypton-85m	4.2×10^{-1}	1.0	4.2×10^{-1}
Krypton-87	2.4	1.0	2.4
Krypton-88	1.6	1.0	1.6
Niobium-98	1.2×10^{3}	1×10^{-3}	1.2
Iodine-131	5.9×10^{-2}	0.5	3.0×10^{-2}
Iodine-132	1.5×10^{-1}	0.5	7.5×10^{-2}
Iodine-132m	1.9×10^{-3}	0.5	9.5×10^{-4}
Iodine-133	6.4×10^{-1}	0.5	3.2×10^{-1}
Iodine-133m	1.0×10^{1}	0.5	5.0
Iodine-134	7.5	0.5	3.8
Iodine-134m	3.8	0.5	1.9
Iodine-135	2.2	0.5	1.1
Iodine-136	2.8×10^{2}	0.5	1.4×10^{2}
Technetium-134	2.2×10^{1}	1×10^{-3}	2.2×10^{-2}
Xenon-133	1.2×10^{-1}	1.0	1.2×10^{-1}
Xenon-133m	5.0×10^{-3}	1.0	5.0×10^{-3}
Xenon-134m	1.5×10^{1}	1.0	1.5×10^{1}
Xenon-135	6.7×10^{-1}	1.0	6.7×10^{-1}
Xenon-135m	3.0×10^{-1}	1.0	3.0×10^{-1}
Xenon-137	1.6×10^{2}	1.0	1.6×10^{2}
Xenon-138	5.3×10^{1}	1.0	5.3×10^{1}

TABLE M.5.6.1.2–1.—*Possible Additional Bounding Radiological Accident Source Terms under the Proposed Action (continued)*

Radionuclide	Quantity Present (Ci)	Release Fraction	Quantity Released (Ci)
Highly enriched uranium[b]			
Uranium-234	6.9×10^{-3}	1×10^{-3}	6.9×10^{-6}
Uranium-235	2.0×10^{-4}	1×10^{-3}	2.0×10^{-7}
Uranium-238	1.8×10^{-6}	1×10^{-3}	1.8×10^{-9}
Krypton-87	4.1	1.0	4.1
Krypton-88	2.6	1.0	2.6
Niobium 98	1.2×10^{3}	1×10^{-3}	1.2
Iodine-131	5.1×10^{-2}	0.5	2.6×10^{-2}
Iodine-132	1.3×10^{-1}	0.5	6.5×10^{-2}
Iodine-132m	3.0×10^{-2}	0.5	1.5×10^{-2}
Iodine-133	6.1×10^{-1}	0.5	3.1×10^{-1}
Iodine-133m	9.8×10^{1}	0.5	4.9×10^{1}
Iodine-134	7.9	0.5	4.0
Iodine-134m	1.7×10^{1}	0.5	8.5
Iodine-135	2.1	0.5	1.1
Iodine-136	1.8×10^{2}	0.5	9.0×10^{1}
Tellurium-134	2.0×10^{1}	1×10^{-3}	2.0×10^{-2}
Xenon-133	1.2×10^{-1}	1.0	1.2×10^{-1}
Xenon-133m	4.9×10^{-3}	1.0	4.9×10^{-3}
Xenon-134m	3.2×10^{2}	1.0	3.2×10^{2}
Xenon-135	6.7×10^{-1}	1.0	6.7×10^{-1}
Xenon-135m	1.7	1.0	1.7
Xenon-137	1.6×10^{2}	1.0	1.6×10^{2}
Xenon-138	5.6×10^{1}	1.0	5.6×10^{1}
Tracers: iodine is bounding and representative			
Iodine-124	6.2×10^{-2}	0.5	3.1×10^{-2}
Iodine-125	6.4×10^{-2}	0.5	3.2×10^{-2}
Iodine-126	1.5×10^{-1}	0.5	7.5×10^{-2}

TABLE M.5.6.1.2–1.—*Possible Additional Bounding Radiological Accident Source Terms under the Proposed Action (continued)*

Radionuclide	Quantity Present (Ci)	Release Fraction	Quantity Released (Ci)
Inner containment vessel, weapons grade plutonium (non-yield[c])	**3 g**		
Plutonium-238	1.0×10^{-2}	1×10^{-3}	1.0×10^{-5}
Plutonium-239	1.8×10^{-1}	1×10^{-3}	1.8×10^{-4}
Plutonium-240	4.0×10^{-2}	1×10^{-3}	4.0×10^{-5}
Plutonium-241	9.1×10^{-1}	1×10^{-3}	9.1×10^{-4}
Plutonium-242	2.4×10^{-6}	1×10^{-3}	2.4×10^{-9}
Americium-241	1.6×10^{-3}	1×10^{-3}	1.6×10^{-6}
Inner containment vessel, weapons grade plutonium (with yield[d])	**1 g**		
Plutonium-238	3.4×10^{-3}	1×10^{-3}	3.4×10^{-6}
Plutonium-239	5.8×10^{-2}	1×10^{-3}	5.8×10^{-5}
Plutonium-240	1.3×10^{-2}	1×10^{-3}	1.3×10^{-5}
Plutonium-241	3.0×10^{-1}	1×10^{-3}	3.0×10^{-4}
Plutonium-242	7.9×10^{-7}	1×10^{-3}	7.9×10^{-10}
Nickel-65	1.6×10^{-5}	1×10^{-3}	1.6×10^{-8}
Niobium 96	3.9×10^{-6}	1×10^{-3}	3.9×10^{-9}
Niobium-97	2.8×10^{-5}	1×10^{-3}	2.8×10^{-8}
Niobium-97	5.5×10^{-4}	1×10^{-3}	5.5×10^{-7}
Niobium-98	1.6×10^{-2}	1×10^{-3}	1.6×10^{-5}
Molybdenum-93m	1.3×10^{-6}	1×10^{-3}	1.3×10^{-9}
Molybdenum-99	5.5×10^{-5}	1×10^{-3}	5.5×10^{-8}
Technetium-99	2.2×10^{-5}	1×10^{-3}	2.2×10^{-8}

Source: LLNL 2003d.

[a] Depleted uranium is already slightly radioactive; the half-life of uranium-238 (dominant isotope) is 4.5×10^{9} years. The assumed composition is 99.64% uranium-238, 0.36% uranium-235, and 0.0028% uranium-234. The quantities listed correspond to the maximum additional quantity used for the proposed action of 100 g. Fission products would result from a single target (maximum of 2.2 g) subject to a 45-MJ fusion yield, 4.6×10^{16} fissions, and would include residual fission products from previous yield experiments (60 @ 20 MJ). The fission product inventories would be peak post-experiment inventories.

[b] Highly enriched uranium is already slightly radioactive; the half-life of uranium-235 (dominant isotope) is 7.0×10^{8} years. The quantity listed corresponds to the maximum quantity used for the proposed action of 100 g. Fission products would result from a single target (maximum of 1.2 g) subject to a 45-MJ fusion yield, 4.6×10^{16} fissions, and would include residual fission products from previous yield experiments (60 @ 20 MJ). The fission product inventories would be peak post-experiment inventories.

[c] Thorium-232 is already slightly radioactive, with a half-life of 1.4×10^{10} yrs. The quantity listed corresponds to the maximum quantity used under the Proposed Action of 450 g. Fission products would result from a single target (maximum of 7.9 g) subject to a 45-MJ fusion yield, 5.3×10^{16} fissions, and would include residual fission products from previous yield experiments (60 @ 20 MJ). The fission product inventories would be peak post-experiment inventories.

[d] The assumed composition of weapons grade material is 0.02% plutonium-238, 93.85% plutonium-239, 5.8% plutonium-240, 0.3% plutonium-241, 0.015% americium-241, and 0.02% plutonium-242. Other isotopic mixes could be used as long as their impacts would be within the bounds described here. The fission products would result from a single target (maximum of 1 g) subject to a 45-MJ fusion yield, 3.2×10^{16} fissions. Because only a single experiment would occur within a containment vessel, only the fission products resulting from this single experiment are included. The fission product inventories would be peak post-experiment inventories.

Ci = curies; g = gram; MJ = megajoules.

TABLE M.5.6.1.2–2.—*Potential Source Terms for Radiological Accident Scenarios*

Accident	Frequency (per year)	Source Term or Hazard (No Action Alternative)	Source Term or Hazard (Proposed Action)
Earthquake during No Action Alternative operations	2×10^{-8}	500 Ci tritium plus activated gases and particulates	500 Ci tritium plus activated gases and particulates
Earthquake during depleted uranium experiment	2×10^{-9}	0.005 g depleted uranium plus 500 Ci tritium plus activated gases and particulates	0.1 g depleted uranium plus 500 Ci tritium plus fission products plus activated gases and particulates
Earthquake during highly enriched uranium experiment	2×10^{-9}	Not applicable	0.1 g highly enriched uranium plus 500 Ci tritium plus fission products plus activated gases and particulates
Earthquake during thorium experiment	2×10^{-9}	Not applicable	0.45 g thorium-232 plus 500 Ci tritium plus fission products plus activated gases and particulates
Earthquake during tracer experiment	2×10^{-9}	Not applicable	0.031 Ci iodine-124 0.032 Ci iodine-125 0.075 Ci iodine-126 500 Ci tritium plus activated gases and particulates
Earthquake during plutonium without yield experiment	2×10^{-9}	Not applicable	0.003 g weapons grade plutonium plus 500 Ci tritium plus activated gases and particulates
Earthquake during plutonium with yield experiment	2×10^{-9}	Not applicable	0.001 g weapons grade plutonium plus 500 Ci tritium plus fission products, plus activation gases and particulates

Source: LLNL 2003d.
g = grams; Ci = curies.

TABLE M.5.6.1.2–3.—*National Ignition Facility Accident Frequency and Consequences (Median Meteorology)*

		MEI		Offsite Population [a]		Individual Noninvolved Worker		Noninvolved Worker Population	
Accident	**Frequency (per year)**	**Dose (rem)**	**LCFs [b]**	**Dose (person-rem)**	**LCFs [c]**	**Dose (rem)**	**LCFs [b]**	**Dose (person-rem)**	**LCFs [c]**
Earthquake during No Action Alternative operations	2.0×10^{-8}	4.78×10^{-4}	2.87×10^{-7}	1.96×10^{-1}	1.18×10^{-4}	1.43×10^{-3}	8.60×10^{-7}	2.08×10^{-1}	1.25×10^{-4}
Earthquake during depleted uranium shot	2.0×10^{-9}	9.68×10^{-4}	5.81×10^{-7}	2.40×10^{-1}	1.44×10^{-4}	2.55×10^{-3}	1.53×10^{-6}	3.48×10^{-1}	2.09×10^{-4}
Earthquake during highly enriched uranium shot	2.0×10^{-9}	1.02×10^{-3}	6.09×10^{-7}	2.47×10^{-1}	1.48×10^{-4}	2.64×10^{-3}	1.59×10^{-6}	3.59×10^{-1}	2.16×10^{-4}
Earthquake during thorium shot	2.0×10^{-9}	1.04×10^{-3}	6.24×10^{-7}	2.43×10^{-1}	1.46×10^{-4}	2.65×10^{-3}	1.59×10^{-6}	3.57×10^{-1}	2.14×10^{-4}
Earthquake during tracer shot	2.0×10^{-9}	5.44×10^{-4}	3.26×10^{-7}	2.09×10^{-1}	1.26×10^{-4}	1.63×10^{-3}	9.80×10^{-7}	2.29×10^{-1}	1.38×10^{-4}
Earthquake during plutonium without yield shot	2.0×10^{-9}	1.65×10^{-3}	9.89×10^{-7}	5.46×10^{-1}	3.28×10^{-4}	4.99×10^{-3}	3.00×10^{-6}	7.41×10^{-1}	4.45×10^{-4}
Earthquake during plutonium with yield shot	2.0×10^{-9}	9.01×10^{-4}	5.41×10^{-7}	3.16×10^{-1}	1.90×10^{-4}	2.69×10^{-3}	1.62×10^{-6}	3.96×10^{-1}	2.38×10^{-4}

Source: LLNL 2003d.
[a] Based on the population of approximately 6,900,000 persons residing within 50 miles of LLNL.
[b] Increased likelihood of a latent cancer fatality.
[c] Increased number of latent cancer fatalities.
LCFs = latent cancer fatalities; MEI = maximally exposed individual.

TABLE M.5.6.1.2–4.—*National Ignition Facility Accident Frequency and Consequence (Unfavorable Meteorology)*

		MEI		Offsite Population [a]		Individual Noninvolved Worker		Noninvolved Worker Population	
Accident	**Frequency (per year)**	**Dose (rem)**	**LCFs [b]**	**Dose (person-rem)**	**LCFs [c]**	**Dose (rem)**	**LCFs [b]**	**Dose (person-rem)**	**LCFs [c]**
Earthquake during No Action Alternative operations	2.00×10^{-8}	6.15×10^{-3}	3.69×10^{-6}	3.05	1.83×10^{-3}	1.33×10^{-2}	8.01×10^{-6}	2.22	1.33×10^{-3}
Earthquake during depleted uranium shot	2.00×10^{-9}	1.10×10^{-2}	6.57×10^{-6}	4.51	2.71×10^{-3}	2.25×10^{-2}	1.35×10^{-5}	3.74	2.24×10^{-3}
Earthquake during highly enriched uranium shot	2.00×10^{-9}	1.14×10^{-2}	6.84×10^{-6}	4.67	2.80×10^{-3}	2.33×10^{-2}	1.40×10^{-5}	3.83	2.30×10^{-3}
Earthquake during thorium shot	2.00×10^{-9}	1.14×10^{-2}	6.86×10^{-6}	4.76	2.86×10^{-3}	2.31×10^{-2}	1.39×10^{-5}	4.10	2.46×10^{-3}
Earthquake during tracer shot	2.00×10^{-9}	7.02×10^{-3}	4.21×10^{-6}	3.26	1.95×10^{-3}	1.52×10^{-2}	9.14×10^{-6}	2.44	1.46×10^{-3}
Earthquake during plutonium without yield shot	2.00×10^{-9}	2.16×10^{-2}	1.30×10^{-5}	8.33	5.00×10^{-3}	4.69×10^{-2}	2.82×10^{-5}	8.23	4.94×10^{-3}
Earthquake during plutonium with yield shot	2.00×10^{-9}	1.16×10^{-2}	6.96×10^{-6}	4.98	2.99×10^{-3}	2.50×10^{-2}	1.50×10^{-5}	4.27	2.56×10^{-3}

Source: LLNL 2003d.
[a] Based on the population of approximately 6,900,000 persons residing within 50 miles of LLNL.
[b] Increased likelihood of a latent cancer fatality.
[c] Increased number of latent cancer fatalities.
LCFs = latent cancer fatalities; MEI = maximally exposed individual.

TABLE M.5.6.1.2–5. —*National Ignition Facility Accident Frequency and Risk (Median Meteorology)*

		MEI		Offsite Population [a]		Individual Noninvolved Worker		Noninvolved Worker Population	
Accident	**Frequency (per year)**	**Dose (rem)**	**LCFs [b]**	**Dose (person-rem)**	**LCFs [c]**	**Dose (rem)**	**LCFs [b]**	**Dose (person-rem)**	**LCFs [c]**
Earthquake during No Action Alternative operations	2.00×10^{-8}	9.56×10^{-12}	5.74×10^{-15}	3.92×10^{-9}	2.35×10^{-12}	2.87×10^{-11}	1.72×10^{-14}	4.17×10^{-9}	2.50×10^{-12}
Earthquake during depleted uranium shot	2.00×10^{-9}	1.94×10^{-12}	1.16×10^{-15}	4.80×10^{-10}	2.88×10^{-13}	5.11×10^{-12}	3.06×10^{-15}	6.97×10^{-10}	4.18×10^{-13}
Earthquake during highly enriched uranium shot	2.00×10^{-9}	2.03×10^{-12}	1.22×10^{-15}	4.94×10^{-10}	2.97×10^{-13}	5.29×10^{-12}	3.17×10^{-15}	7.19×10^{-10}	4.31×10^{-13}
Earthquake during thorium shot	2.00×10^{-9}	2.08×10^{-12}	1.25×10^{-15}	4.86×10^{-10}	2.92×10^{-13}	5.31×10^{-12}	3.18×10^{-15}	7.15×10^{-10}	4.29×10^{-13}
Earthquake during tracer shot	2.00×10^{-9}	1.09×10^{-12}	6.53×10^{-16}	4.19×10^{-10}	2.51×10^{-13}	3.27×10^{-12}	1.96×10^{-15}	4.59×10^{-10}	2.75×10^{-13}
Earthquake during plutonium without yield shot	2.00×10^{-9}	3.30×10^{-12}	1.98×10^{-15}	1.09×10^{-9}	6.55×10^{-13}	9.99×10^{-12}	5.99×10^{-15}	1.48×10^{-9}	8.90×10^{-13}
Earthquake during plutonium with yield shot	2.00×10^{-9}	1.80×10^{-12}	1.08×10^{-15}	6.32×10^{-10}	3.79×10^{-13}	5.39×10^{-12}	3.23×10^{-15}	7.93×10^{-10}	4.76×10^{-13}

Source: LLNL 2003d.
[a] Based on the population of approximately 6,900,000 persons residing within 50 miles of LLNL.
[b] Increased likelihood of a latent cancer fatality.
[c] Increased number of latent cancer fatalities.
LCFs = latent cancer fatalities; MEI = maximally exposed individual.

TABLE M.5.6.1.2–6. — *National Ignition Facility Accident Frequency and Risk (Unfavorable Meteorology)*

		MEI		Offsite Population [a]		Individual Noninvolved Worker		Noninvolved Worker Population	
Accident	**Frequency (per year)**	**Dose (rem)**	**LCFs [b]**	**Dose (person-rem)**	**LCFs [c]**	**Dose (rem)**	**LCFs [b]**	**Dose (person-rem)**	**LCFs [c]**
Earthquake during No Action Alternative operations	2.00×10^{-8}	1.23×10^{-10}	7.38×10^{-14}	6.10×10^{-8}	3.66×10^{-11}	2.67×10^{-10}	1.60×10^{-13}	4.44×10^{-8}	2.66×10^{-11}
Earthquake during depleted uranium shot	2.00×10^{-9}	2.19×10^{-11}	1.31×10^{-14}	9.02×10^{-9}	5.41×10^{-12}	4.51×10^{-11}	2.71×10^{-14}	7.48×10^{-9}	4.49×10^{-12}
Earthquake during highly enriched uranium shot	2.00×10^{-9}	2.28×10^{-11}	1.37×10^{-14}	9.34×10^{-9}	5.61×10^{-12}	4.66×10^{-11}	2.80×10^{-14}	7.66×10^{-9}	4.60×10^{-12}
Earthquake during thorium shot	2.00×10^{-9}	2.29×10^{-11}	1.37×10^{-14}	9.52×10^{-9}	5.71×10^{-12}	4.62×10^{-11}	2.77×10^{-14}	8.20×10^{-9}	4.92×10^{-12}
Earthquake during tracer shot	2.00×10^{-9}	1.40×10^{-11}	8.42×10^{-15}	6.52×10^{-9}	3.91×10^{-12}	3.05×10^{-11}	1.83×10^{-14}	4.88×10^{-9}	2.93×10^{-12}
Earthquake during plutonium without yield shot	2.00×10^{-9}	4.33×10^{-11}	2.60×10^{-14}	1.67×10^{-8}	1.00×10^{-11}	9.39×10^{-11}	5.63×10^{-14}	1.65×10^{-8}	9.88×10^{-12}
Earthquake during plutonium with yield shot	2.00×10^{-9}	2.32×10^{-11}	1.39×10^{-14}	9.96×10^{-9}	5.98×10^{-12}	5.01×10^{-11}	3.01×10^{-14}	8.54×10^{-9}	5.12×10^{-12}

Source: LLNL 2003d.

[a] Based on the population of approximately 6,900,000 persons residing within 50 miles of LLNL.

[b] Increased likelihood of a latent cancer fatality.

[c] Increased number of latent cancer fatalities.

LCFs = latent cancer fatalities; MEI = maximally exposed individual.

TABLE M.5.6.2.2–2.—*National Ignition Facility Chemical Accident Consequences (Median Meteorology)*

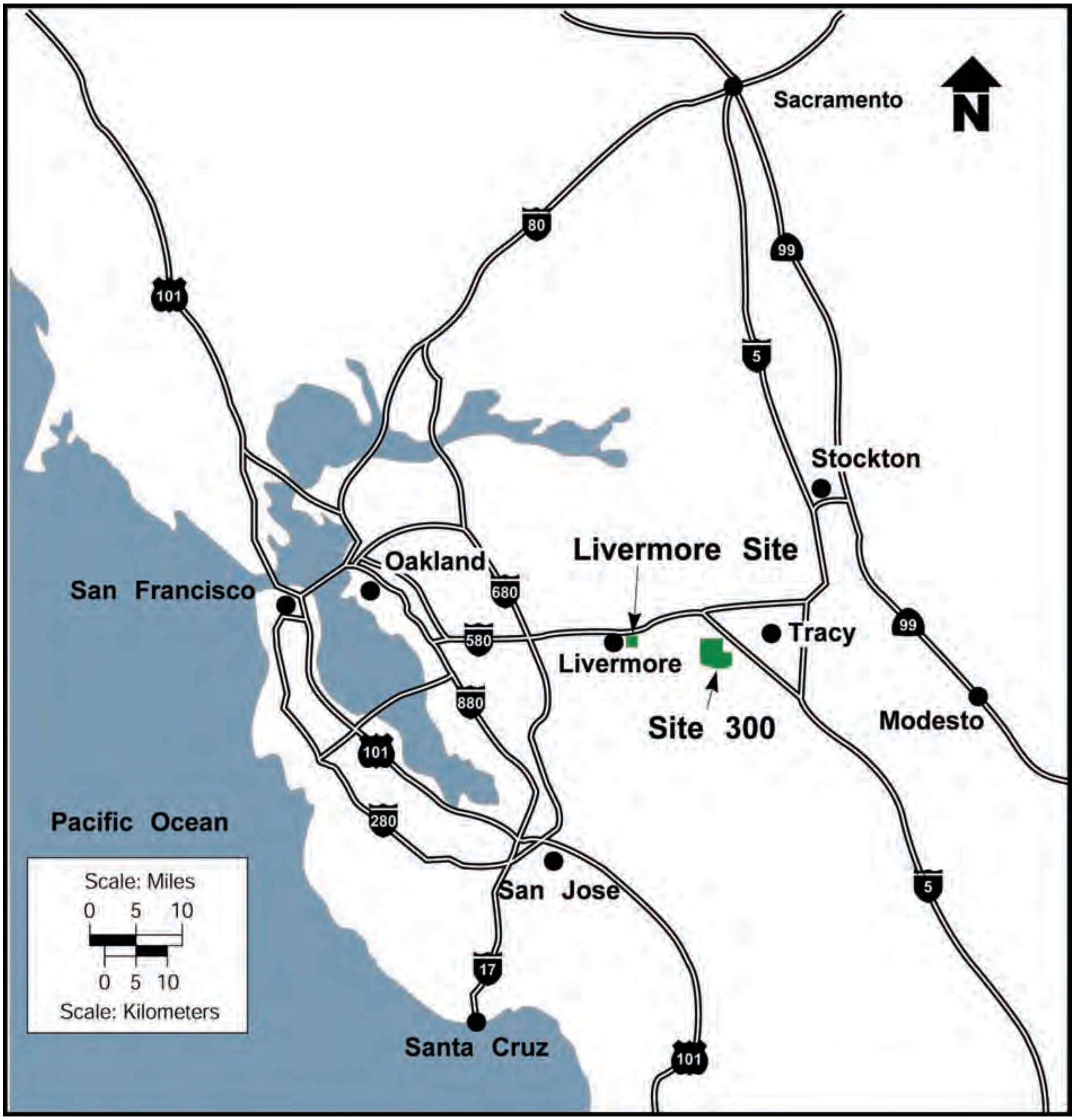
ERPG-2[a] Concentration (ppm)	ERPG-3[a] Concentration (ppm)	Noninvolved Worker Average Predicted Concentration (ppm)	Noninvolved Worker Fraction of ERPG-2	Site Boundary Average Predicted Concentration (ppm)	Site Boundary Fraction of ERPG-2	ERPG-2 Distance (meters)
Release of nitric acid solution						
6	78	199	33.2	17.6	2.93	604
Release of acetone						
8,500	8,500	279	0.033	279	0.033	11
Mercury release from ignitrons						
0.25	0.5	0.0153	0.0612	0.0098	0.0392	23
Aircraft crash release of mercury						
0.25	0.5	0	0	0	0	< 10
Earthquake release of lithium hydride[b]						
0.31	1.56	0	0	0	0	< 10
Earthquake release of beryllium[b]						
0.068	0.27	0	0	0	0	< 10
Earthquake release of thorium[b]						
5.27	26.37	0	0	0	0	< 10
Earthquake release of uranium[b]						
0.103	1.03	0	0	0	0	< 10

Source: LLNL 2003d.
[a] ERPG=Emergency Response Planning Guideline.
[b] Smaller amounts used for No Action and Reduced Action Alternatives.
ppm = parts per million.

TABLE M.5.6.2.2–3.—*National Ignition Facility Chemical Accident Consequences (Unfavorable Meteorology)*

ERPG-2[a] Concentration (ppm)	ERPG-3[a] Concentration (ppm)	Noninvolved Worker Average Predicted Concentration (ppm)	Noninvolved Worker Fraction of ERPG-2	Site Boundary Average Predicted Concentration (ppm)	Site Boundary Fraction of ERPG-2	ERPG-2 Distance (meters)
Release of nitric acid solution						
6	78	394	65.7	31.8	5.3	1,100
Release of acetone						
8,500	8,500	552	0.065	552	0.065	30
Mercury release from ignitrons						
0.25	0.5	0.25	1.0	0.164	0.66	100
Aircraft crash release of mercury						
0.25	0.5	0	0	0	0	11
Earthquake release of lithium hydride[b]						
0.31	1.56	0.1076	0.35	0	0	58
Earthquake release of beryllium[b]						
0.068	0.27	0	0	0	0	44
Earthquake release of thorium[b]						
5.27	26.37	0.00128	2.43×10^{-4}	0	0	< 10
Earthquake release of uranium[b]						
0.103	1.03	0.00262	0.025	0	0	16

Source: LLNL 2003d.
[a] ERPG=Emergency Response Planning Guideline.
[b] Smaller amounts used for No Action and Reduced Action Alternatives.
ppm = parts per million.



Source: LLNL 2003l.

FIGURE S.3.1–1.— *Livermore Site and Site 300 in Relation to Surrounding Areas*

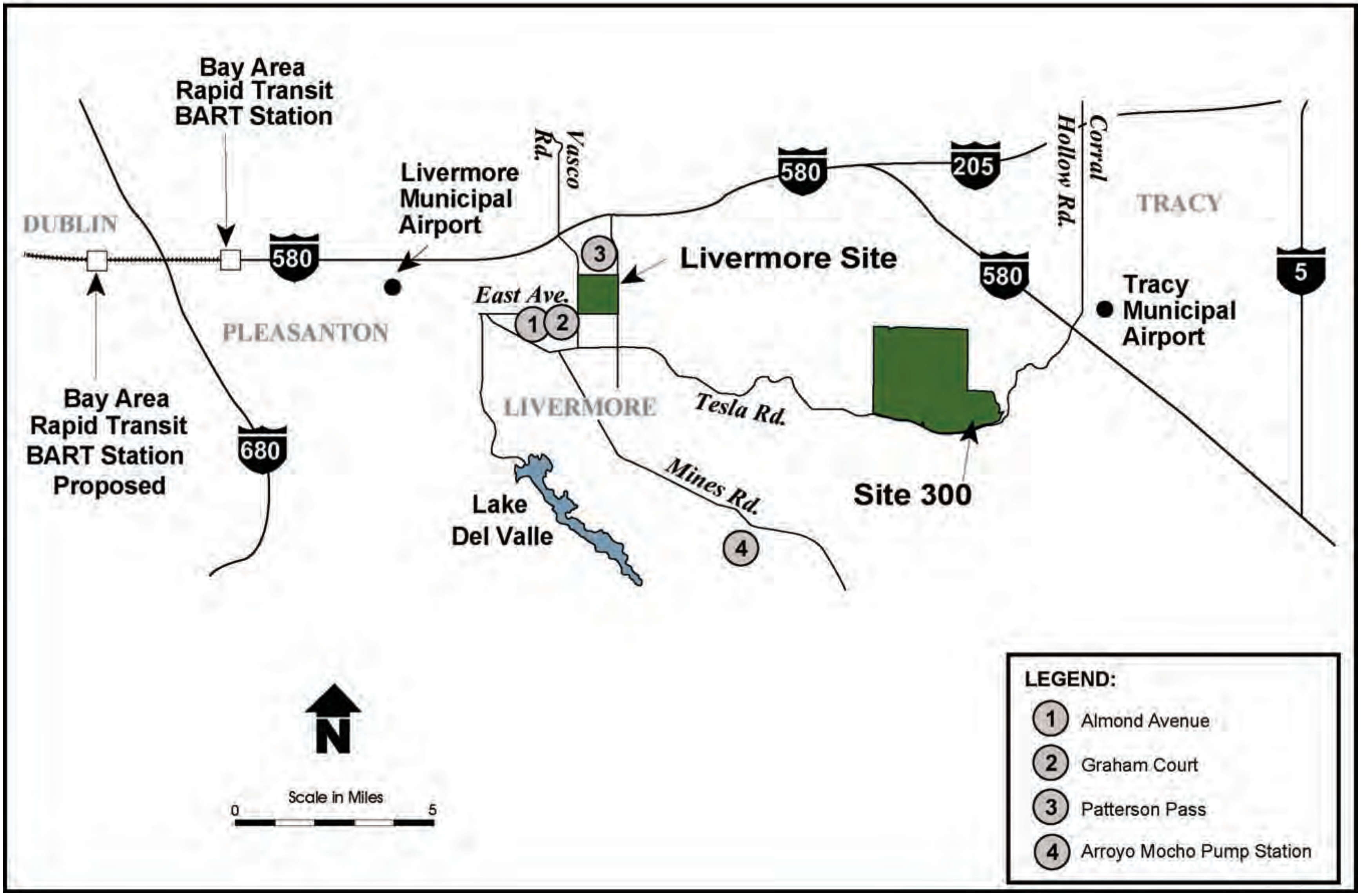
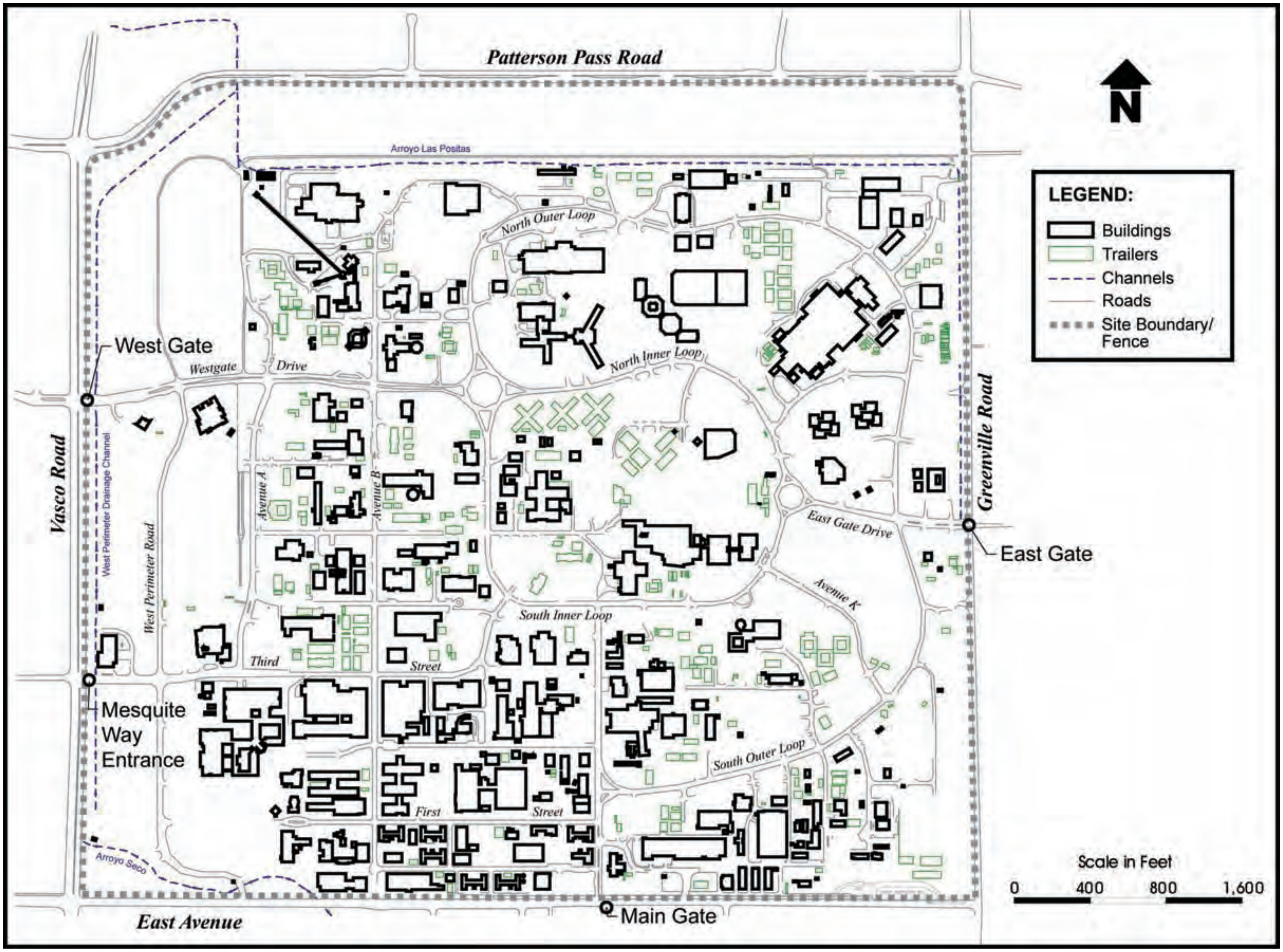
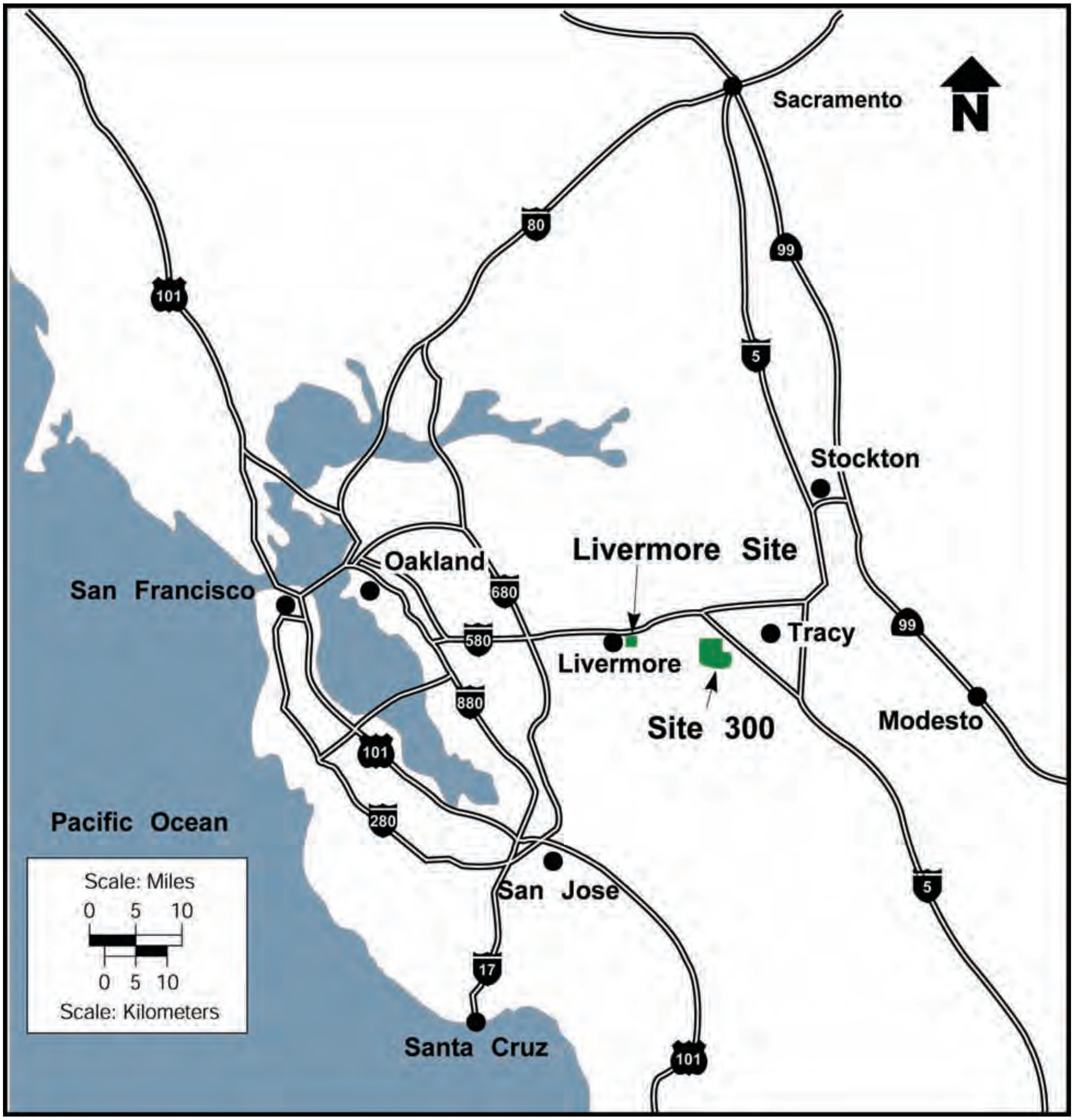


FIGURE S.3.1–2.—*Locations of Livermore Site, Site 300, and Offsite Facilities Relative to Surrounding Communities*



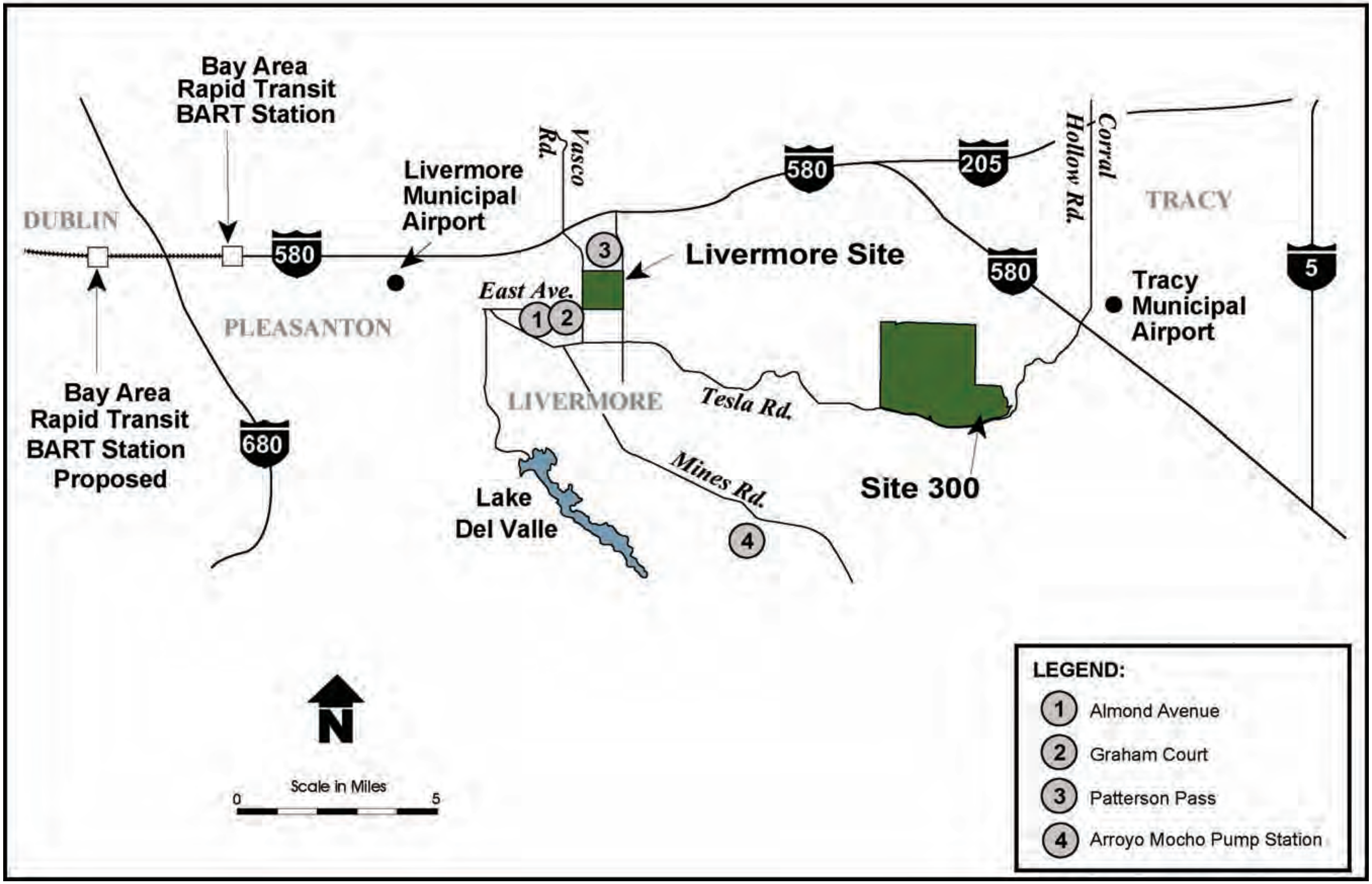
Source: LLNL 2003o.

FIGURE S.3.2–1.—*Livermore Site Map*



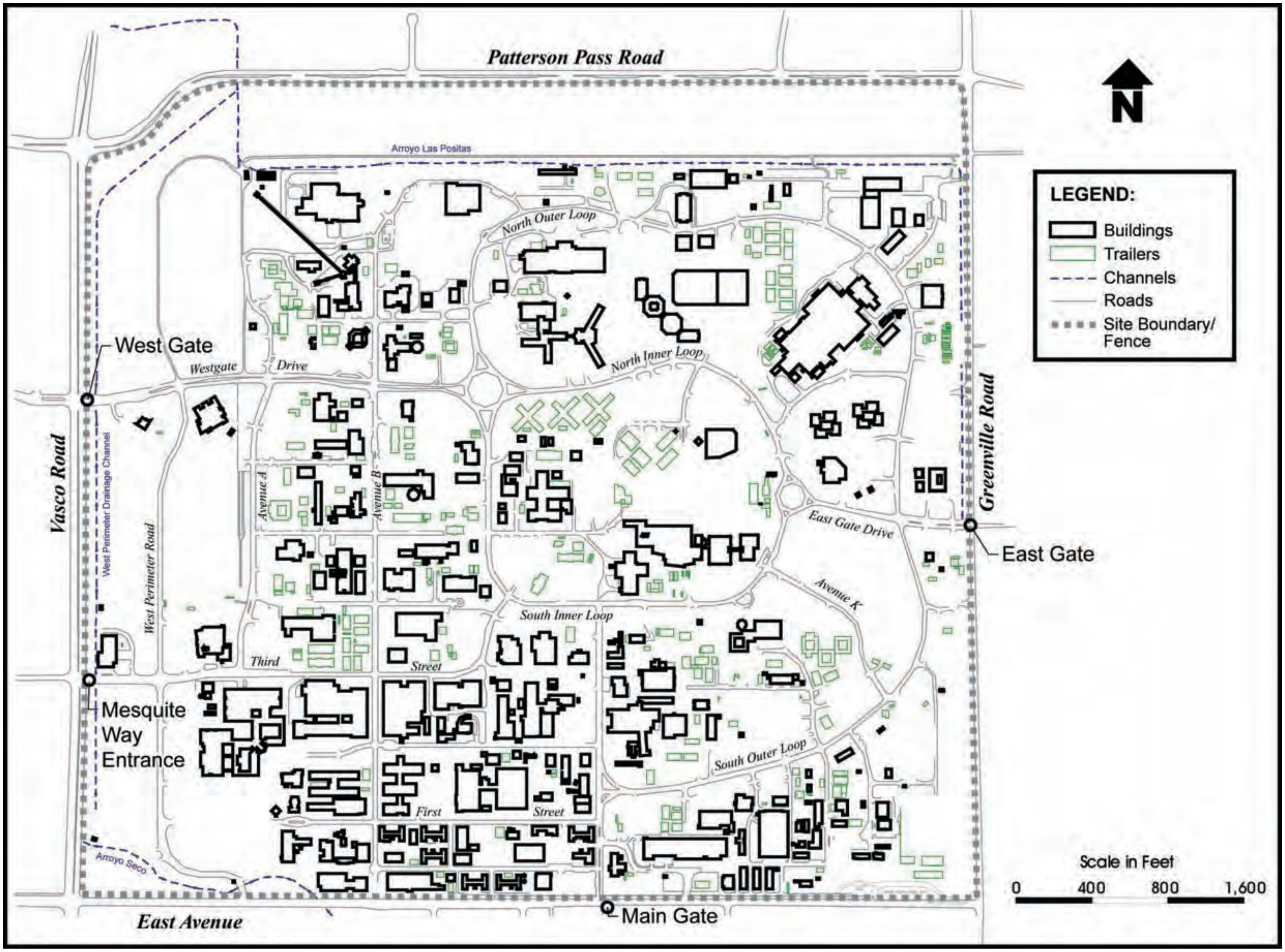
Source: LLNL 2001v.

FIGURE 2.1–1.—*Livermore Site and Site 300*



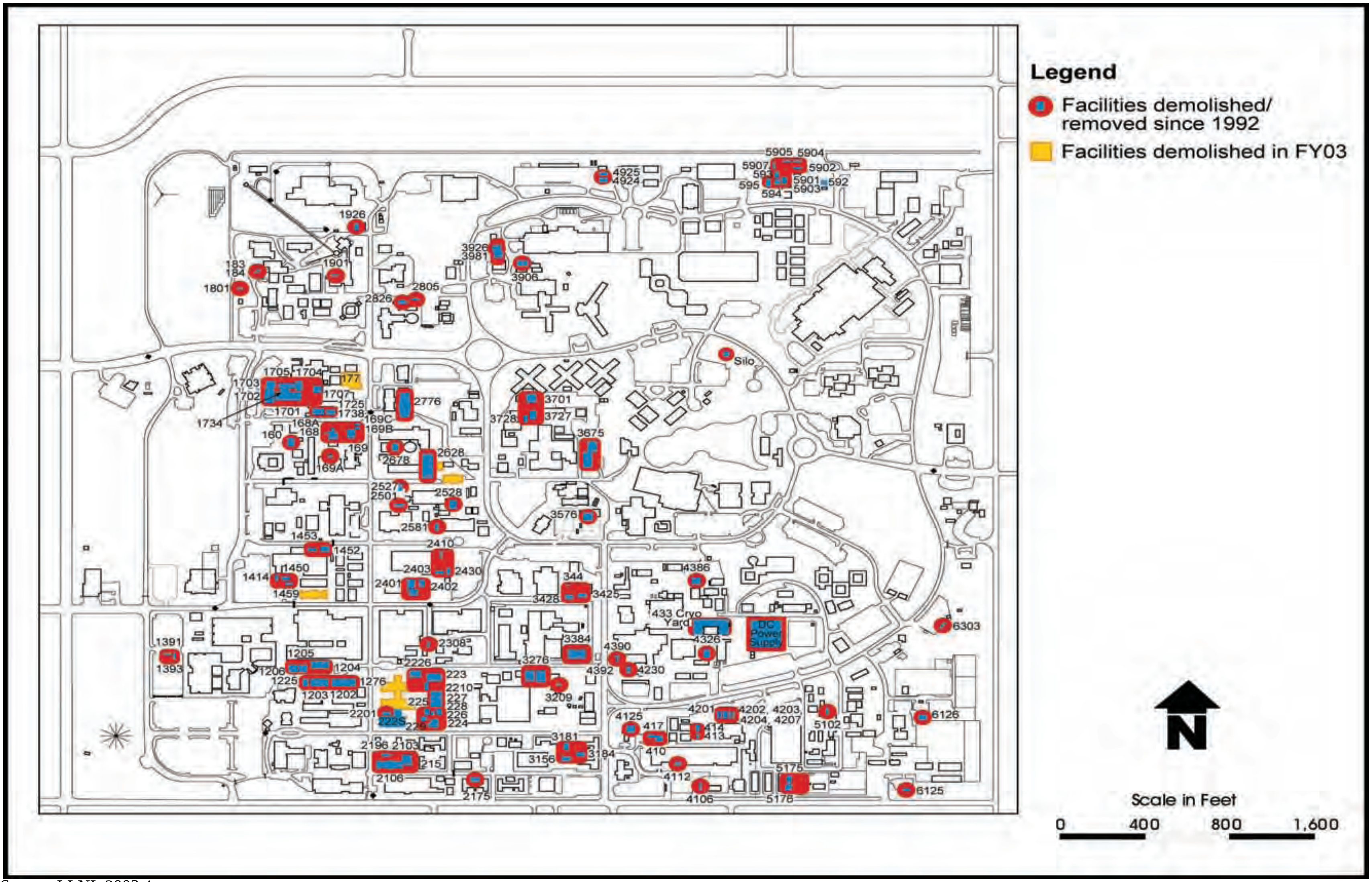
Source: LLNL 2003cj.

FIGURE 2.1–2.—*Locations of Livermore Site, Site 300, and Offsite Facilities Relative to Surrounding Communities*



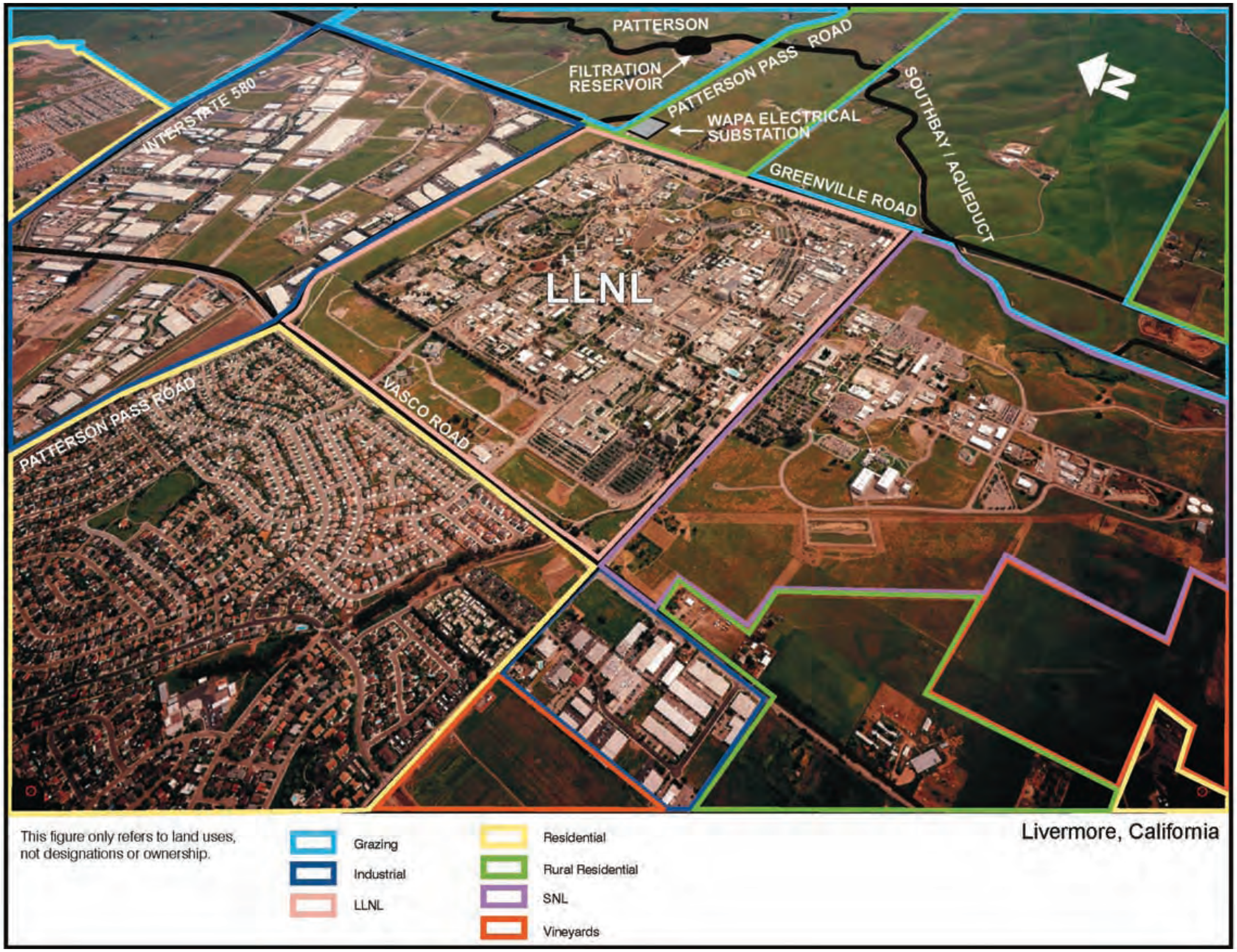
Source: LLNL 2003o.

FIGURE 2.5.1–1.—*Livermore Site Map*



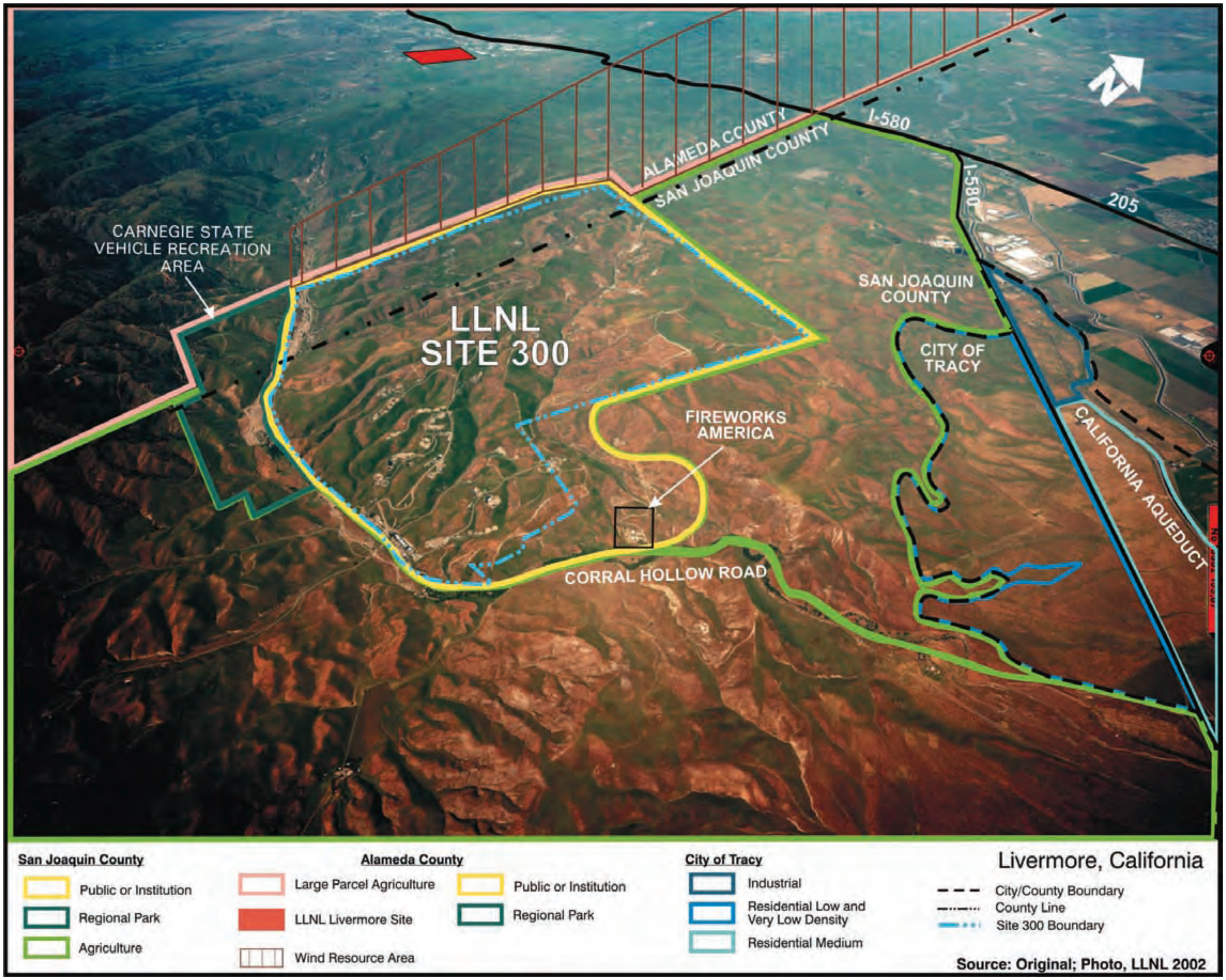
Source: LLNL 2003cj.

FIGURE 2.5.1–2.—*Facility Changes from the 1992 Final Environmental Impact Statement and Environmental Impact Report for Continued Operation of the Lawrence Livermore National Laboratory and Sandia National Laboratories, Livermore at the Livermore Site*



Source: Original Photo.

FIGURE 4.2.1.1–1.—*Livermore Site Surrounding Land Uses*



Source: Original Photo.

FIGURE 4.2.1.2–1.—*Site 300 Surrounding Land Uses and Land Use Designations*

Source: Original Photo.

FIGURE 4.2.2.1–1.—*Livermore Site Surrounding Land Use Designations*

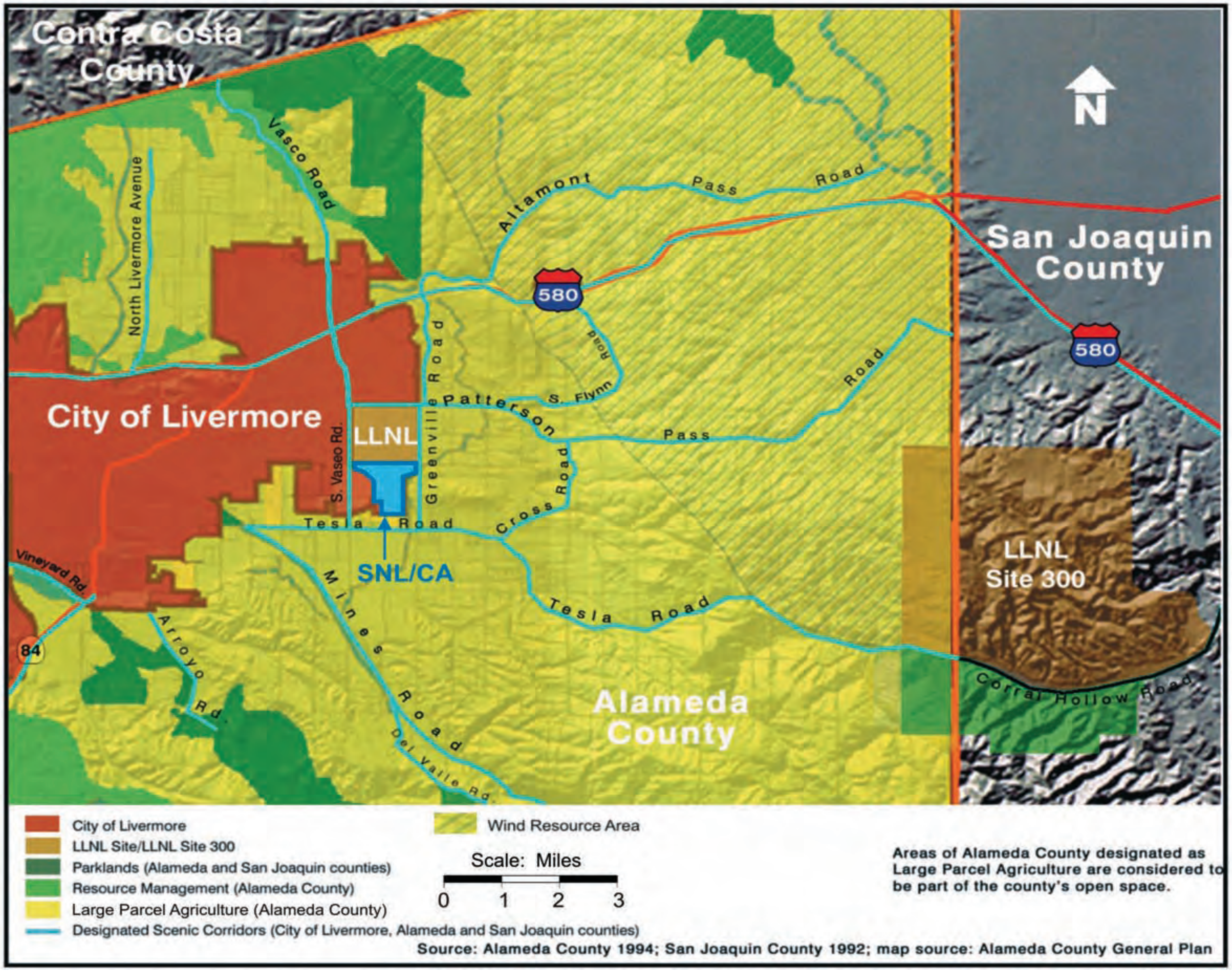


FIGURE 4.2.2.1–2.—*Designated Open Space Areas and Scenic Routes*

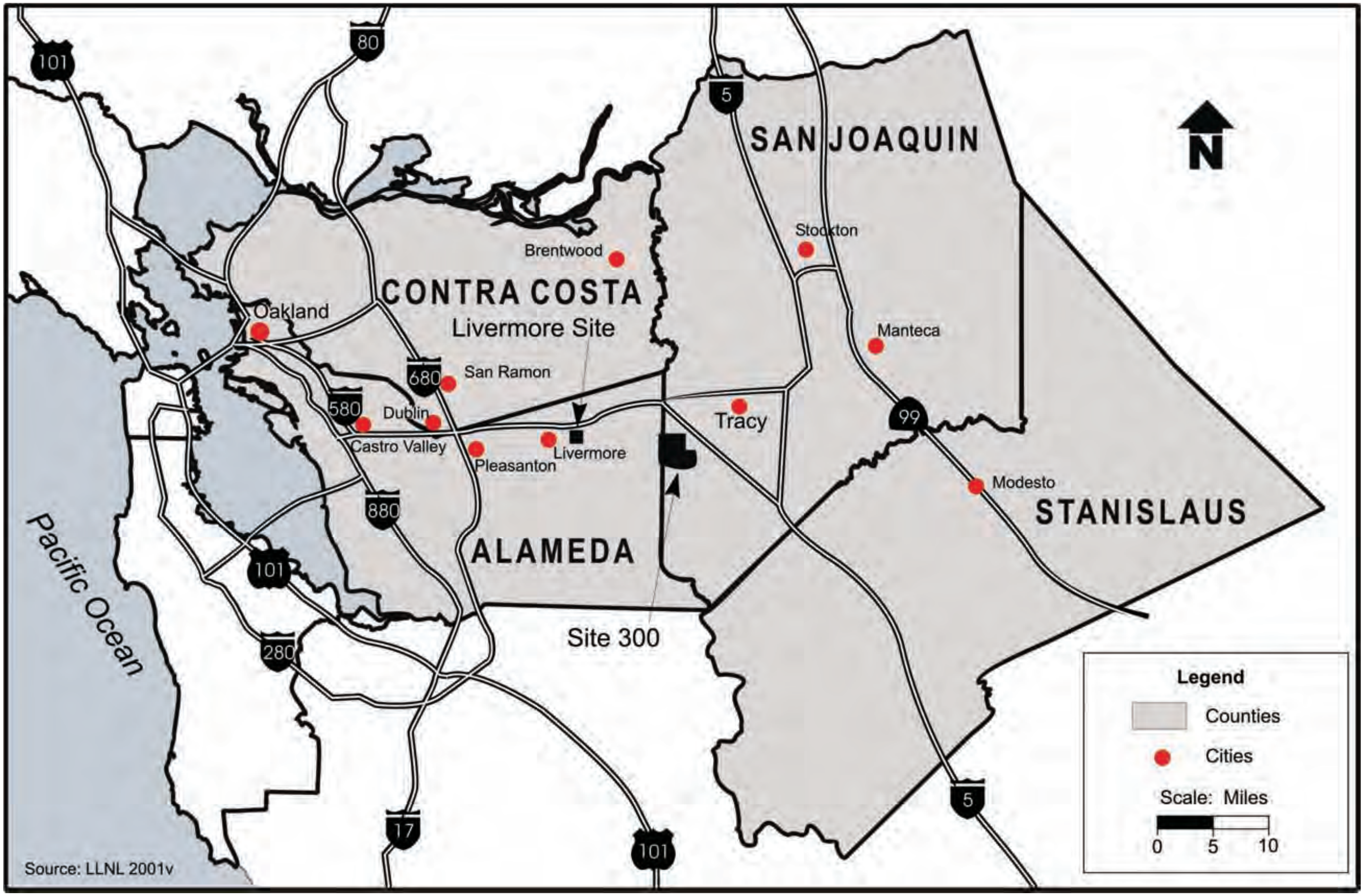


FIGURE 4.3–1.—*Four-County Lawrence Livermore National Laboratory Region of Influence*

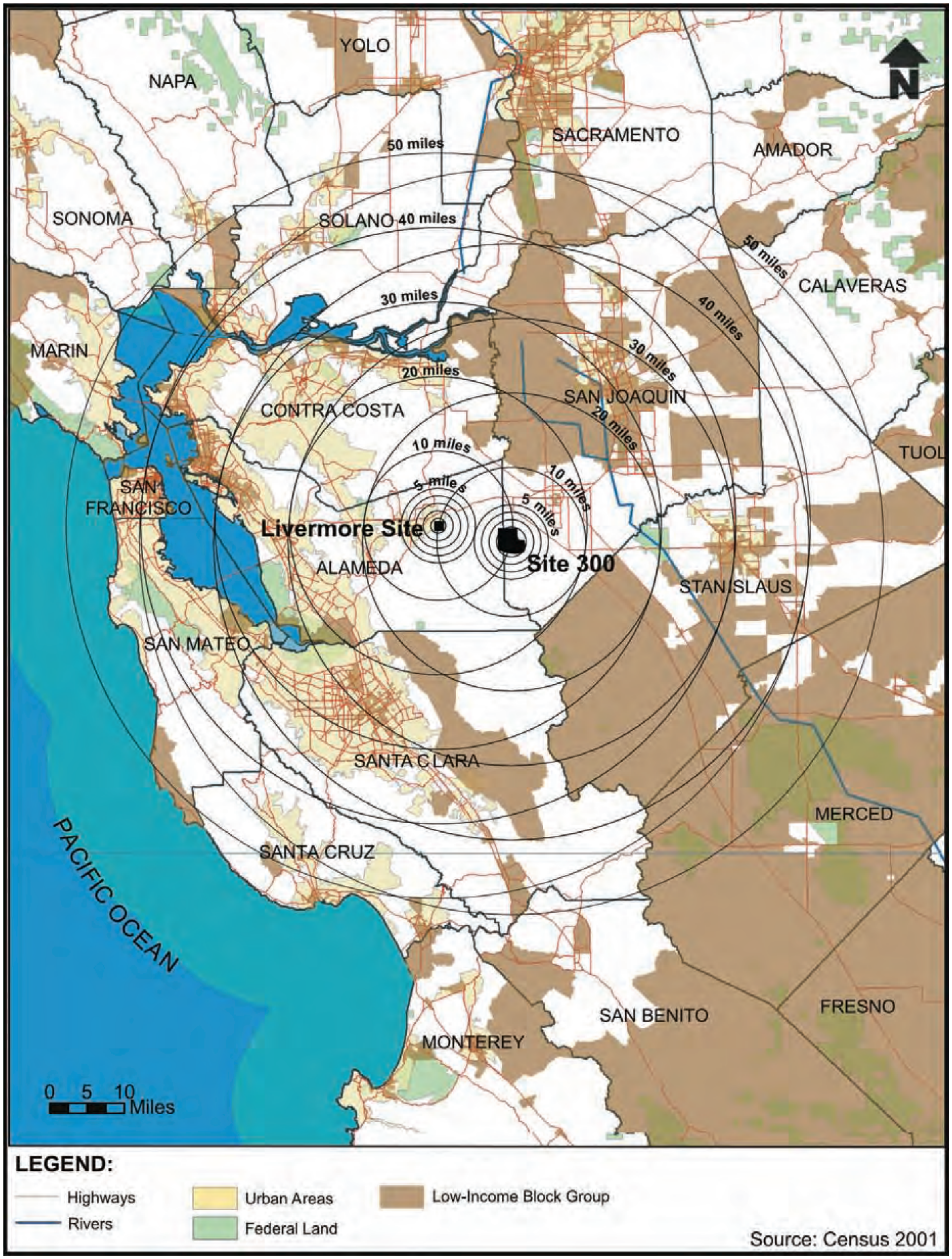


FIGURE 4.3.5–2.—*Low-Income Populations within 50 Miles of the Livermore Site and Site 300*

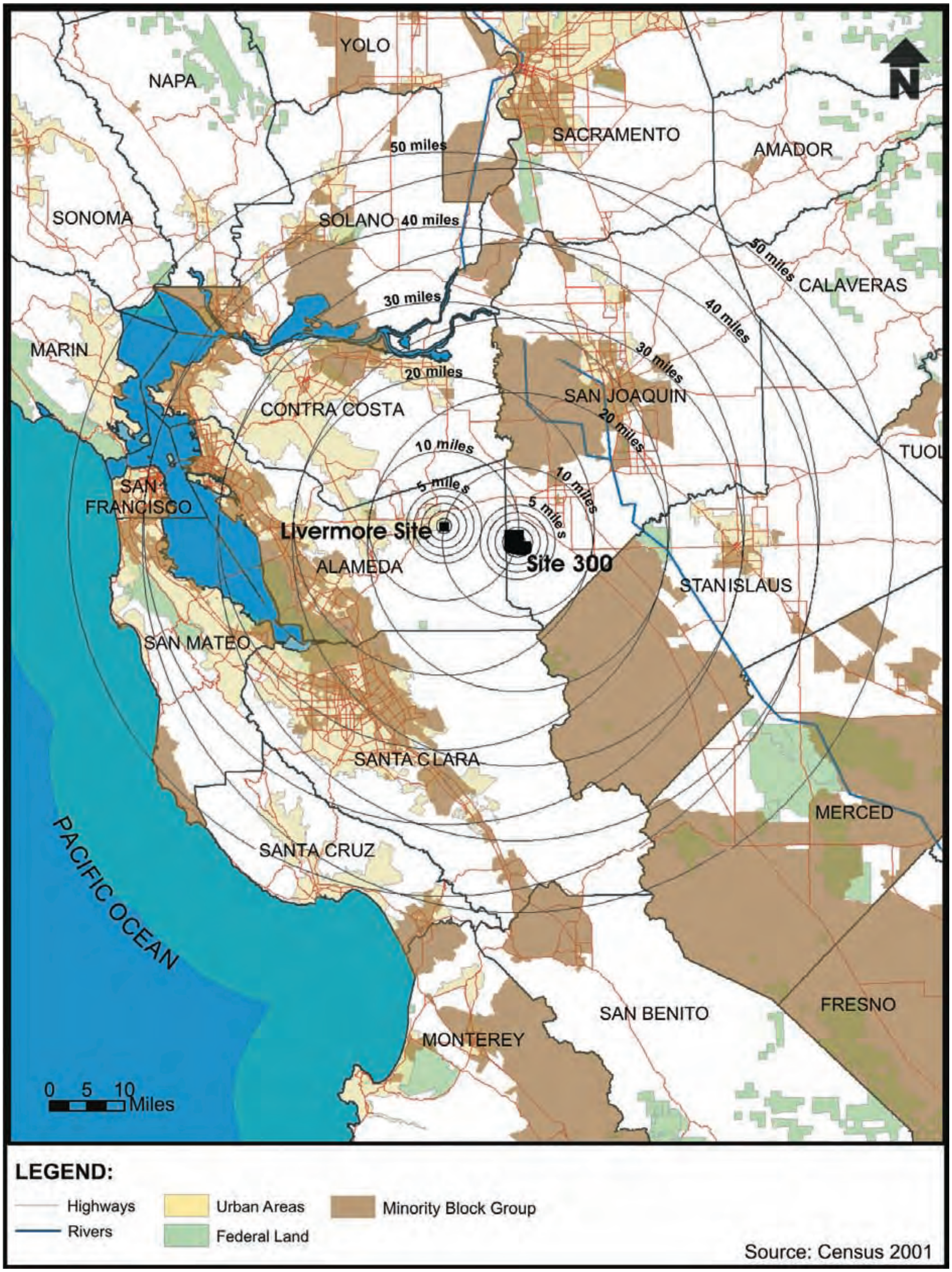
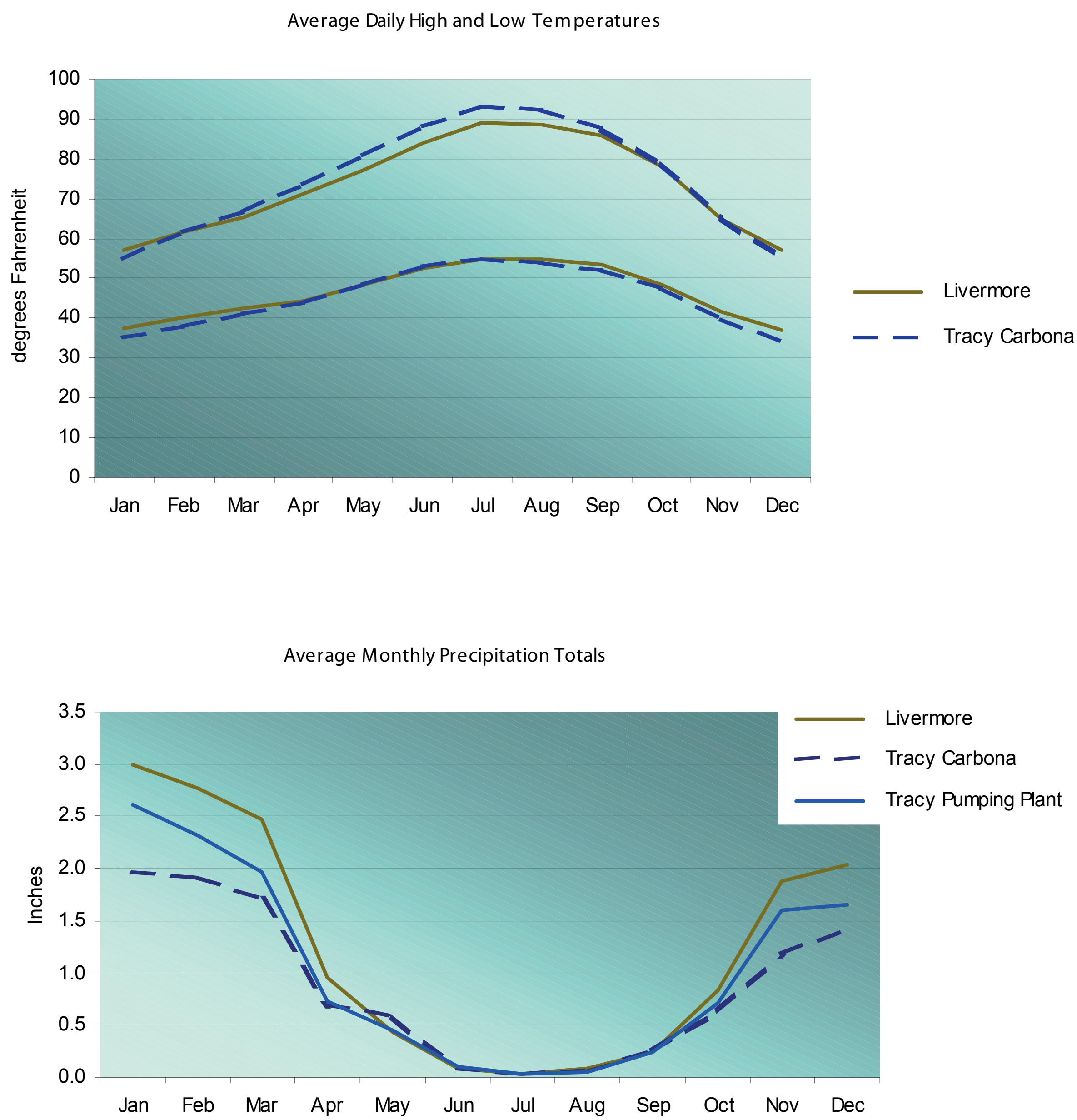
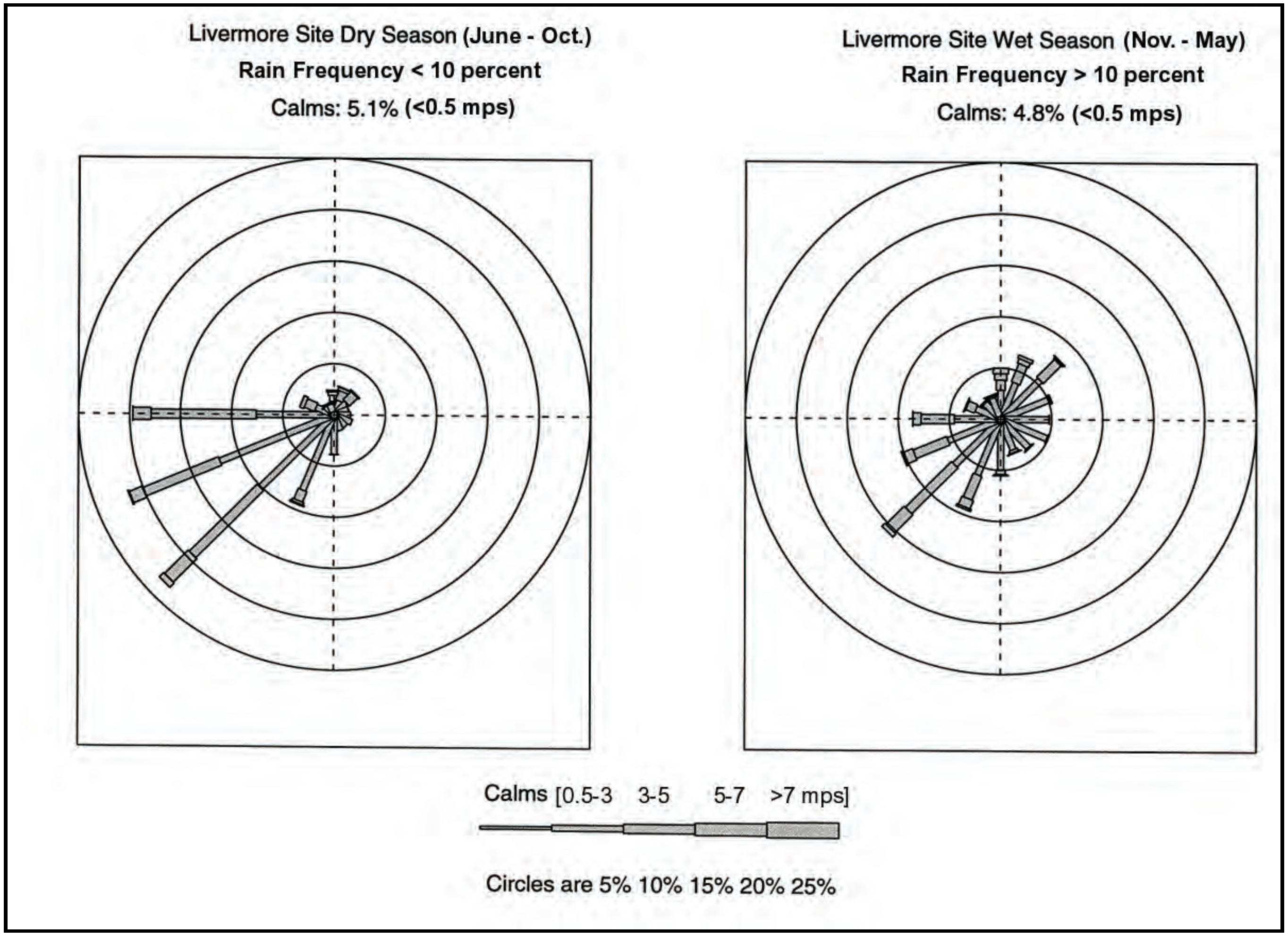


FIGURE 4.3.5–1.—*Minority Populations within 50 Miles of the Livermore Site and Site 300*



Source: NCDC 2002a.

FIGURE 4.7.1–1.—*Average Temperature and Precipitation Totals for Livermore and Tracy*



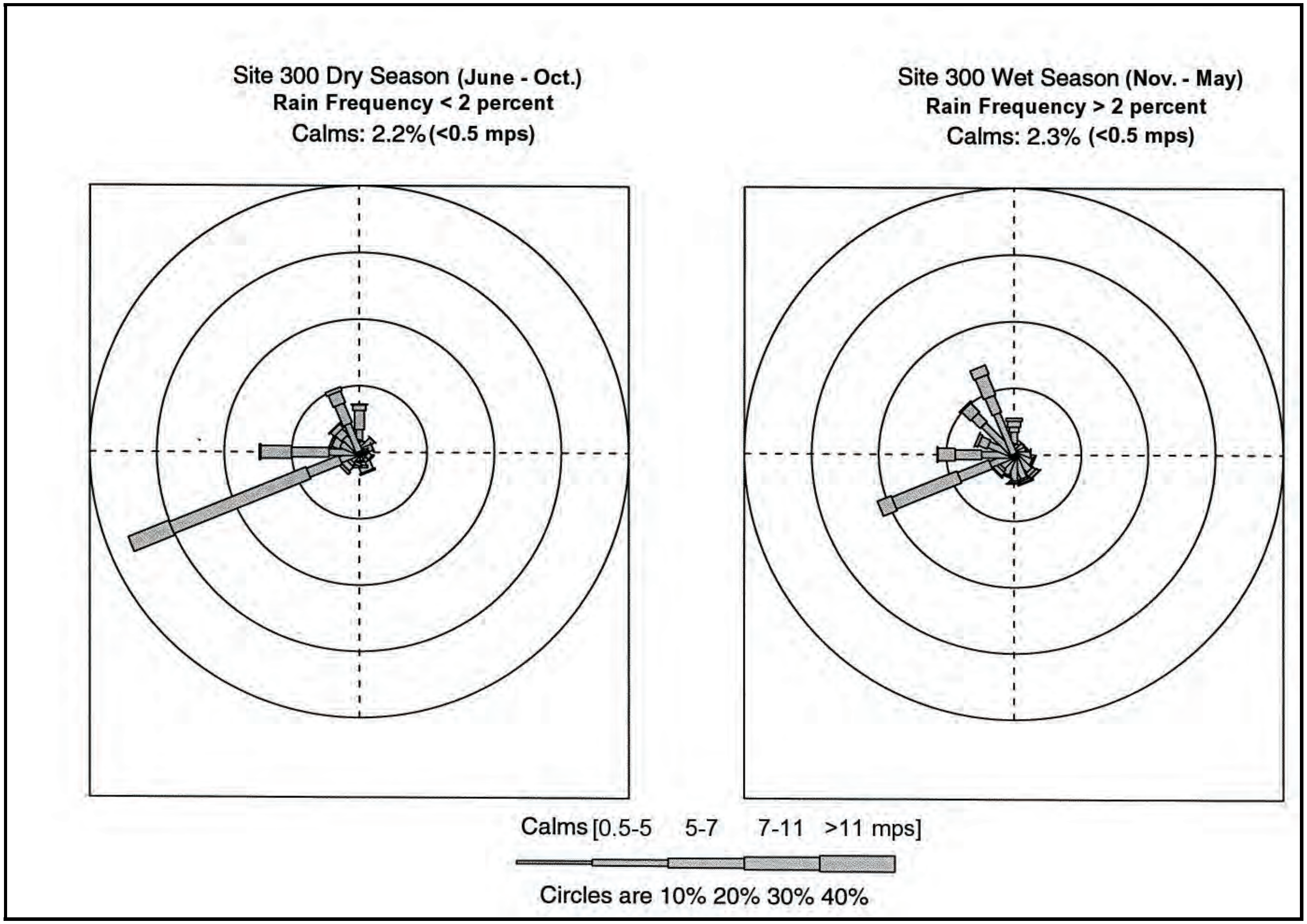
Source: LLNL 2002bx.

Notes: Data from monitoring stations located at Livermore and Site 300.

The absolute length of each directional "telescope," in relation to the percent frequency radials, indicate the frequency of occurrence of each wind direction (direction from which the wind is blowing). Each of the directional telescopes is further segmented to indicate the frequency of individual wind speed classes. Each directional telescope consists of up to four segments relating to wind speed categories, with wider segments corresponding to increasingly higher wind speeds. The relative lengths of individual "telescope segments" are used to infer the frequency of occurrence of wind speed classes for each of the 16 compass wind directions.

One meter per second (mps) equals 2.2 miles per hour.

FIGURE 4.7.3–1.—*Seasonal Wind Roses for the Livermore Site (1997 – 2001)*



Source: LLNL 2002ci.
[a] See notes for Figure 4.7.3-1.

FIGURE 4.7.3–2.—*Seasonal Wind Roses for Site 300 (1997 – 2001)[a]*

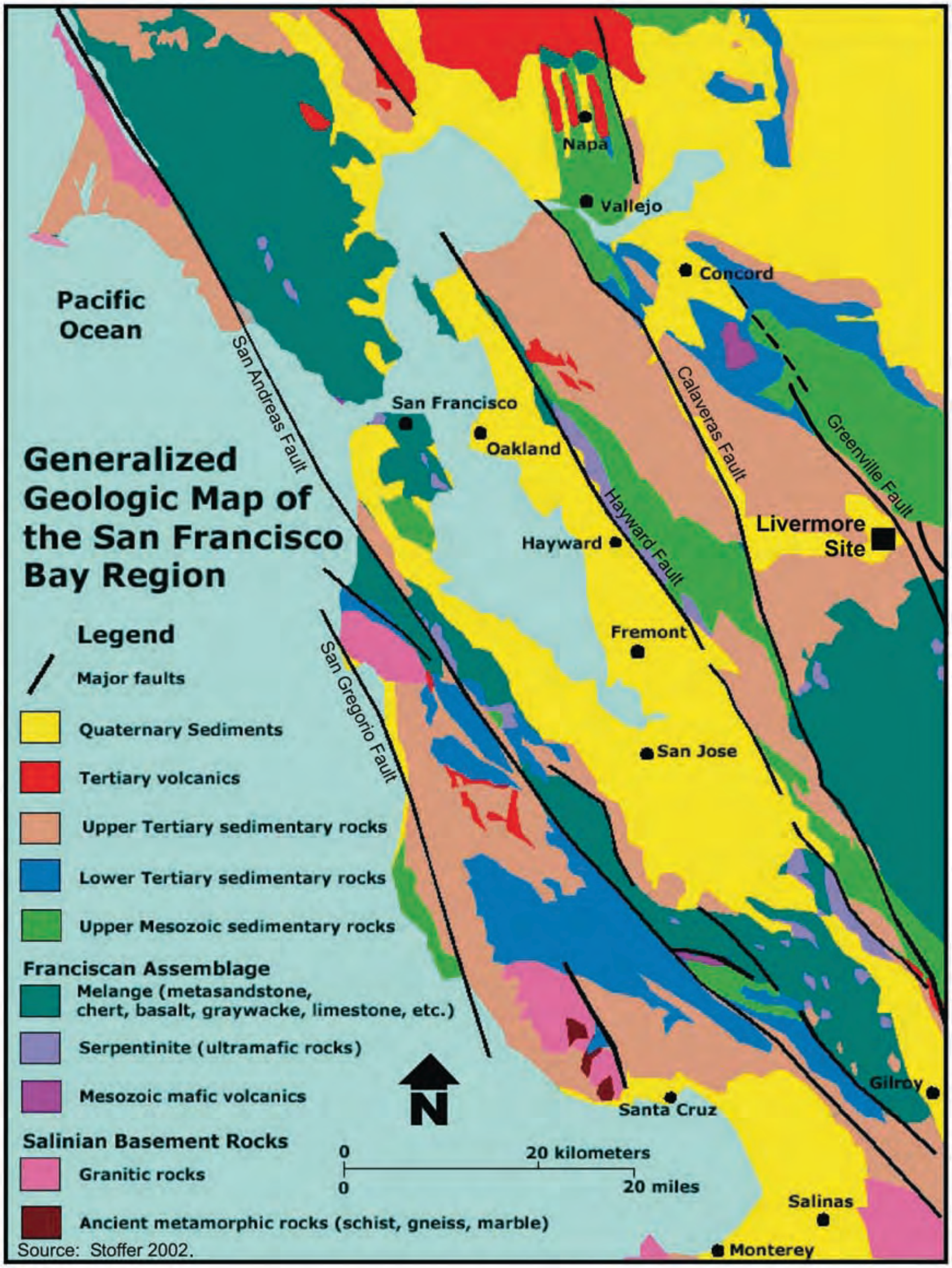
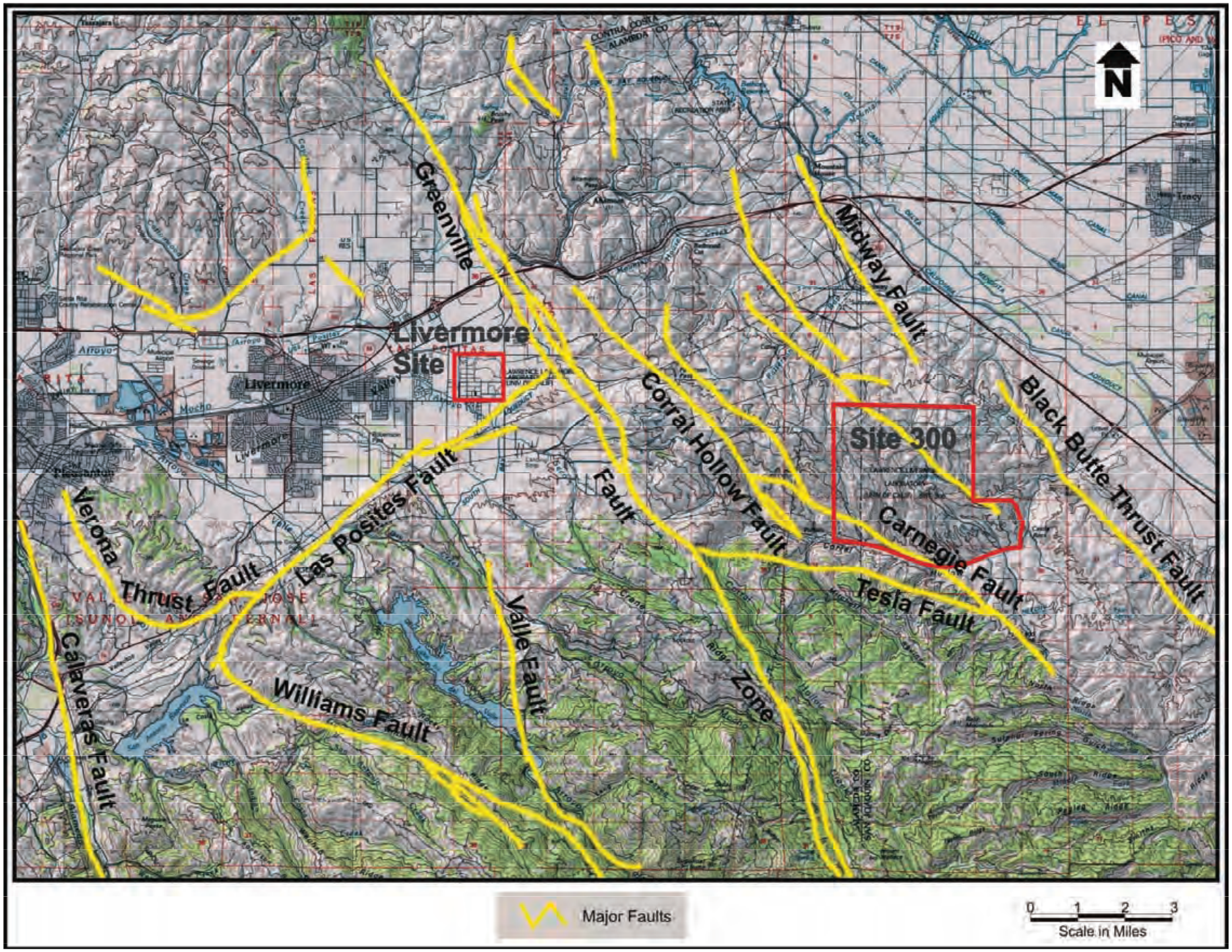
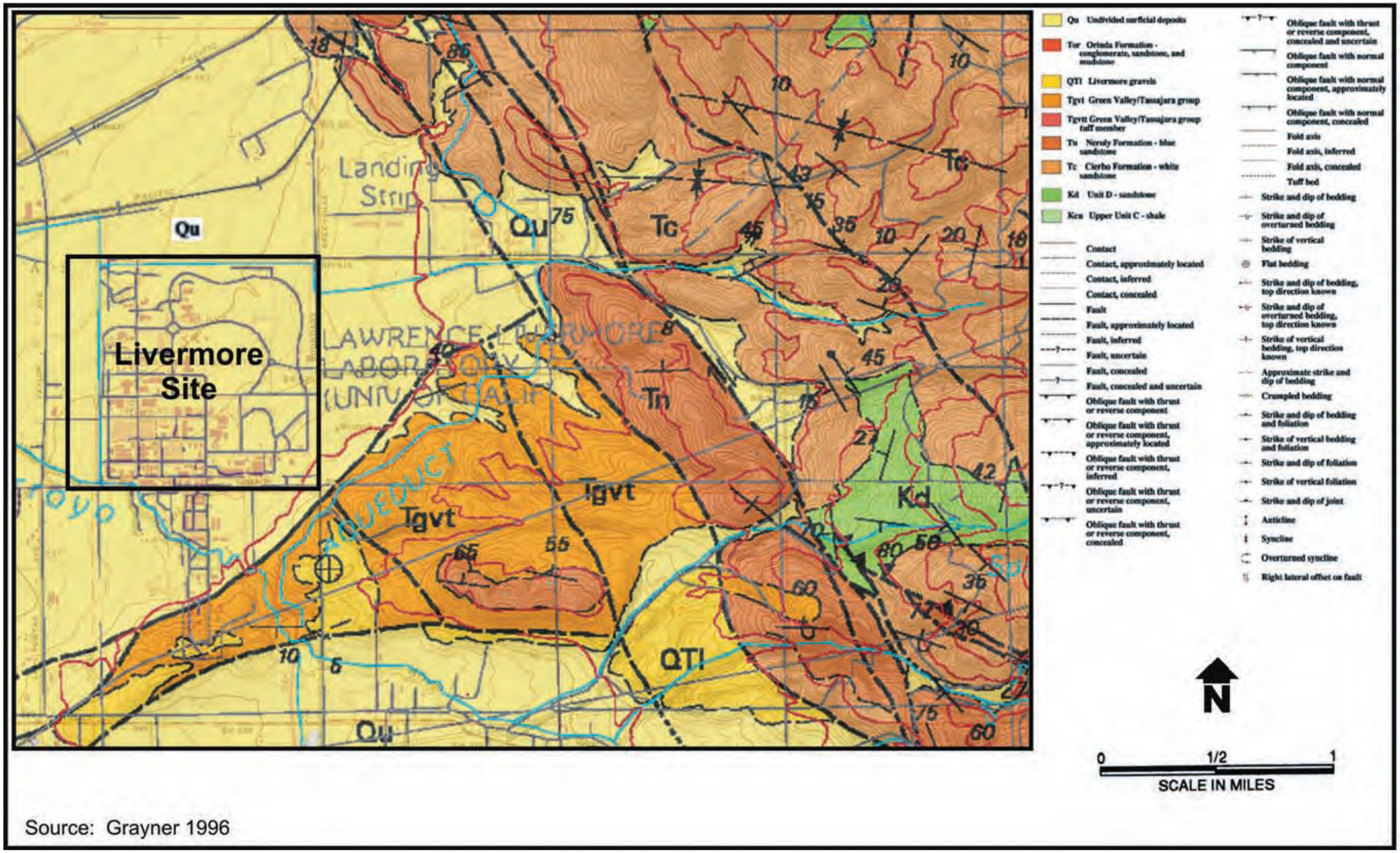


FIGURE 4.8.1–1.—*Generalized Geologic Map of the San Francisco Bay Area Showing the Location of the Livermore Site*



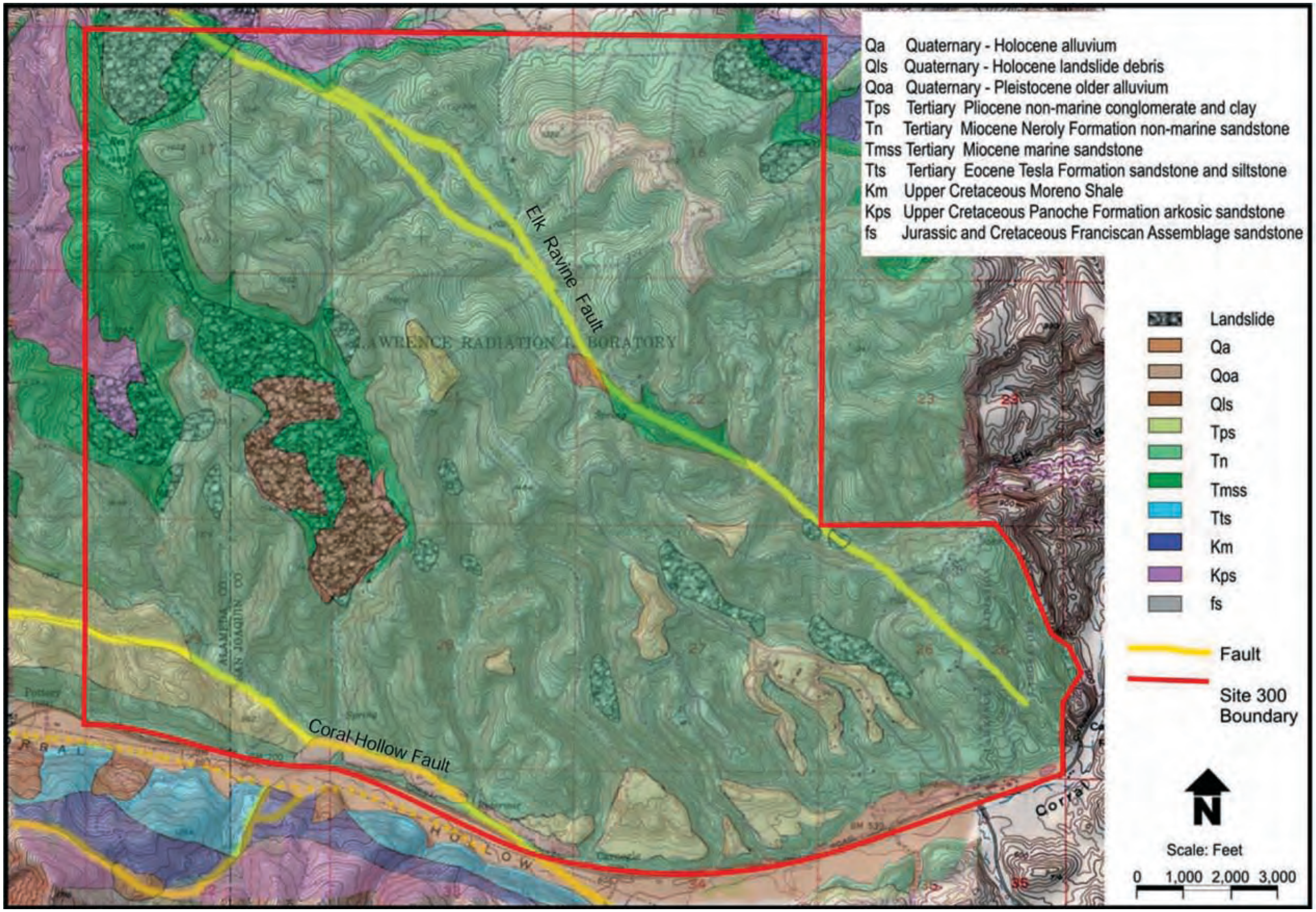
Source: LLNL 1992a.

FIGURE 4.8.1–2.—*Location of the Major Faults Adjacent to the Livermore Site and Site 300*



Source: Graymer et al. 1996.

FIGURE 4.8.1–3.—*Geological Map of the Southeast Livermore Valley*



Source: LLNL 1992a.

FIGURE 4.8.1–4.—*Geological Map of Site 300*

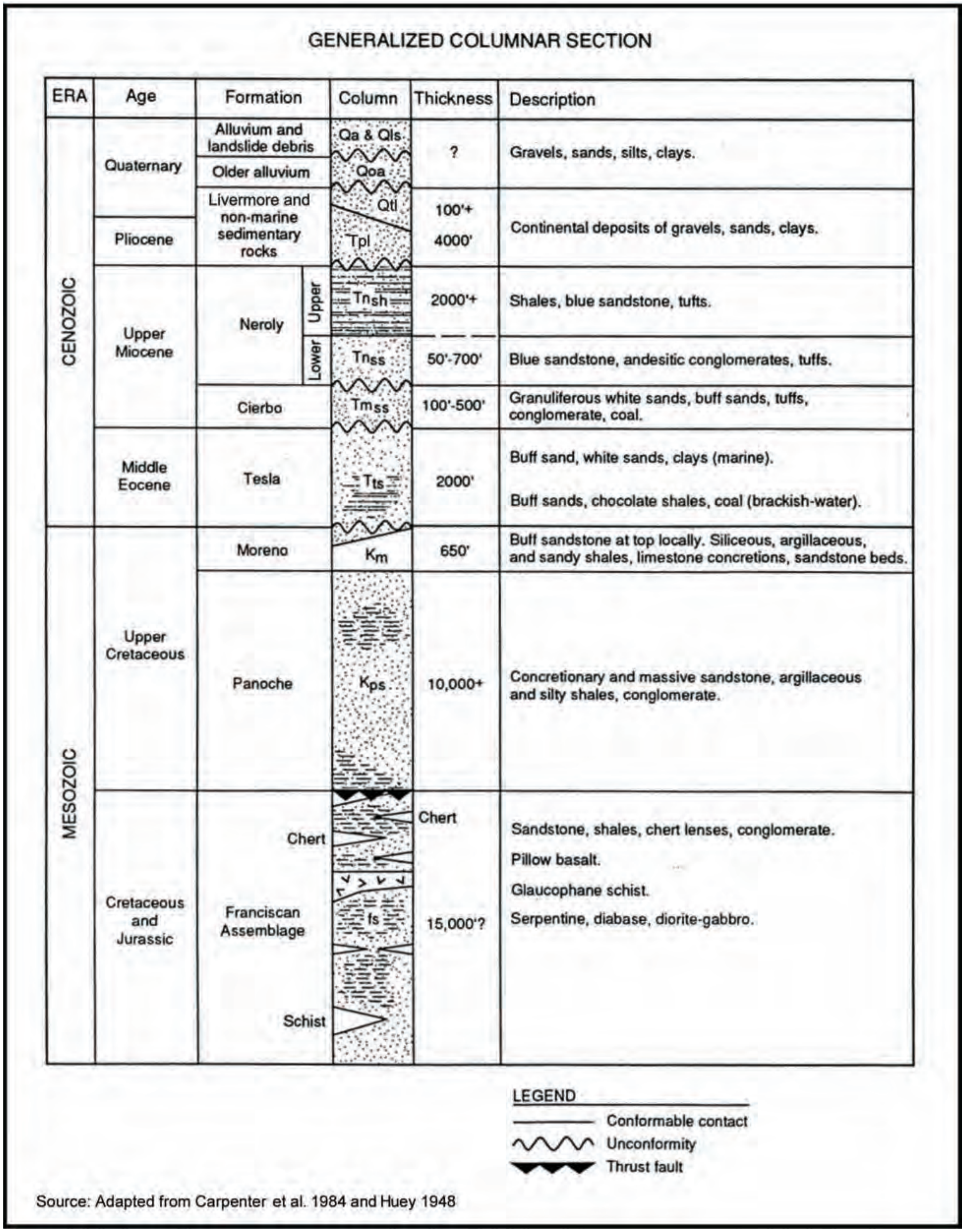


FIGURE 4.8.1–5.—*Stratigraphic Column for the Livermore Site and Site 300*

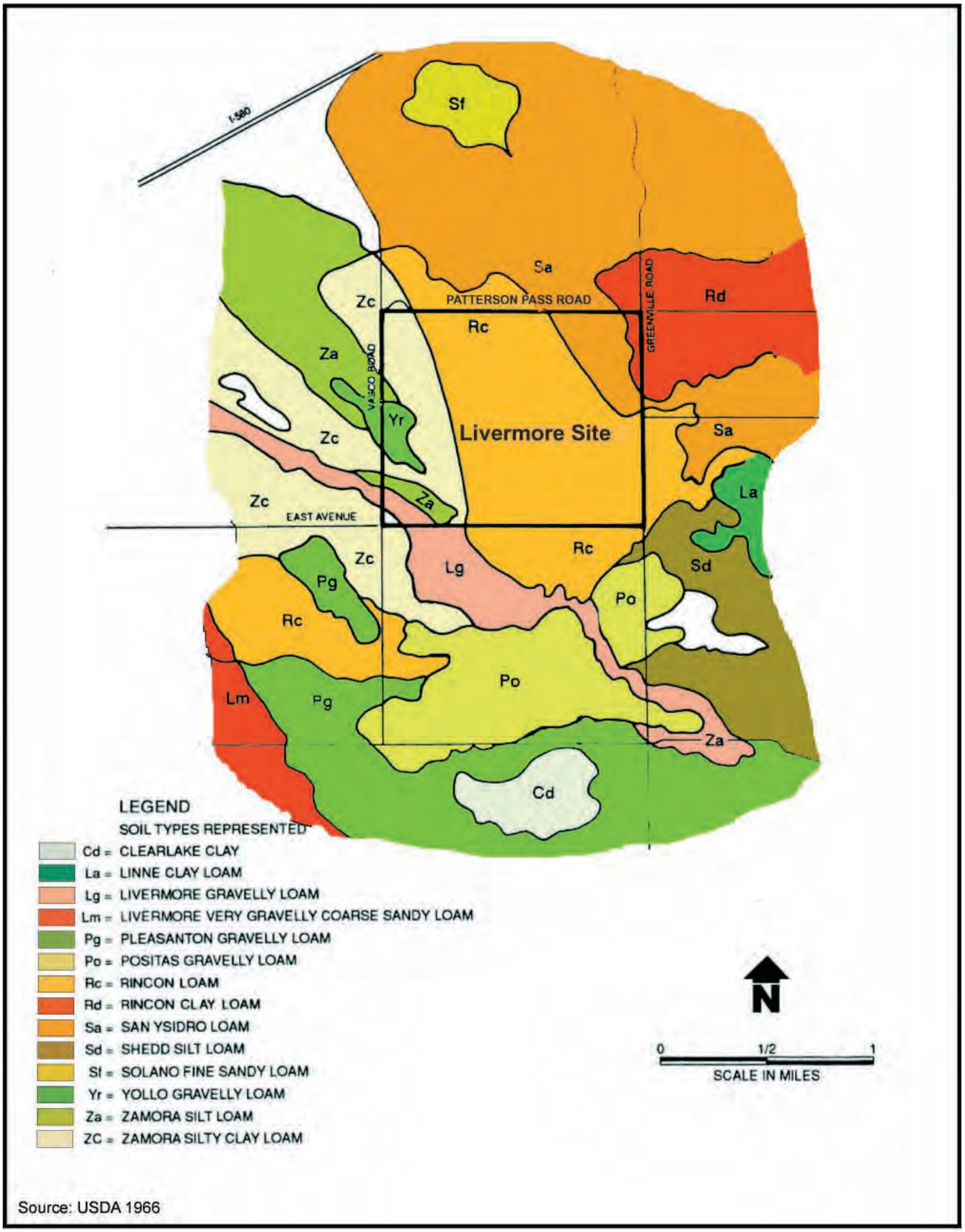


FIGURE 4.8.1–6.—*Soil Map of the Southeast Livermore Valley*

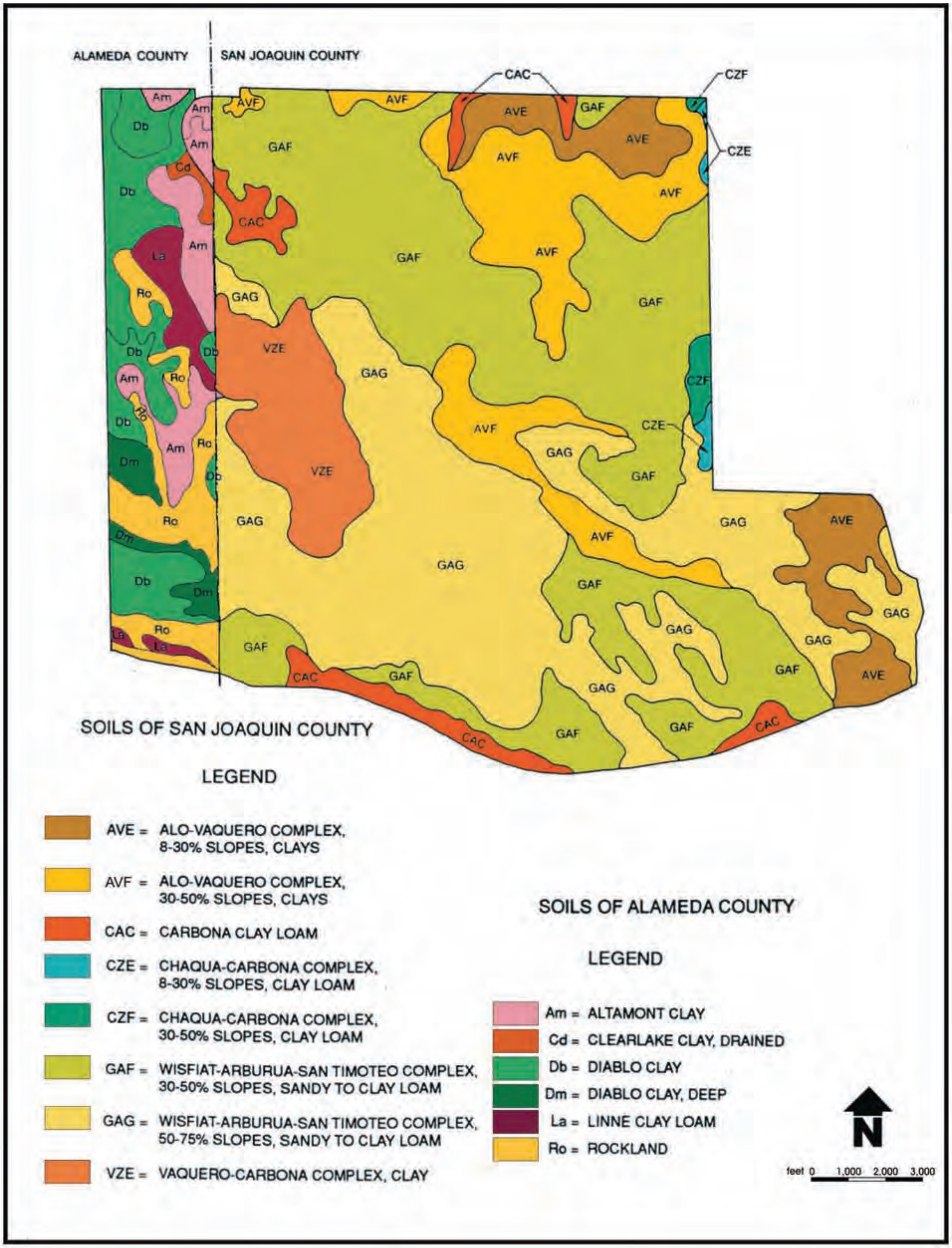


FIGURE 4.8.1–7.—*Soil Map of Site 300*

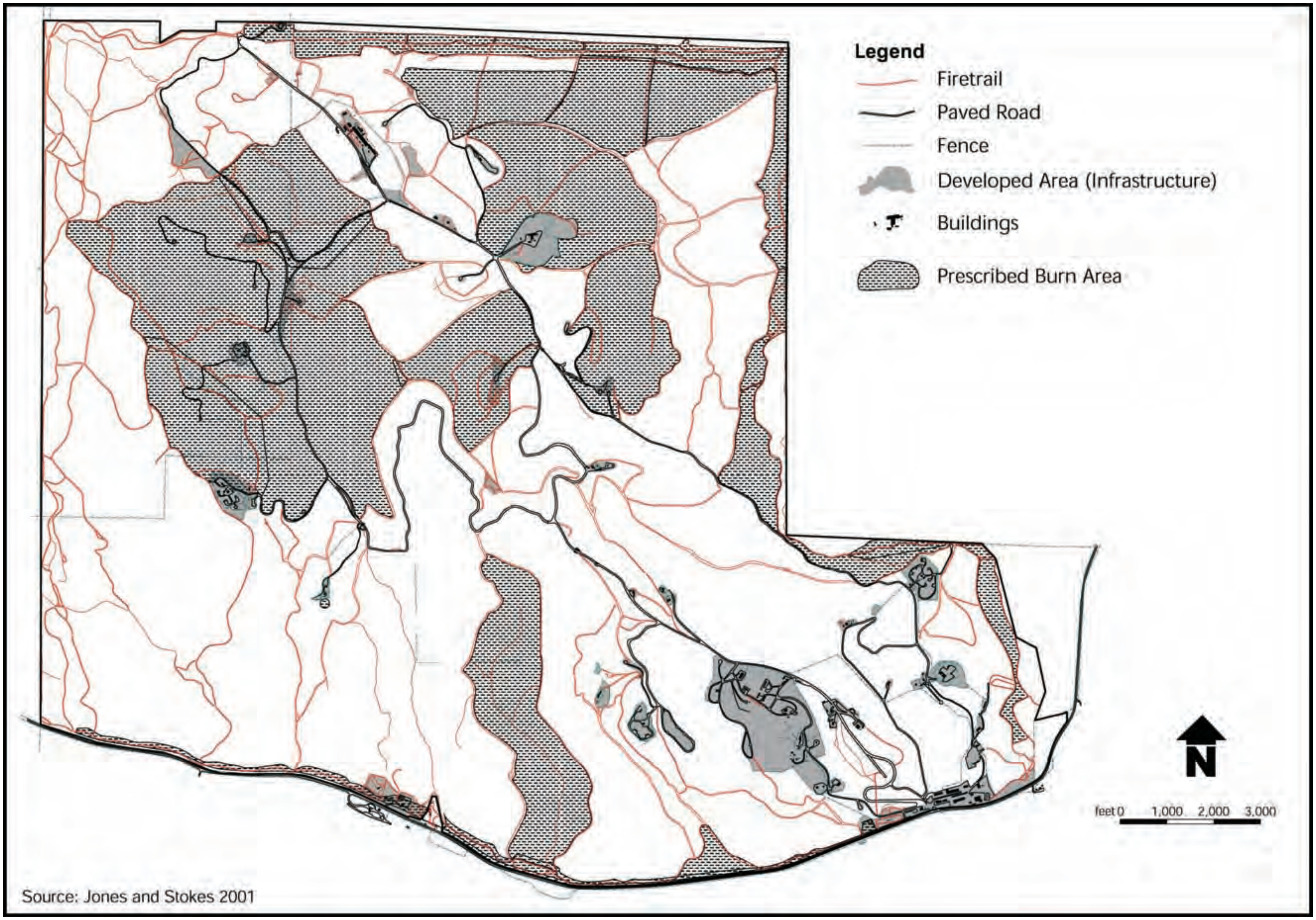


FIGURE 4.9.1–1.—*Annual Prescribed Burn Areas at Site 300*

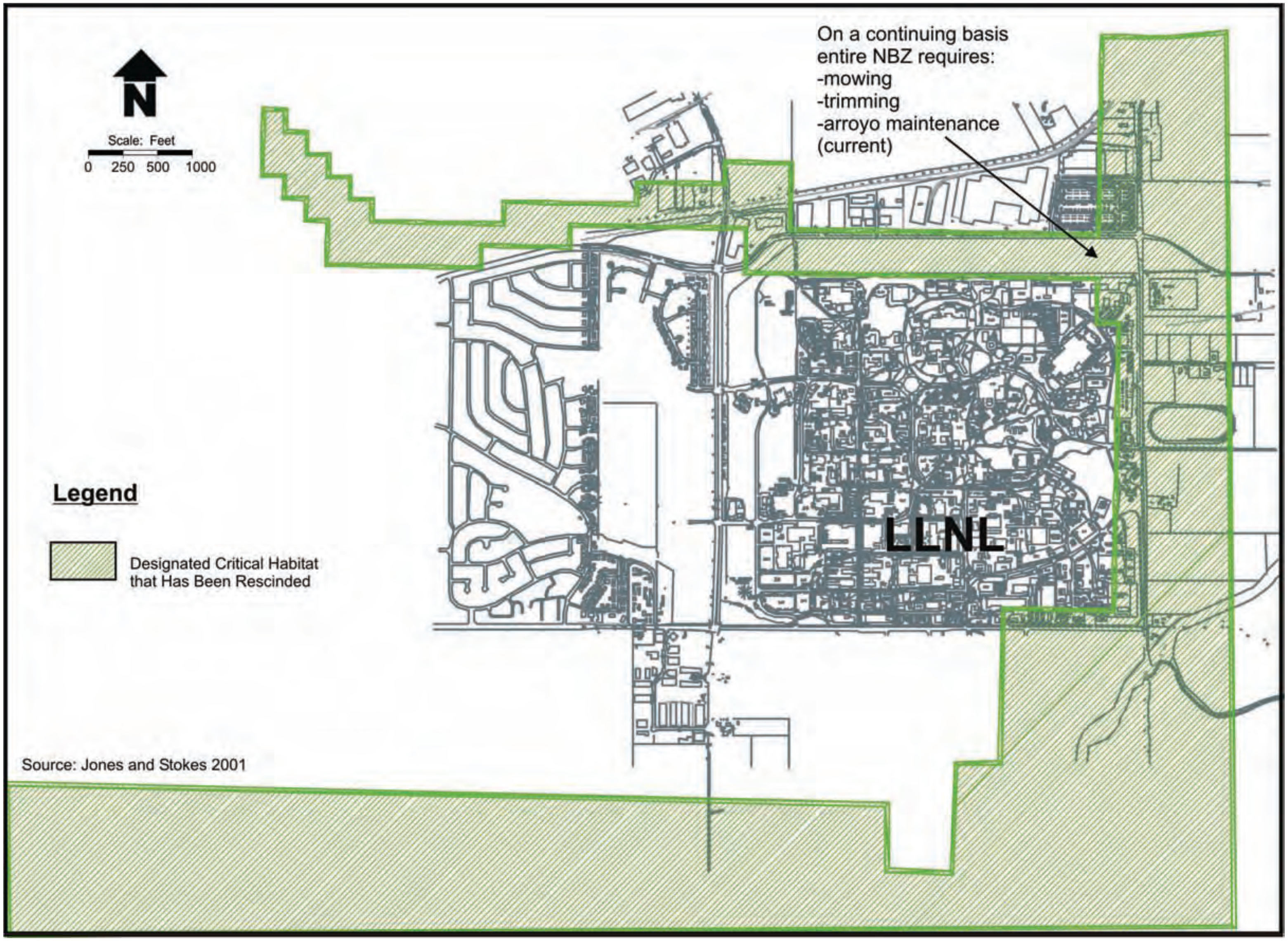


FIGURE 4.9.3–1.—*Location of Rescinded California Red-Legged Frog Designated Critical Habitat at and near the Livermore Site that has been Proposed for Reinstatement*

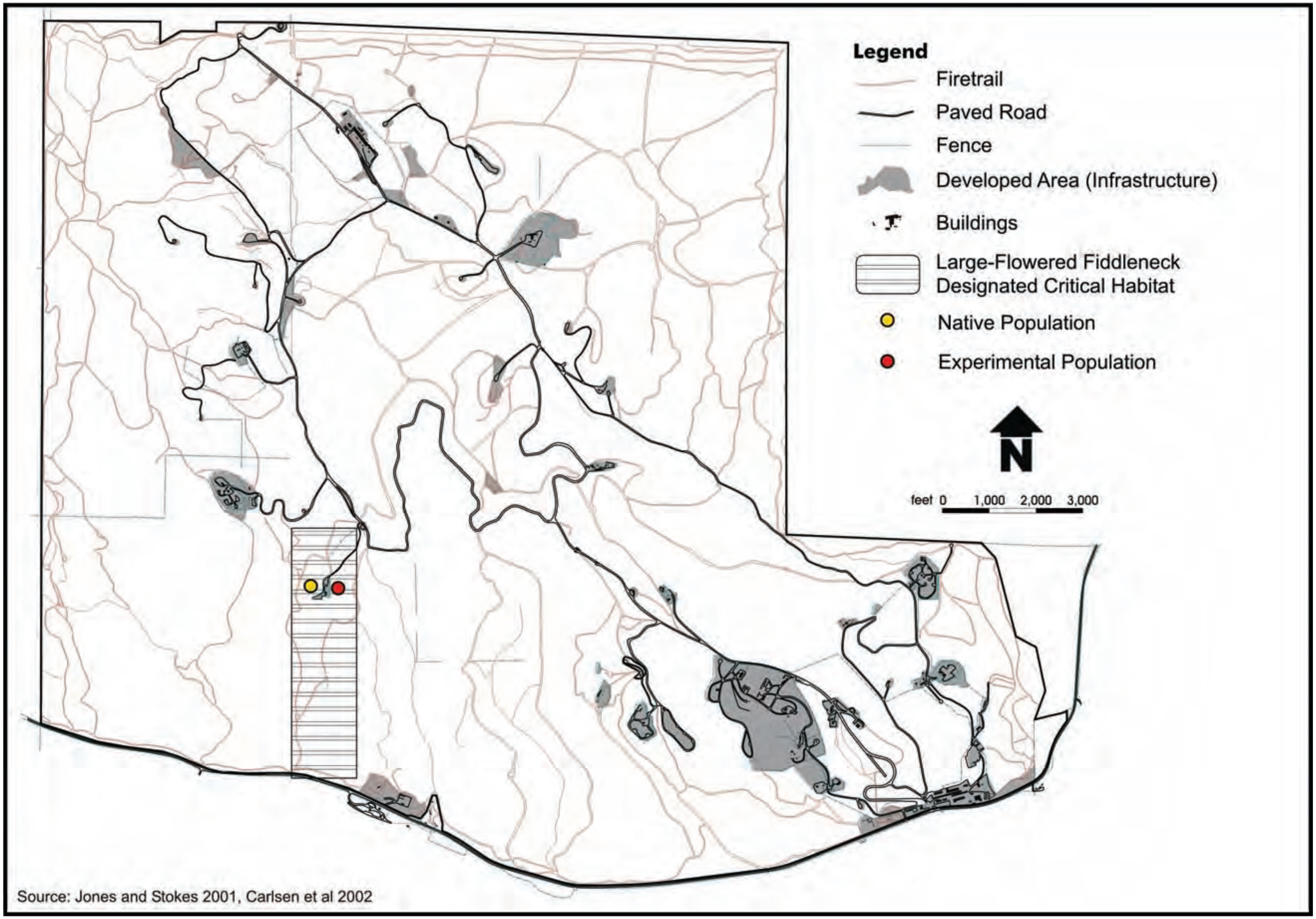
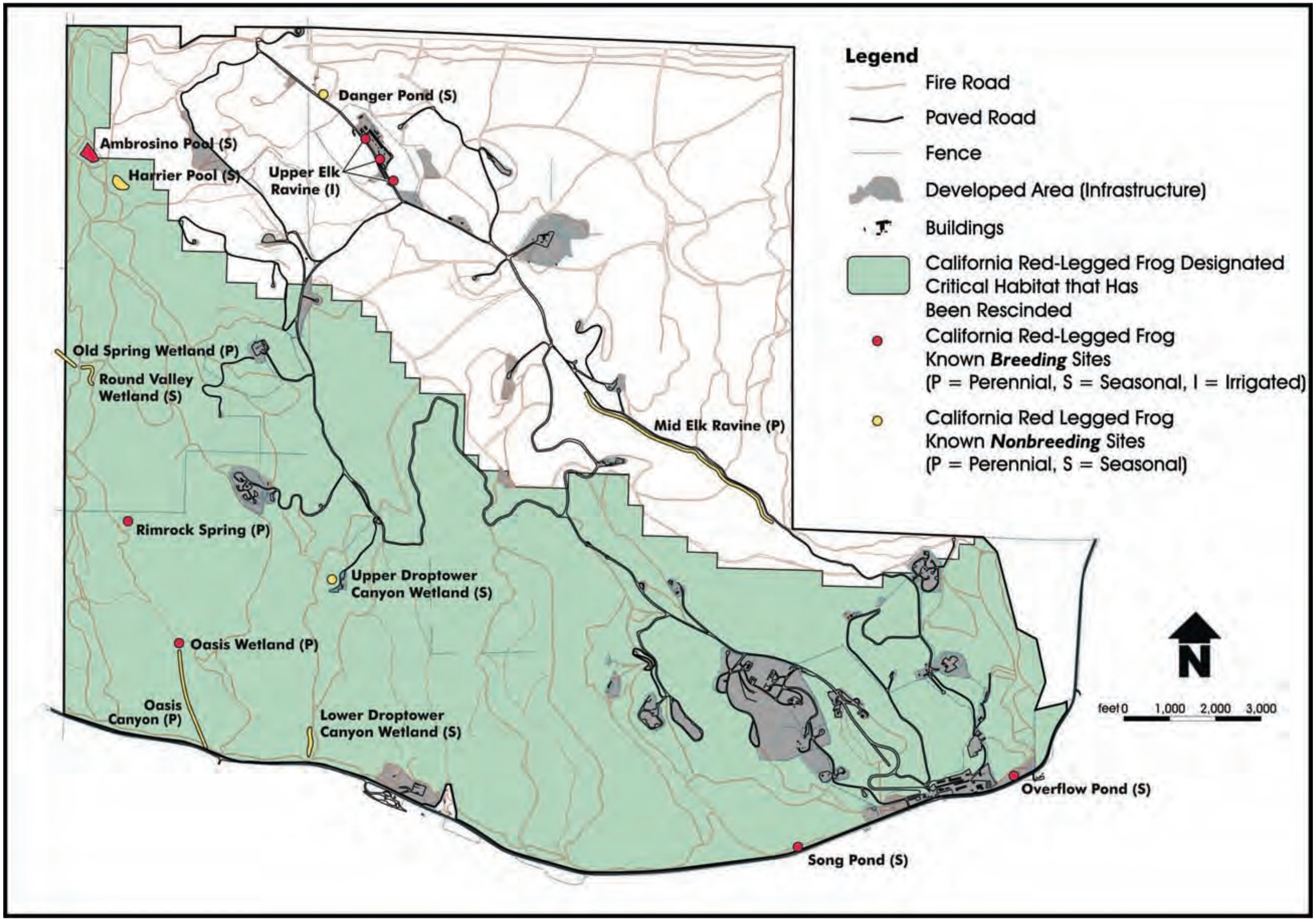


FIGURE 4.9.3–2.—*Location of Large-Flowered Fiddleneck and Critical Habitat at Site 300*



Source: Jones and Stokes 2001.

FIGURE 4.9.3–3.—*Breeding and Nonbreeding Locations for the California Red-Legged Frog at Site 300*

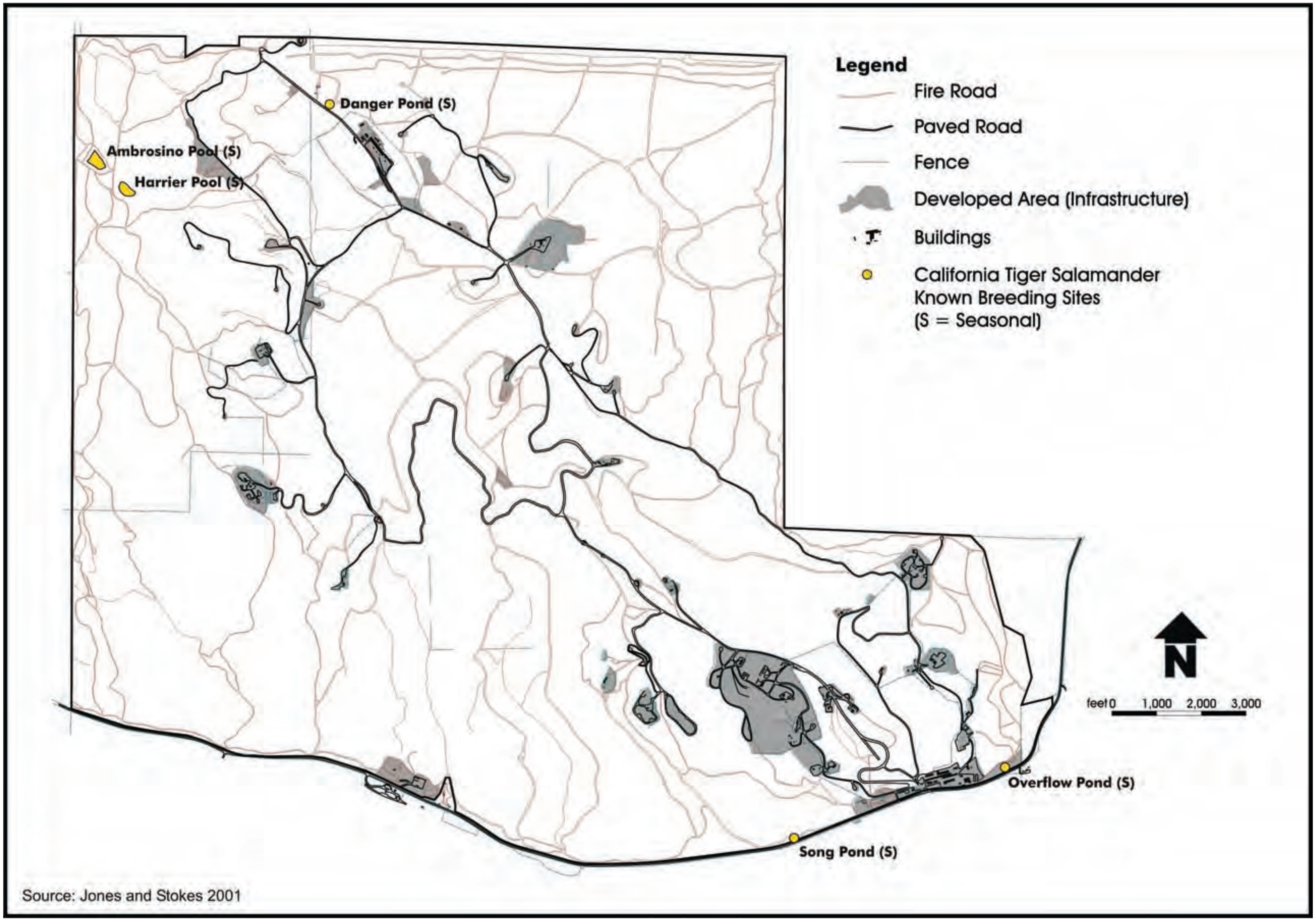


FIGURE 4.9.3–4.—*Breeding Locations for the California Tiger Salamander at Site 300*

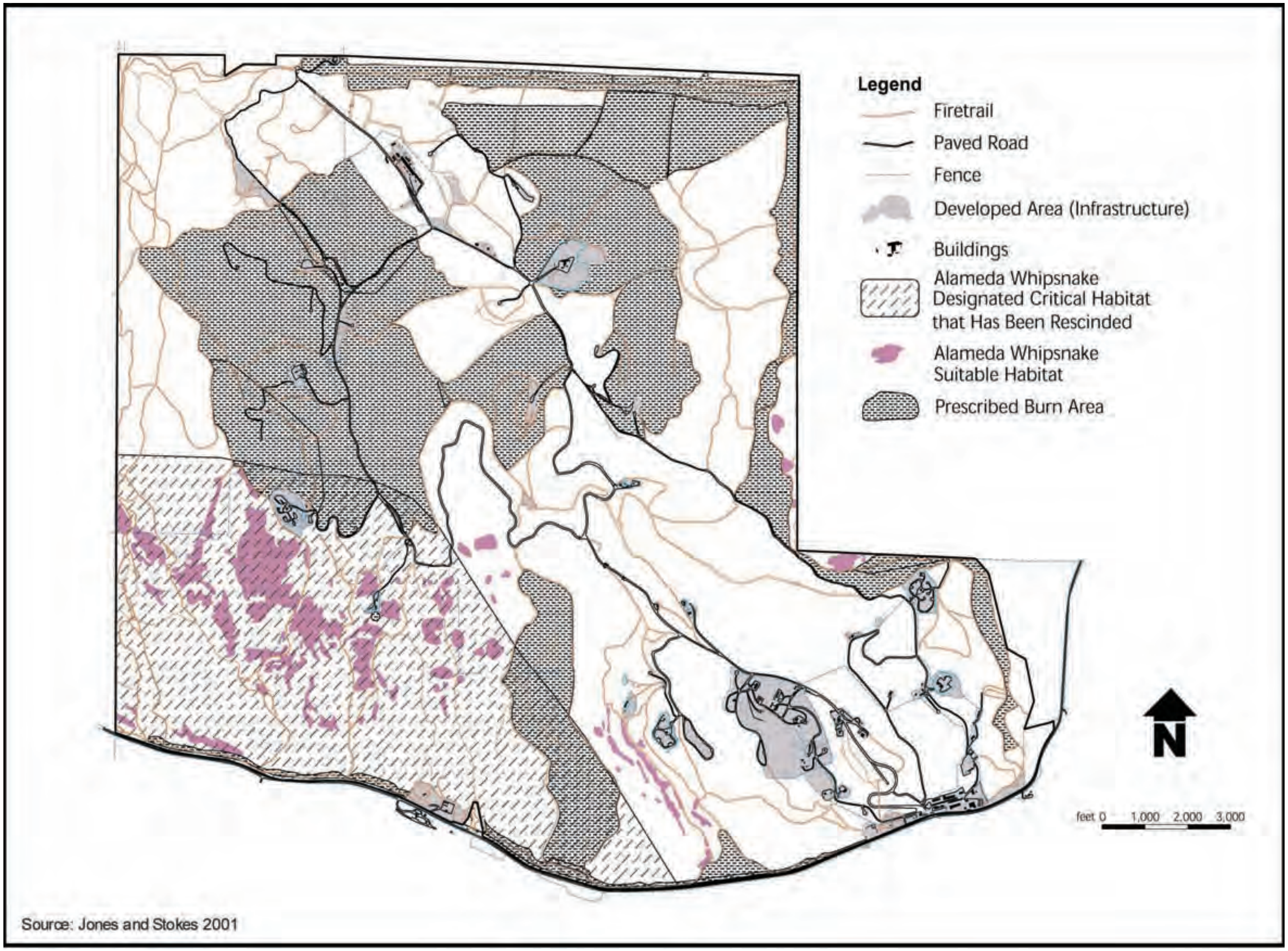
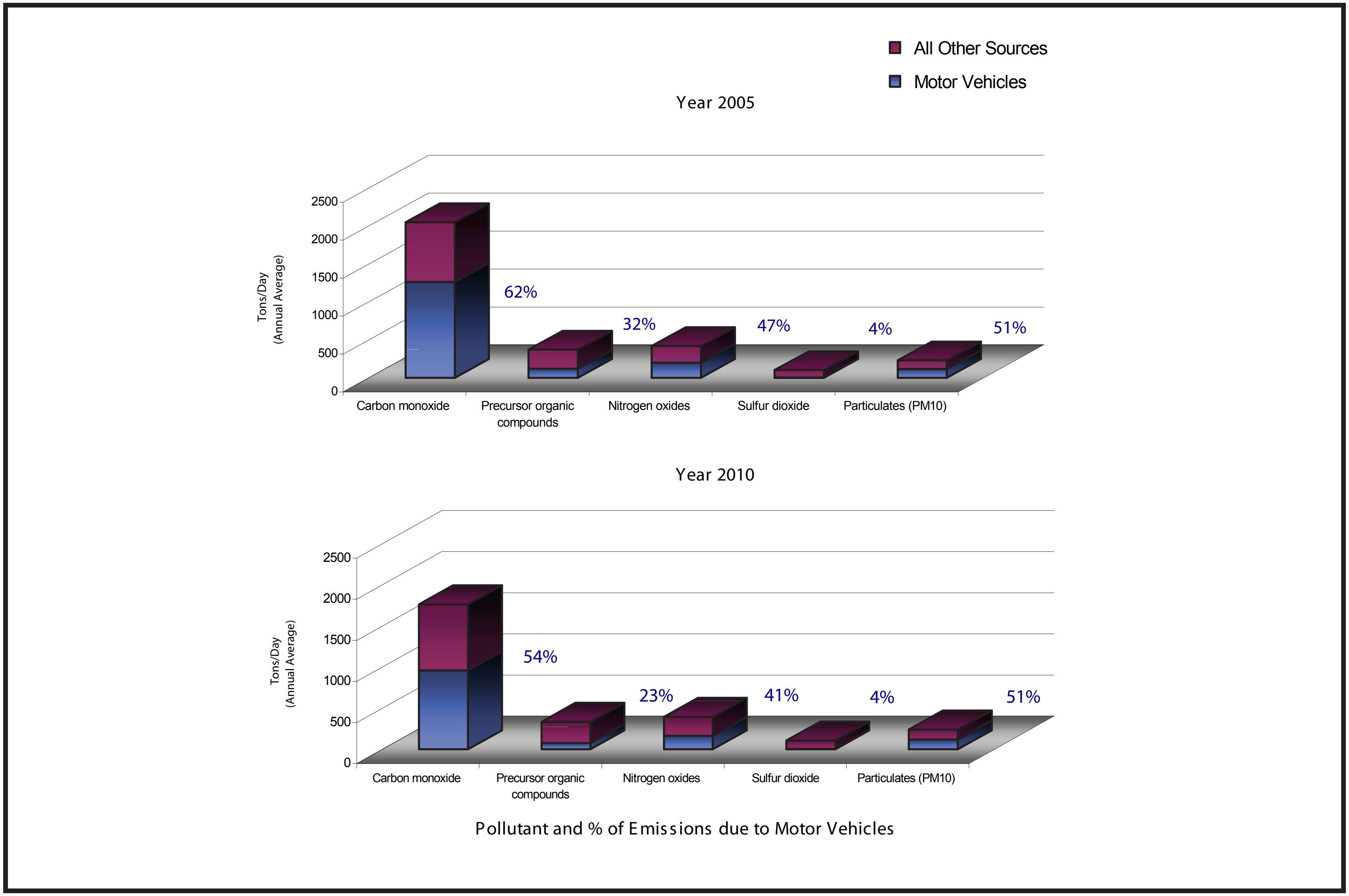


FIGURE 4.9.3–5.—*Formerly Designated Critical Habitat and Potential Habitat for Alameda Whipsnake at Site 300*



Source: BAAQMD 1999.
Note: Projections are based on the district base year 1996 emissions inventory. The category of precursor organic compounds excludes emissions from natural vegetation. Particulate matter emission rate includes entrained road dust.

FIGURE 4.10.2–1.—*Projected Criteria Pollutant Emission Rates for the Bay Area Air Basin Showing Portion Due to Motor Vehicles*

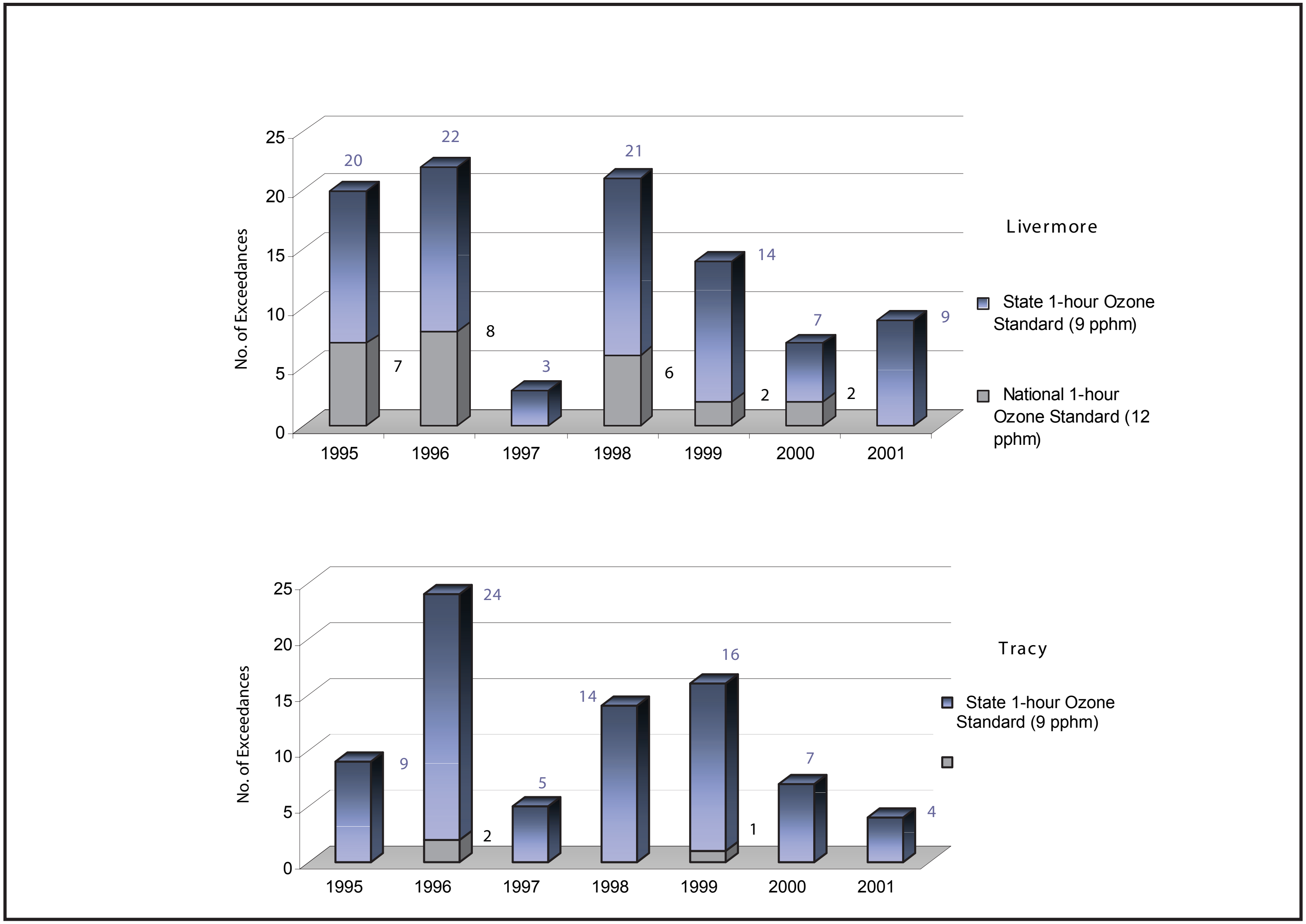
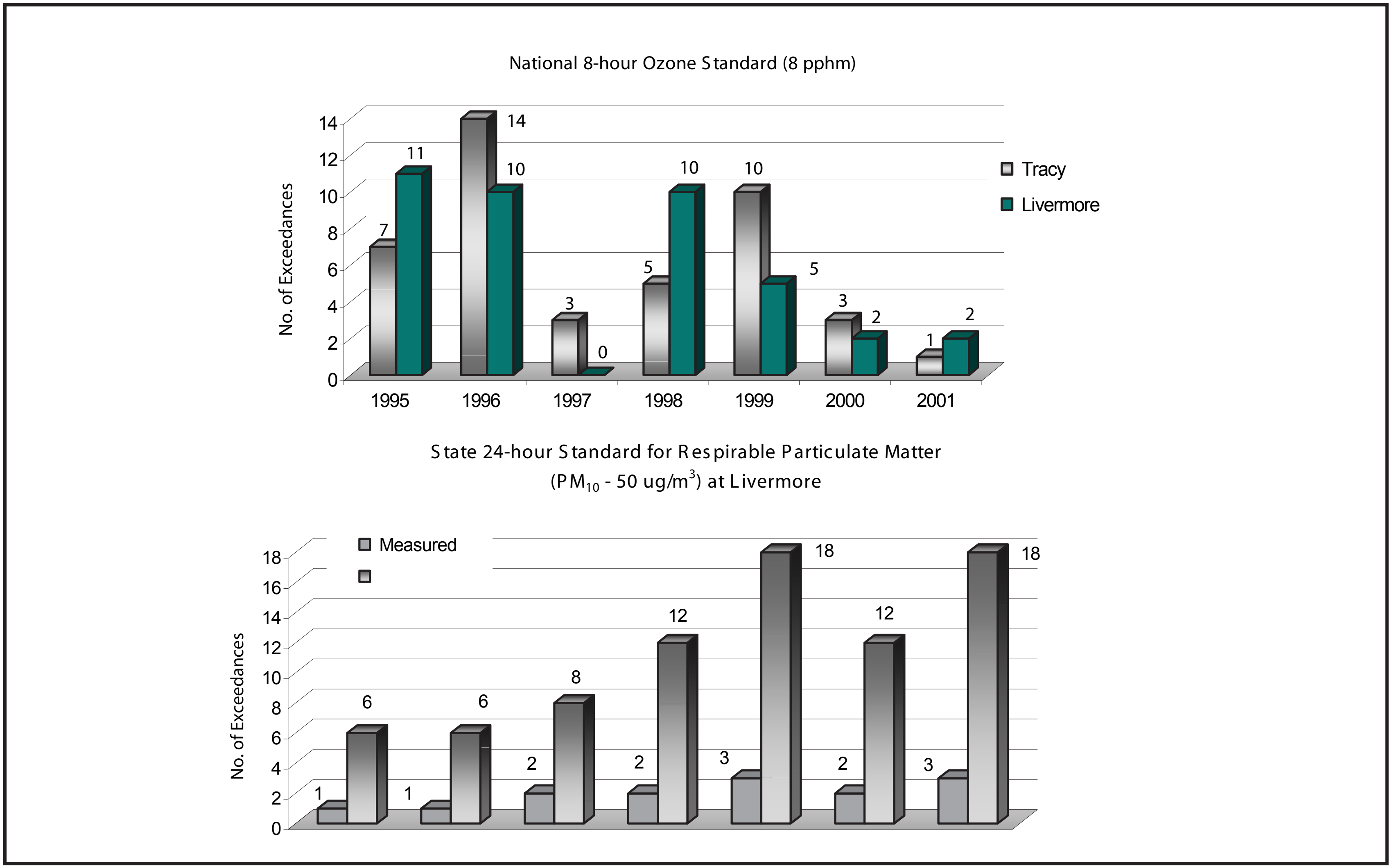


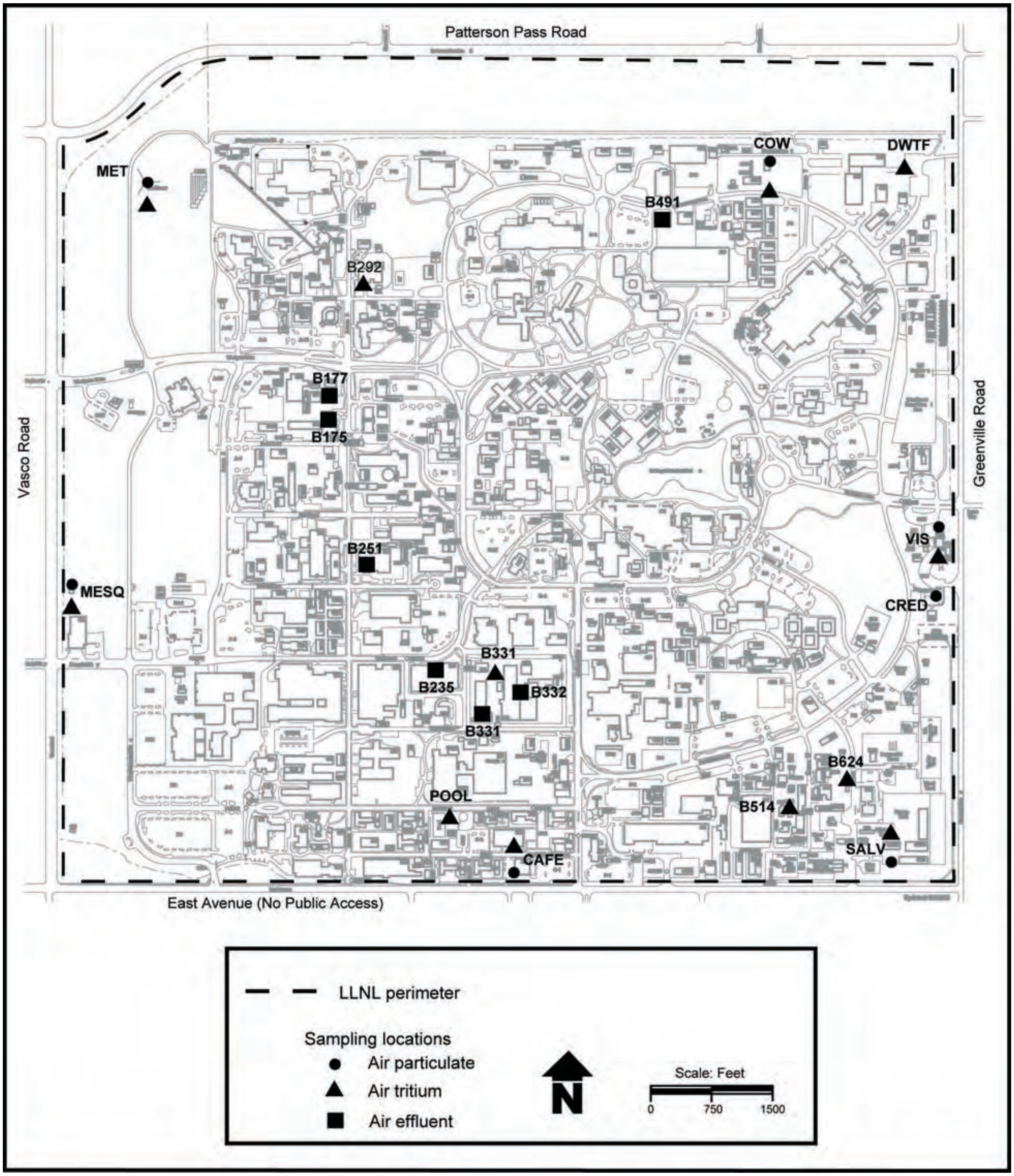
FIGURE 4.10.2–2.—*Tabulation of Exceedances of Ambient Air Quality Standards*



Data collected by air pollution control districts and compiled by the CARB. Extracted from Air Quality Data Statistics website (CARB 2002c). The monitoring station in Tracy is located at Tracy-24371 Patterson Pass Road. In Livermore, measurements have been taken at Livermore-Old 1st Street, and more recently at 793 Rincon Avenue. During overlapping periods (years 1999 and 2000), data from the higher of the two monitoring sites are used.

Depicts number of days at least one measurement was greater than the given standard. Particulate matter measurements are collected every 6 days. Measured days are those days that an actual measurement was greater than the given standard. Calculated days are the estimated number of days that a measurement would have been greater than the level of the standard had measurements been collected every day. Particulates are not monitored at Tracy.
pphm = parts per hundred million; PM_{10} = particulate matter less than 10 microns in diameter; $\mu g/m^3$ = micrograms per cubic meter

FIGURE 4.10.2–2.—*Tabulation of Exceedances of Ambient Air Quality Standards (continued)*



Source: LLNL 2001v.

FIGURE 4.10.5–2.—*Livermore Site Radiation Effluent Air Sampling Locations*

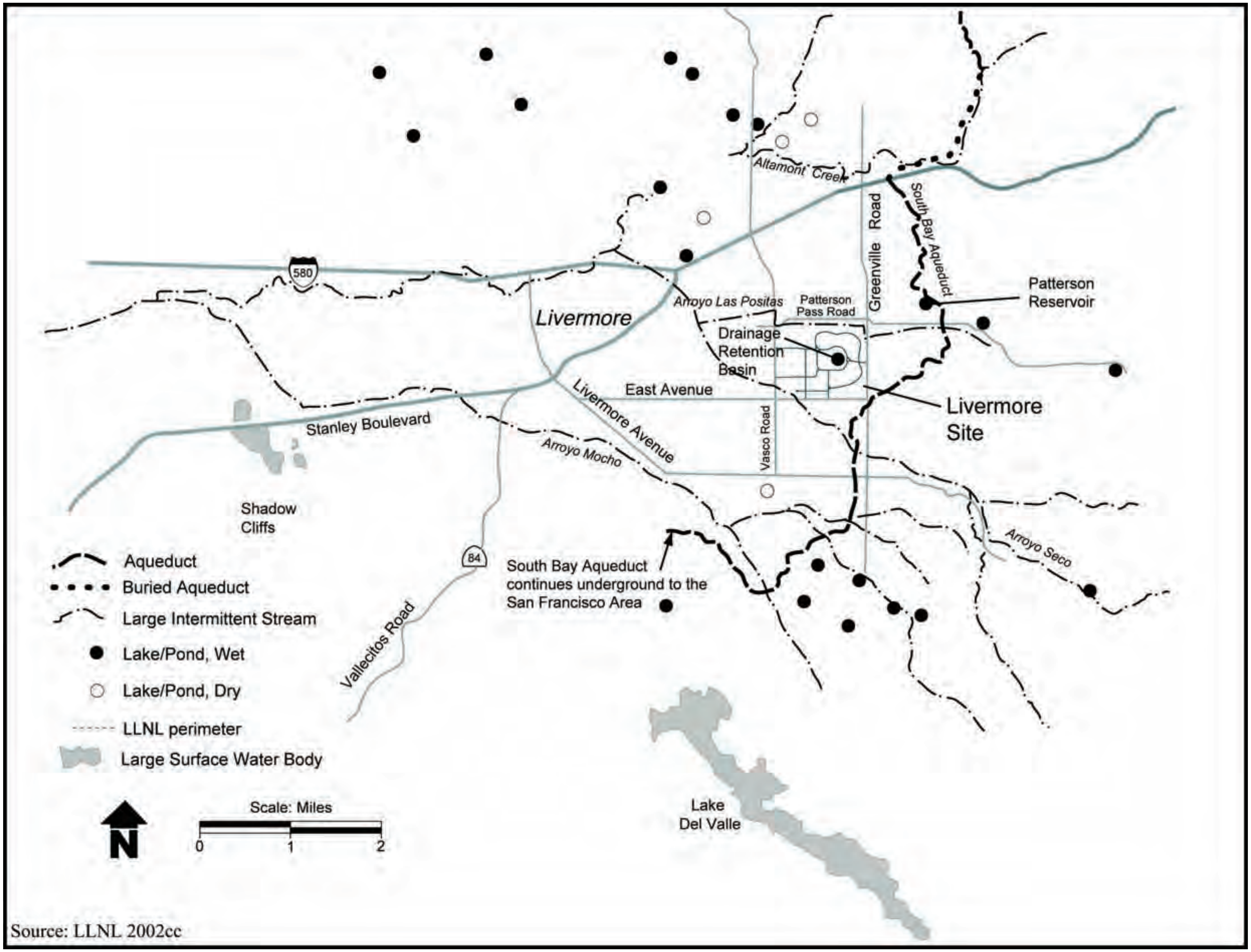


FIGURE 4.11.1–1.—*Livermore Valley Surface Water Features*

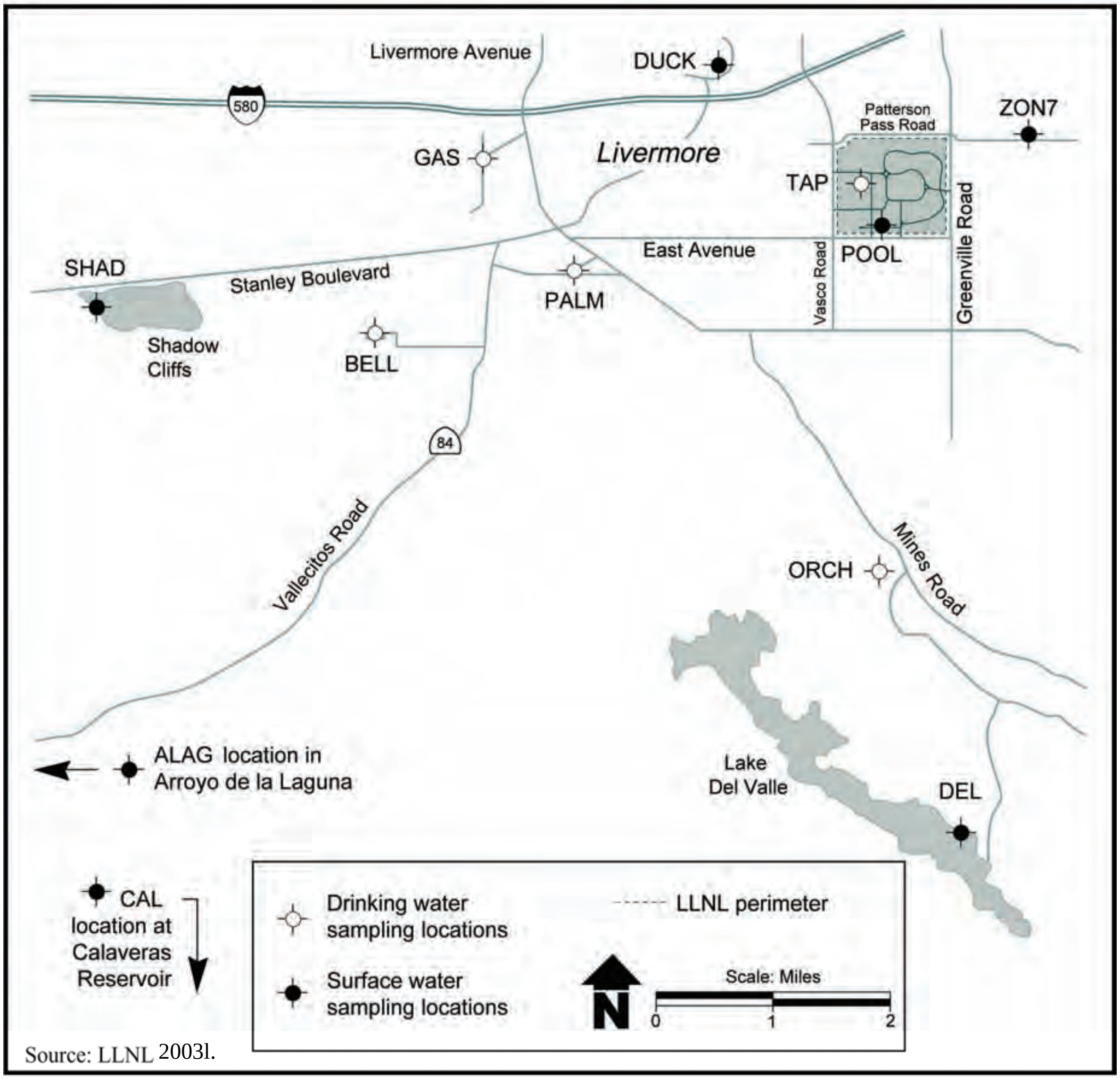


FIGURE 4.11.1–2.—*Livermore Site and Surrounding Area Surface and Drinking Water Sampling Locations*

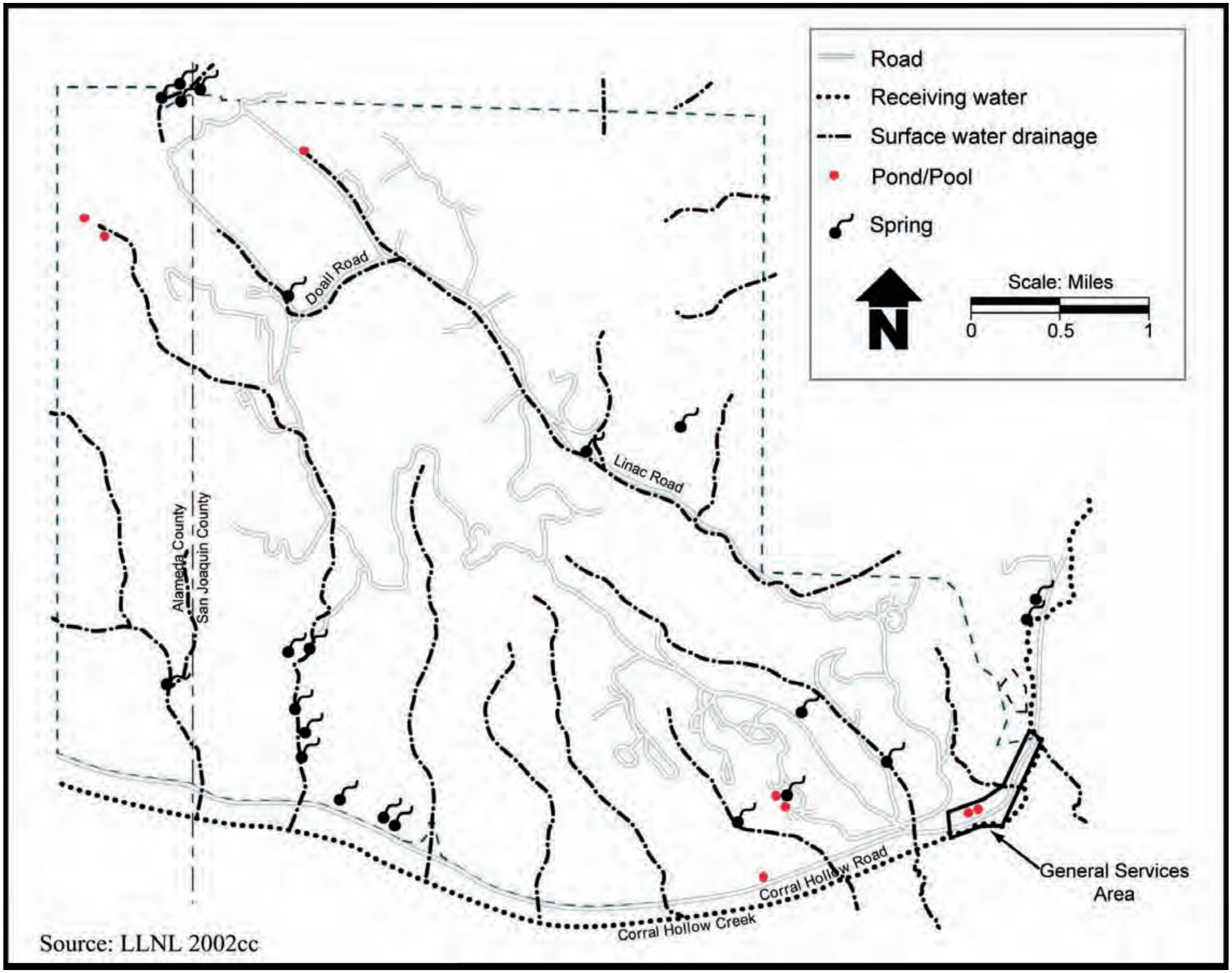


FIGURE 4.11.1–3.—*Site 300 Surface Water Features*

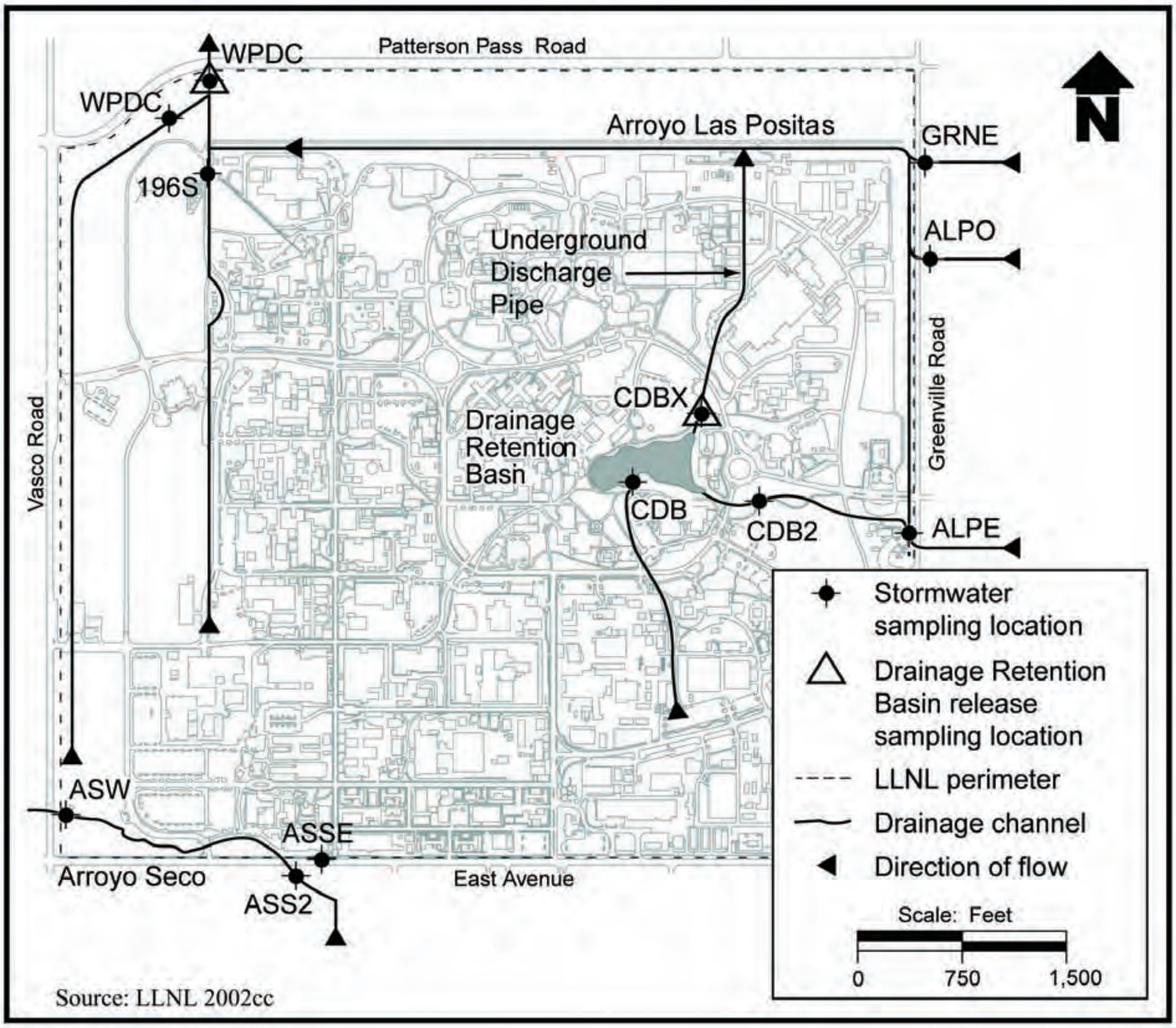


FIGURE 4.11.2–1.—*Livermore Site Stormwater Runoff and Drainage Retention Basin Sampling Locations*

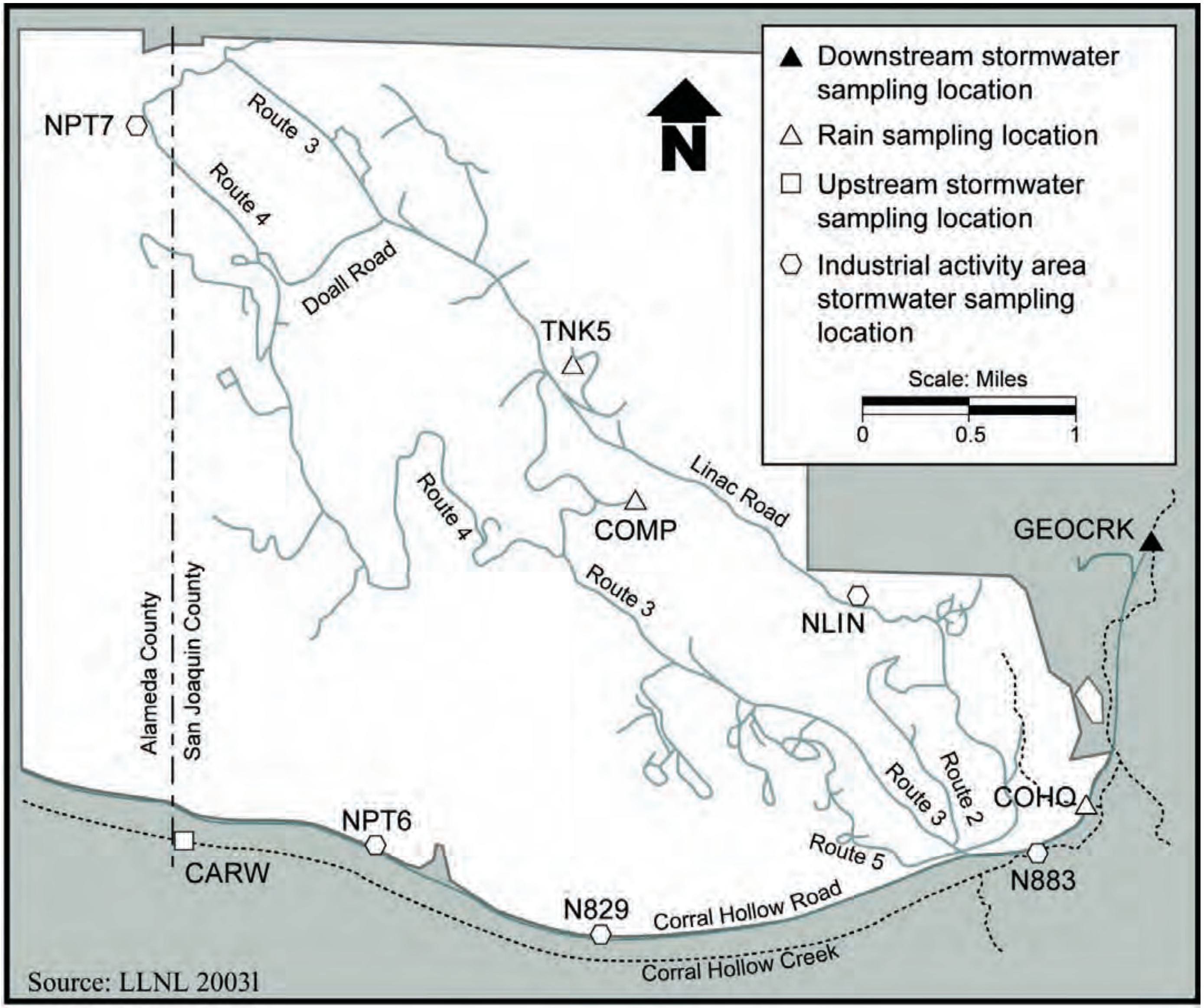


FIGURE 4.11.2–2.—*Site 300 Stormwater and Rainwater Sampling Locations*

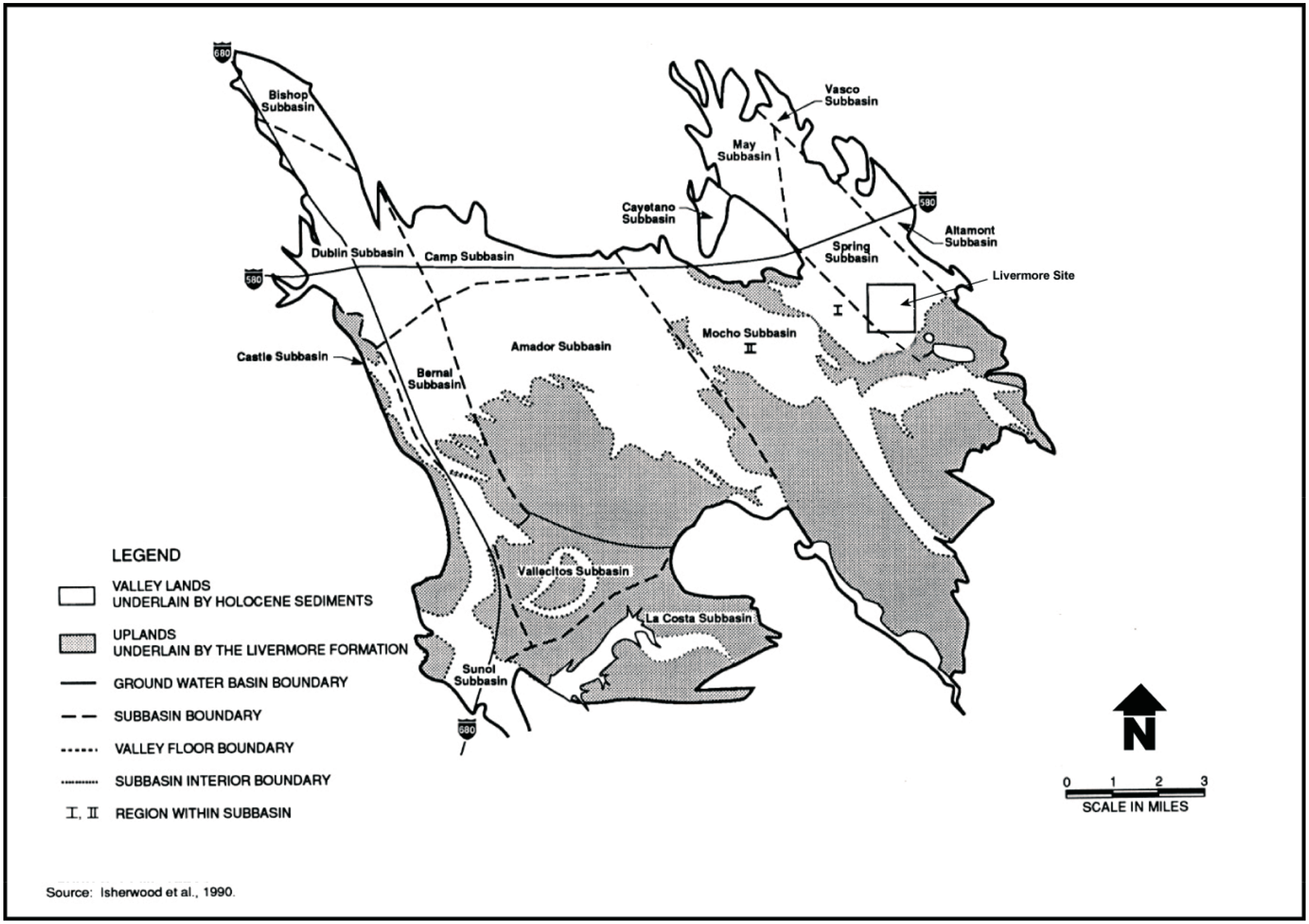
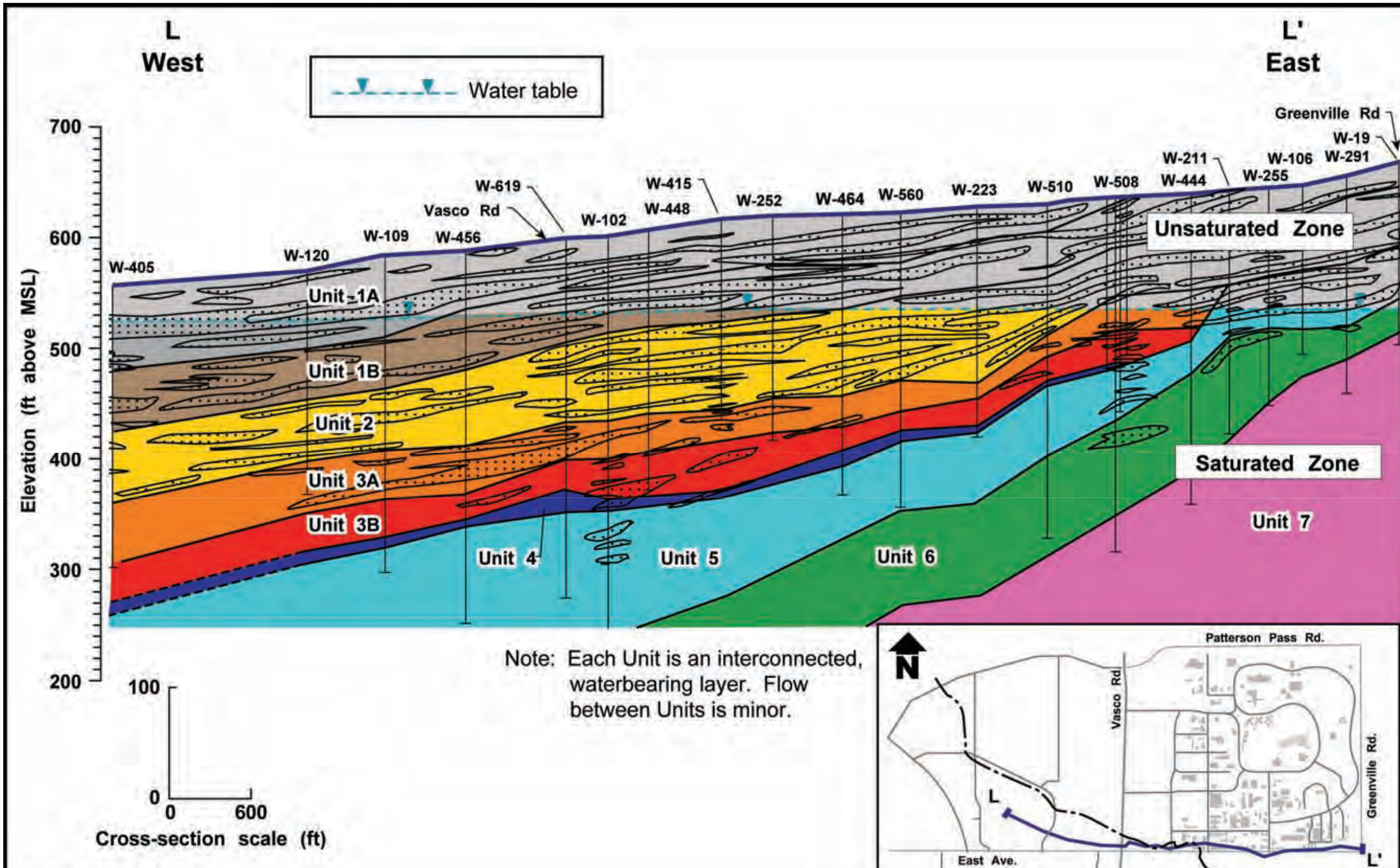


FIGURE 4.11.3.1–1.—*Location of Subbasins and Physiographic Features of the Livermore Valley*



Source: LLNL 2002cc

FIGURE 4.11.3.2–1.—*Hydrogeologic Cross Section of the Livermore Site*

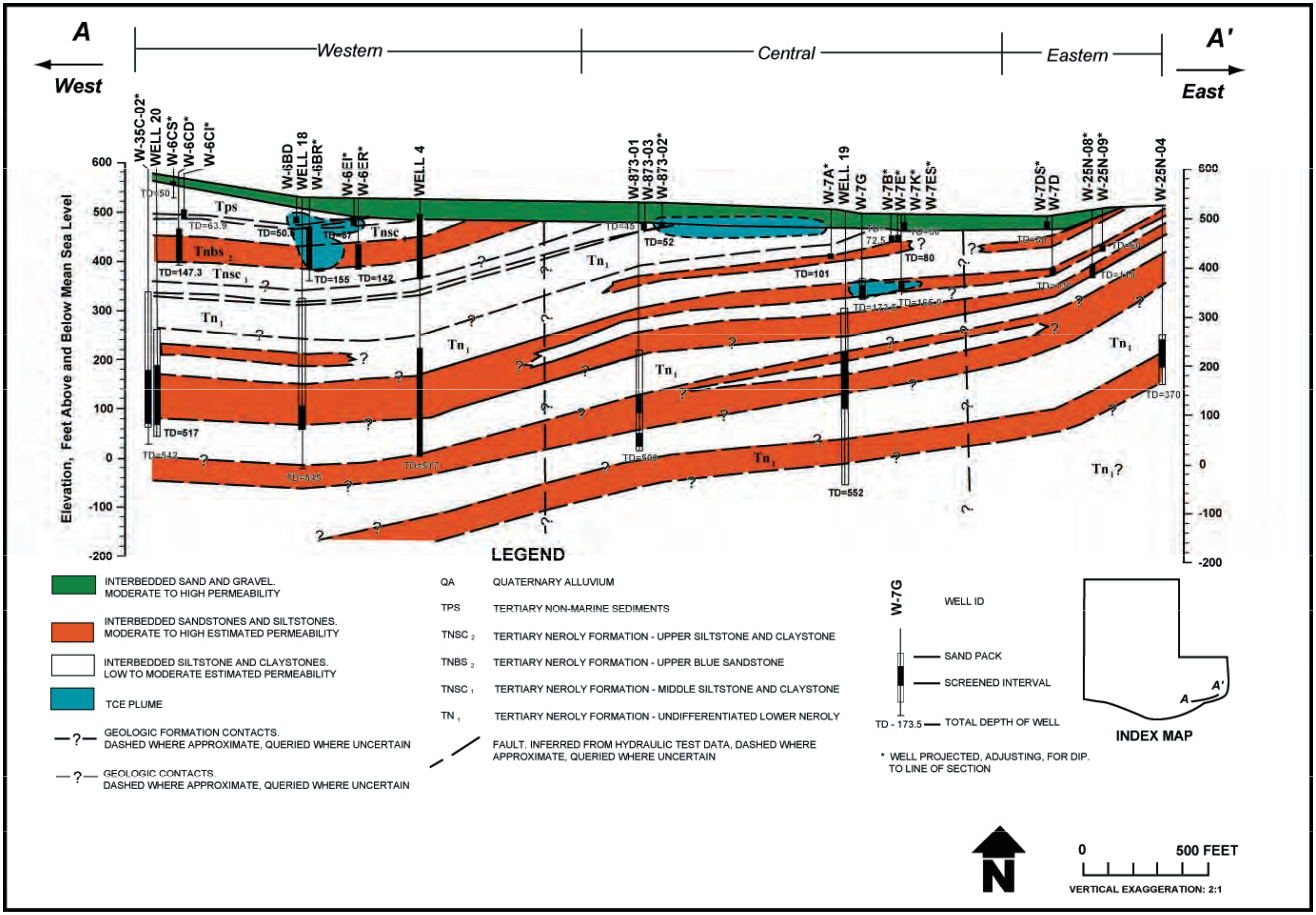


FIGURE 4.11.3.2–2.—*Geologic Cross Section of Site 300 Under the General Services Area*

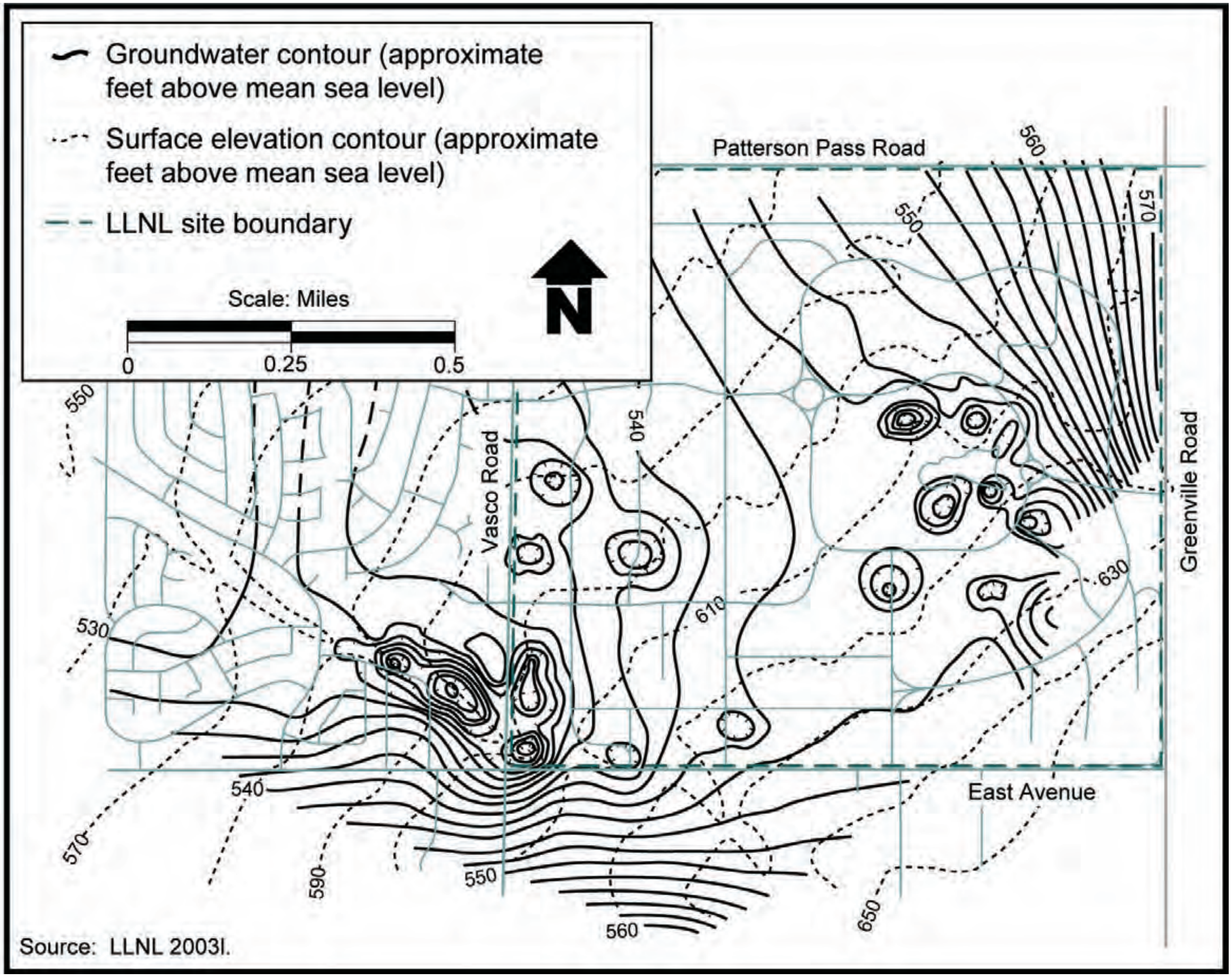


FIGURE 4.11.3.2–3.—*Livermore Site and Vicinity Approximate Groundwater and Surface Elevation Contours*

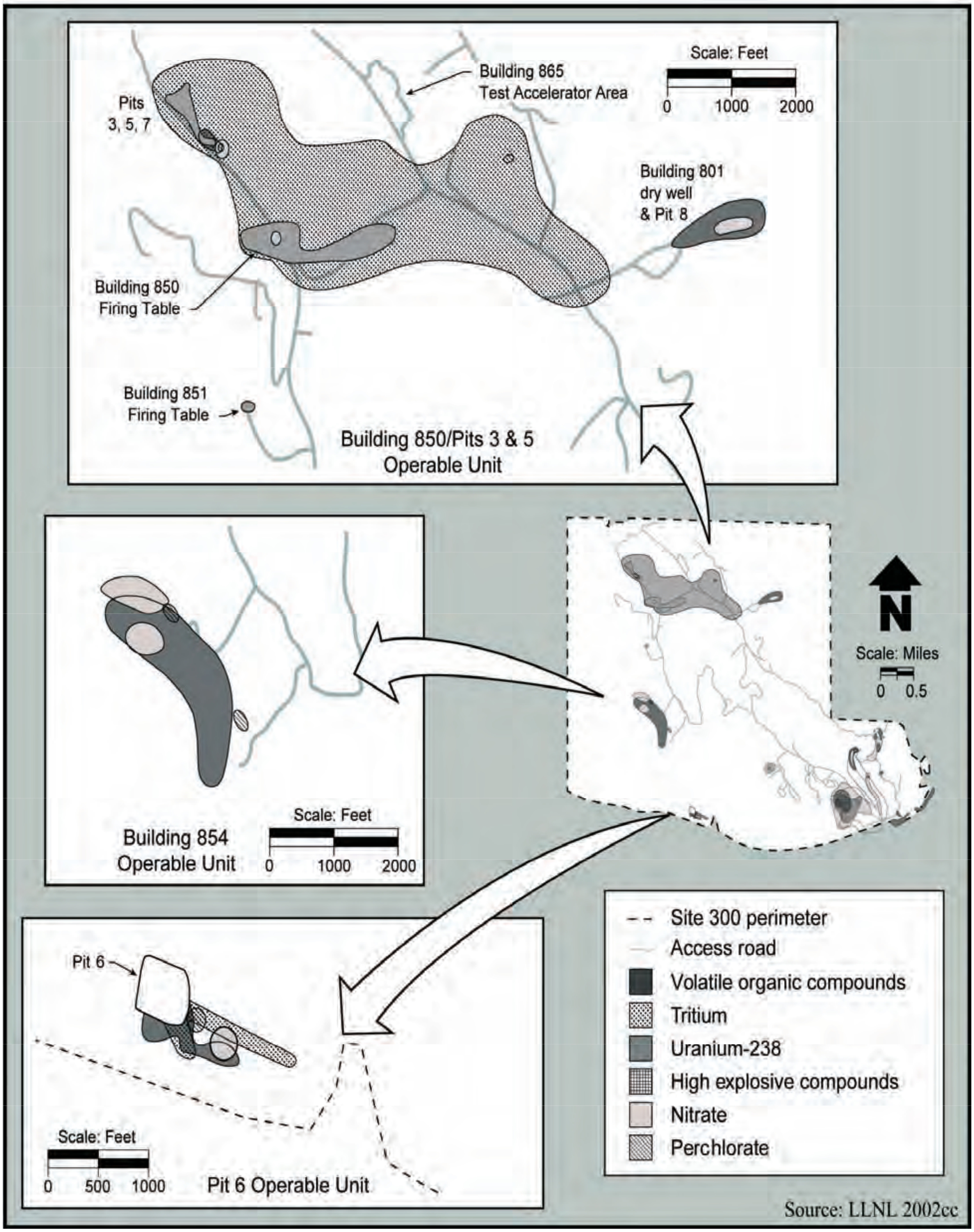


FIGURE 4.11.3.4–2.—*Extent of Groundwater Contamination at Site 300*

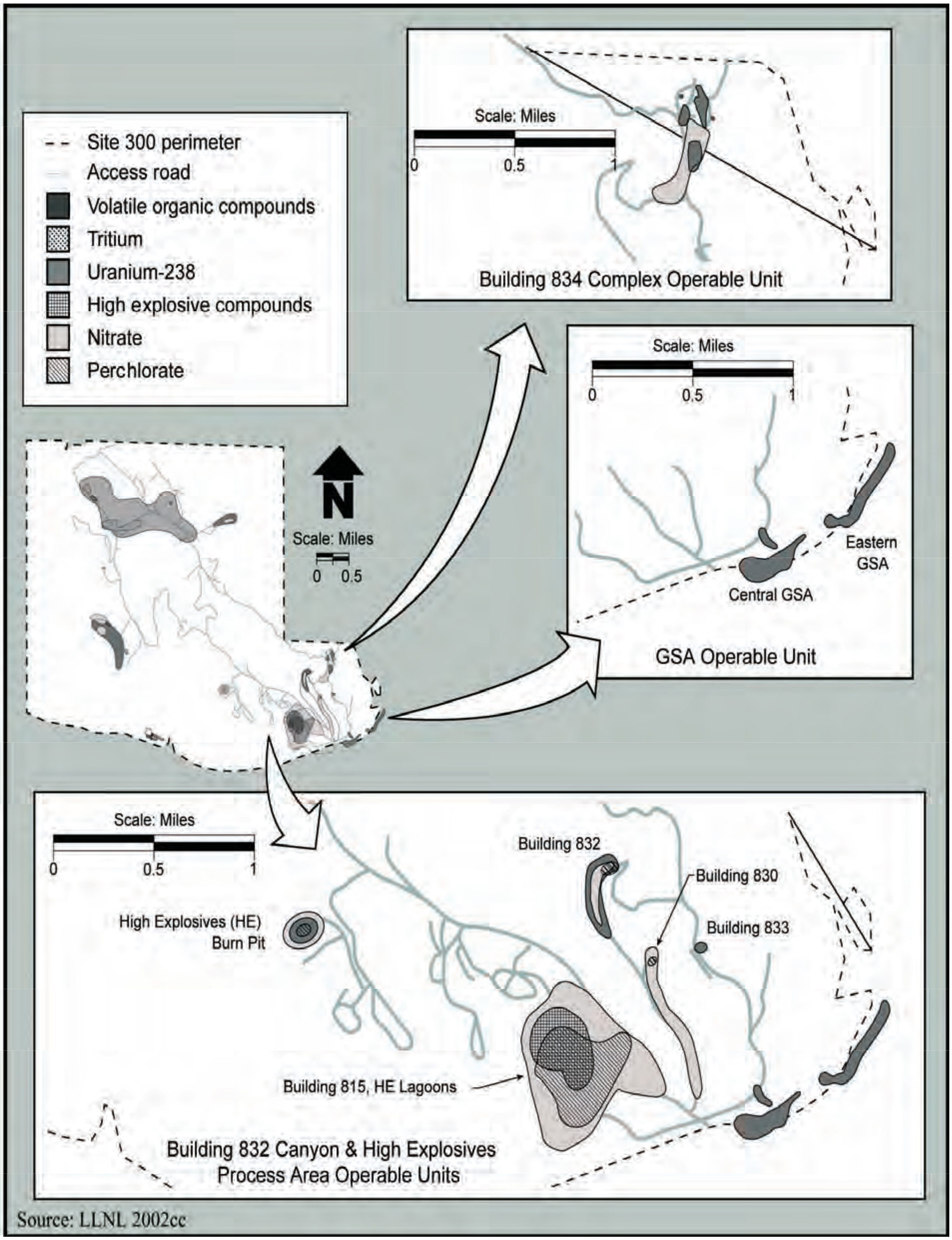


FIGURE 4.11.3.4–2.—*Extent of Groundwater Contamination at Site 300 (continued)*

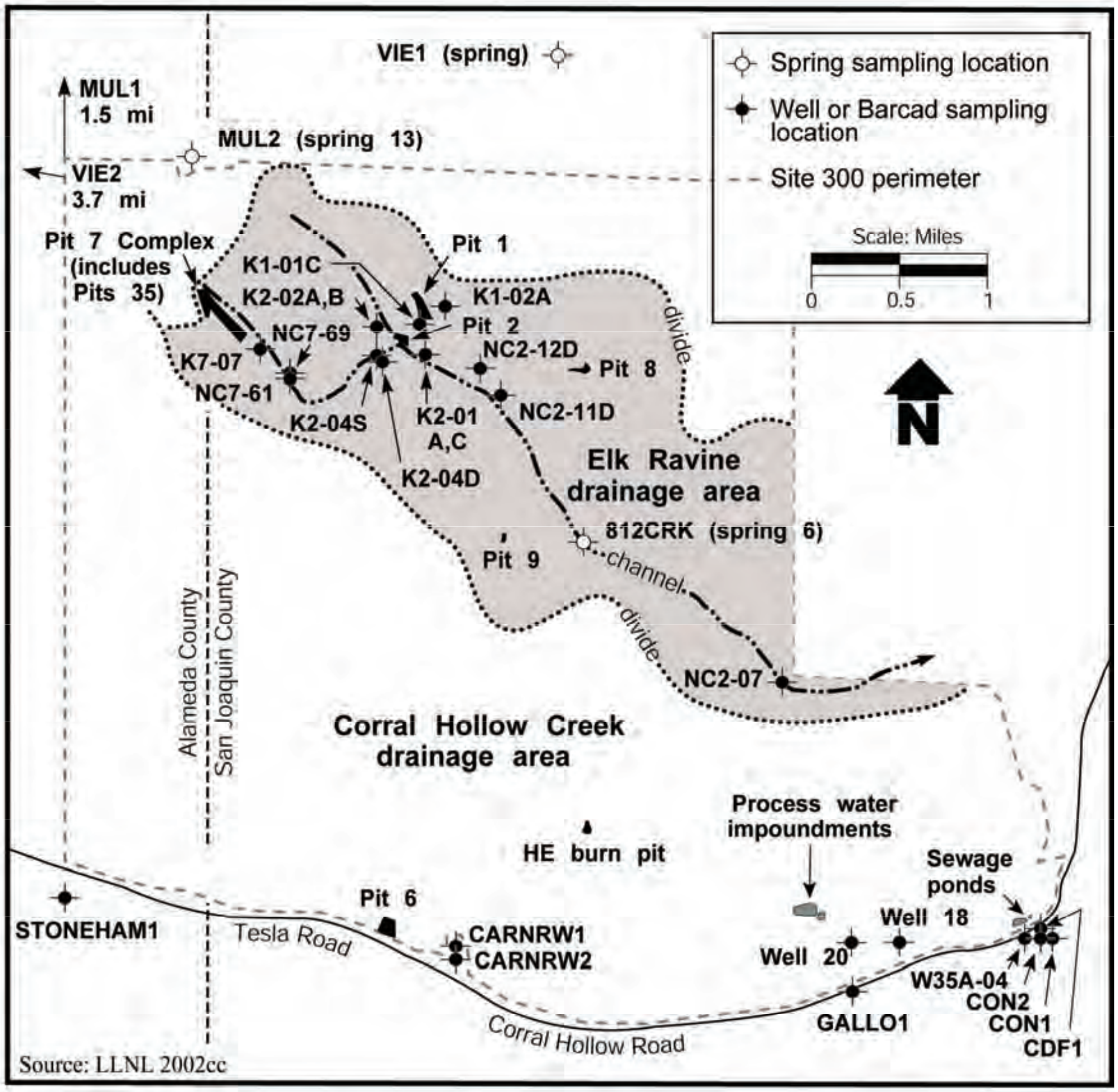


FIGURE 4.11.3.4–3.—*Site 300 Monitoring and Supply Well Locations*

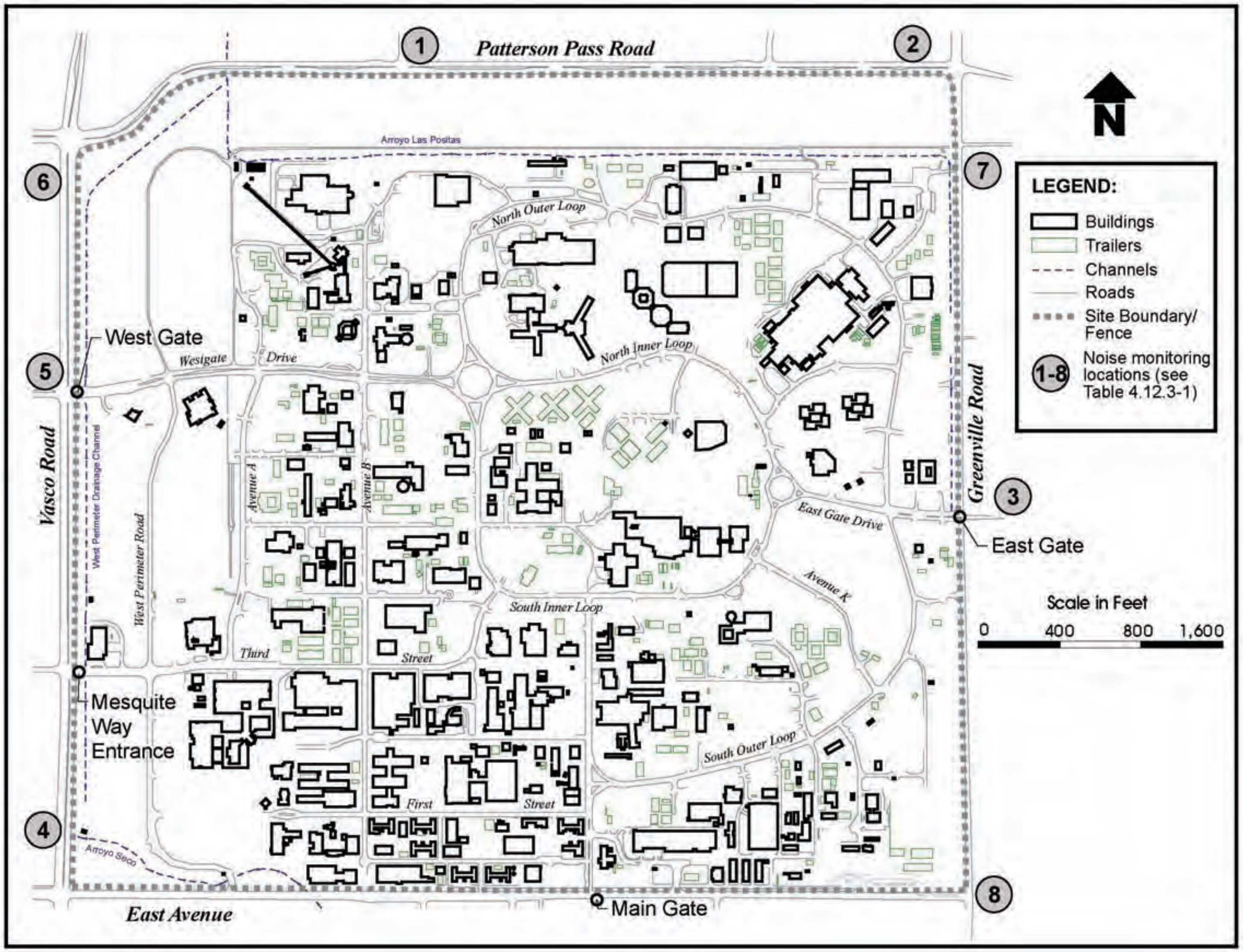
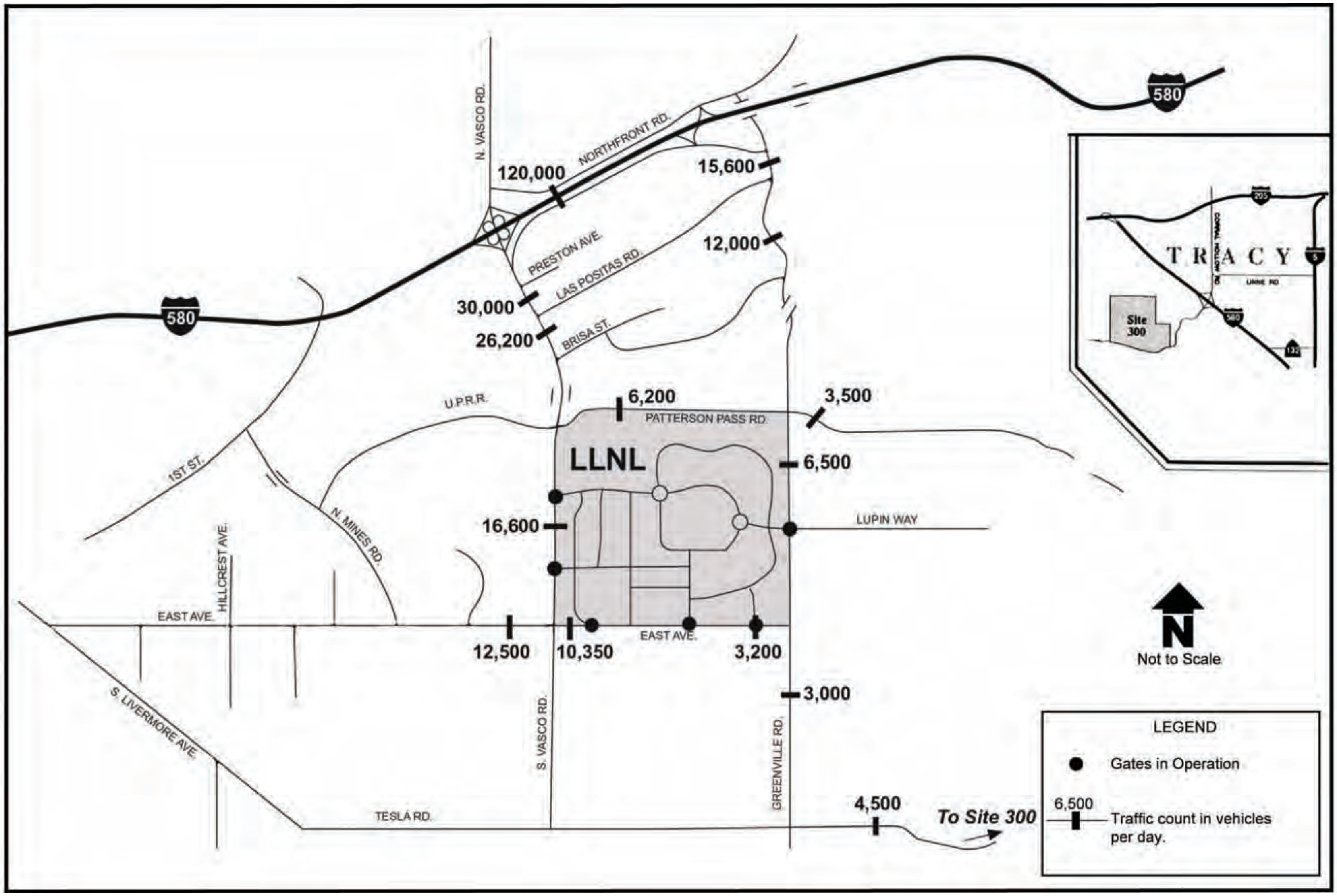
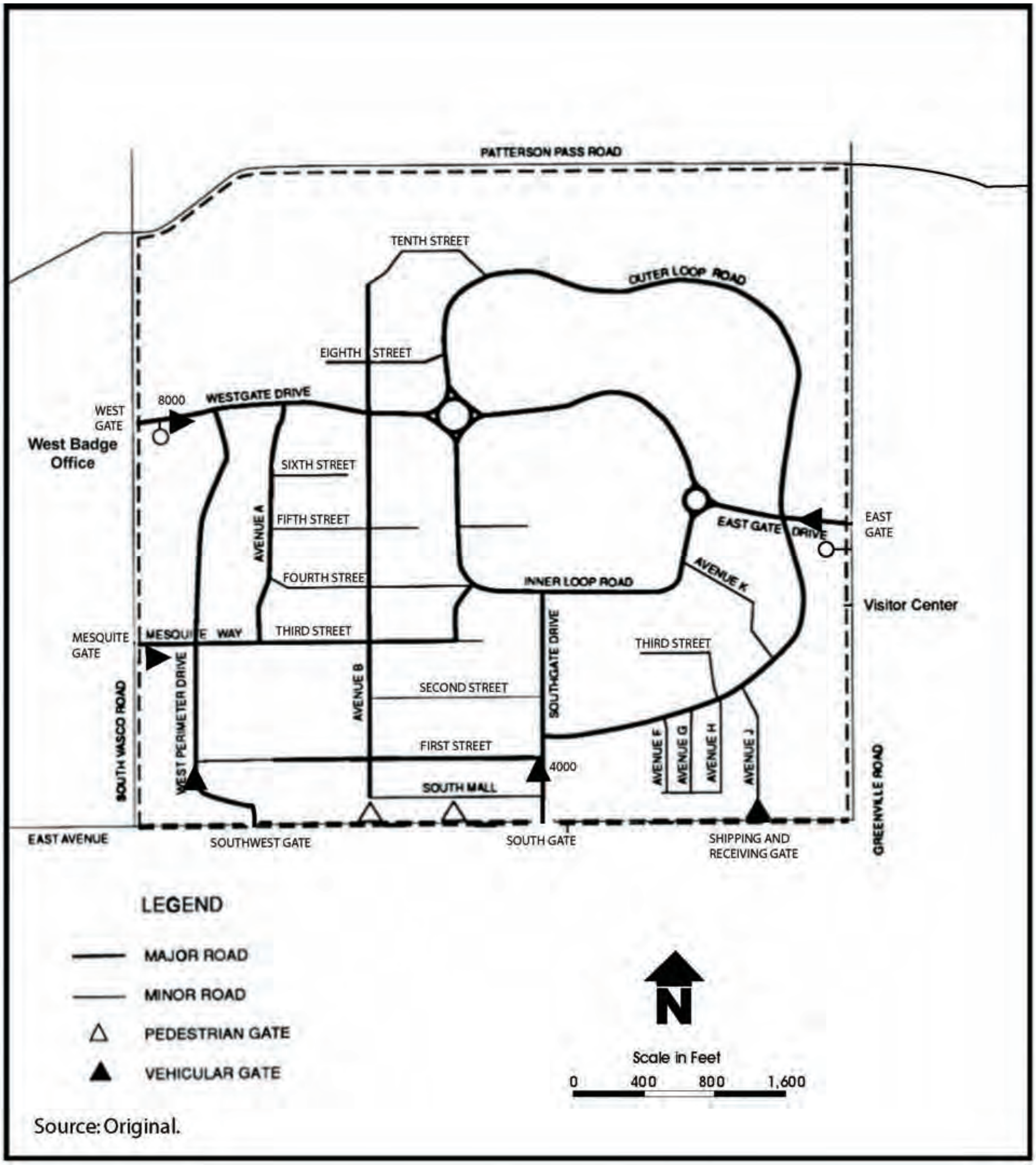


FIGURE 4.12.3–1.—*Noise Monitoring Locations Near the Livermore Site*



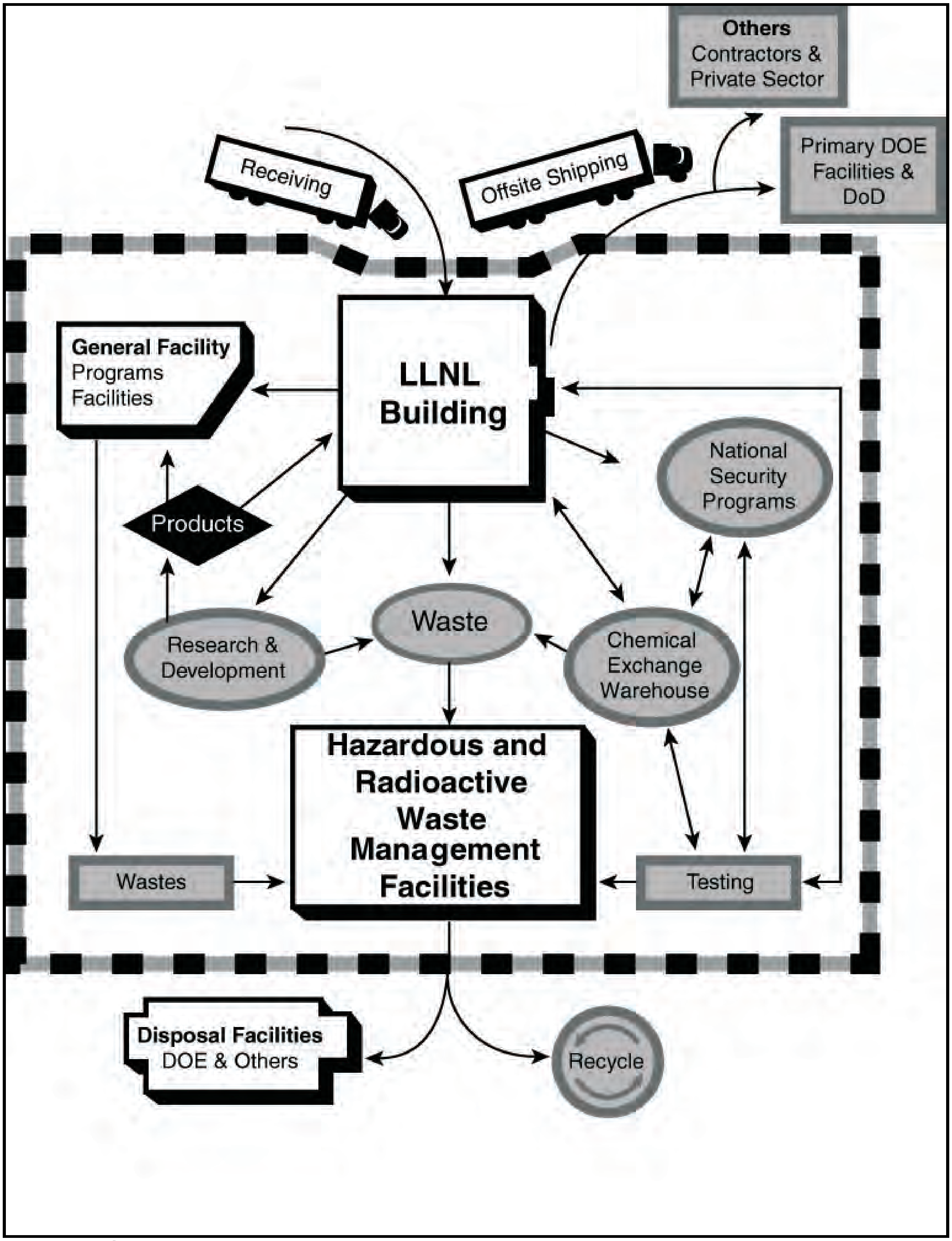
Source: Harrison 2003.

FIGURE 4.13.1–1.—*Regional Transportation Network with Traffic Counts*



Source: Original.

FIGURE 4.13.4–1.—*Livermore Site Transportation Network*



Source: Original.

FIGURE 4.15.1.2–1.—*Conceptual Illustration of Material Movement at Lawrence Livermore National Laboratory*

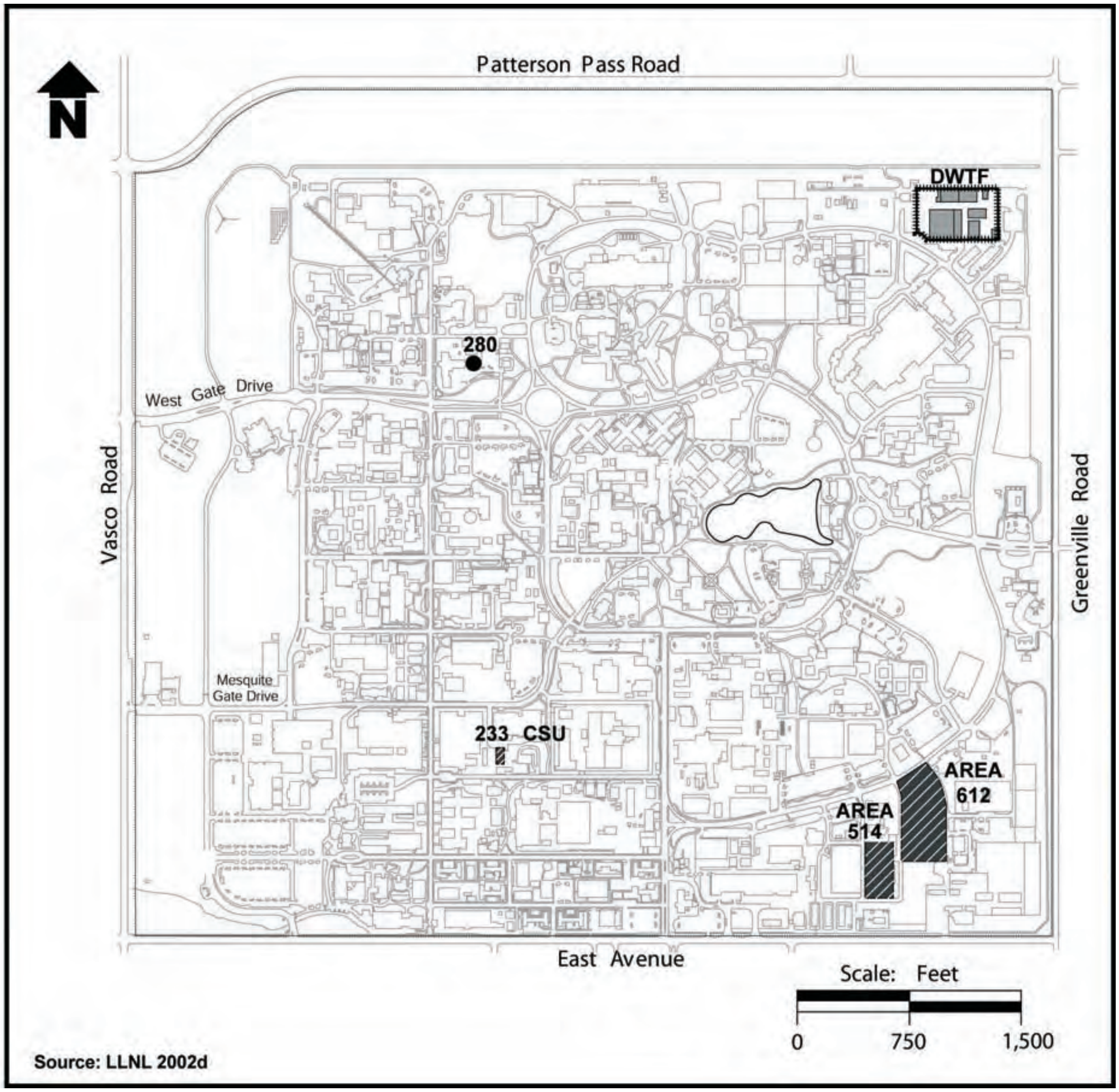
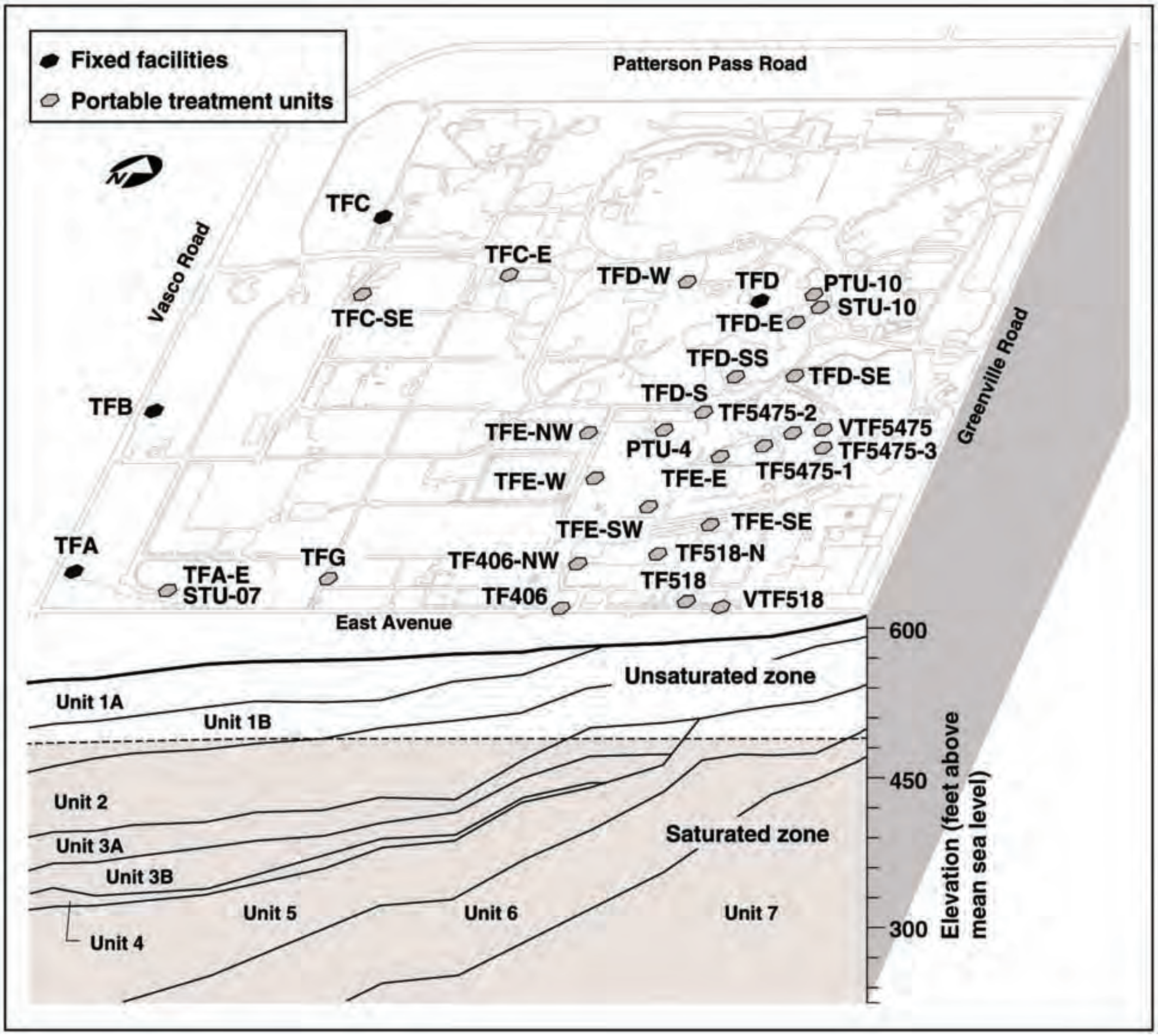
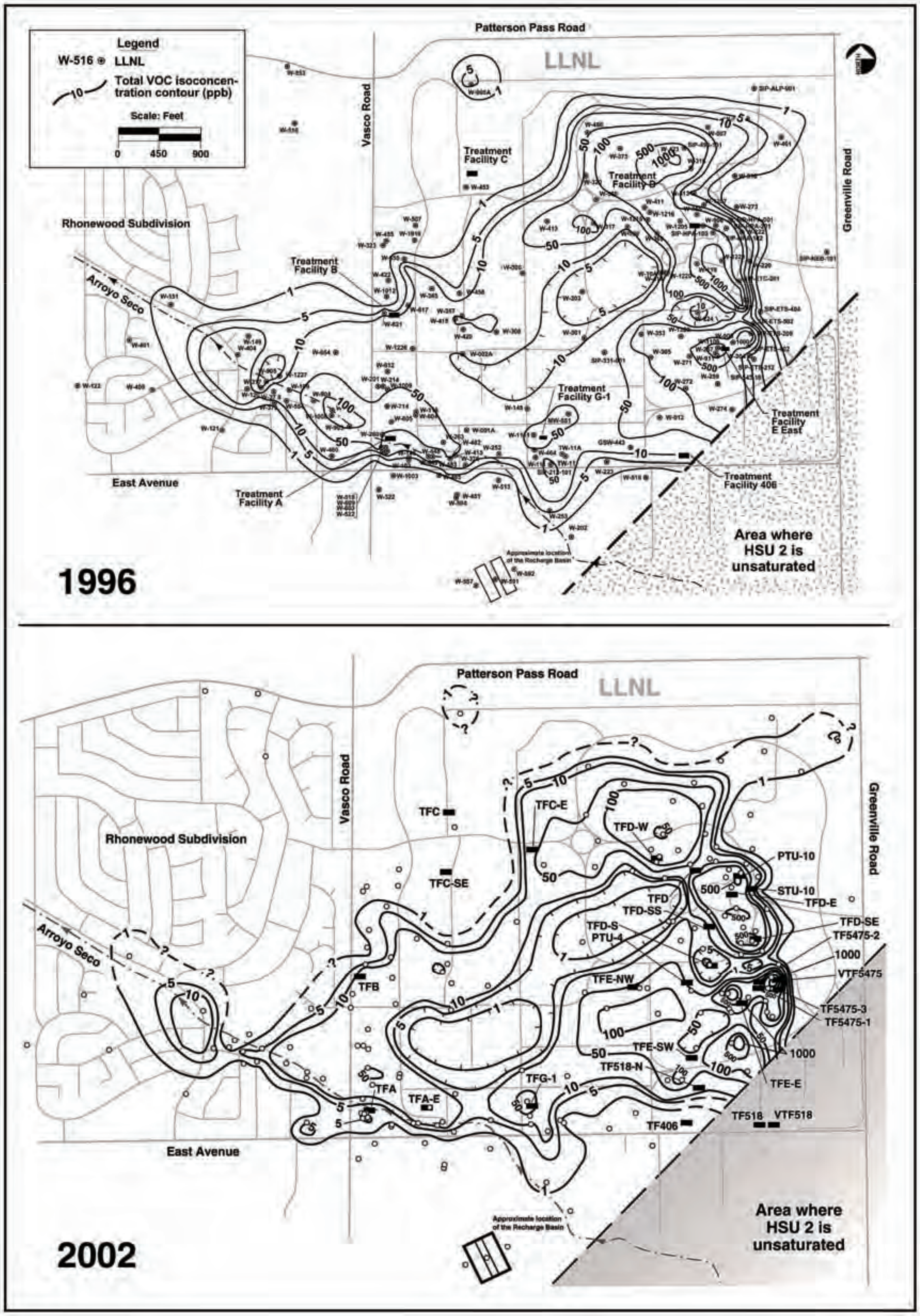


FIGURE 4.15.2–1.—*Livermore Site Map Showing Locations of the Decontamination and Waste Treatment Facility and Other Permitted Waste Management Facilities*



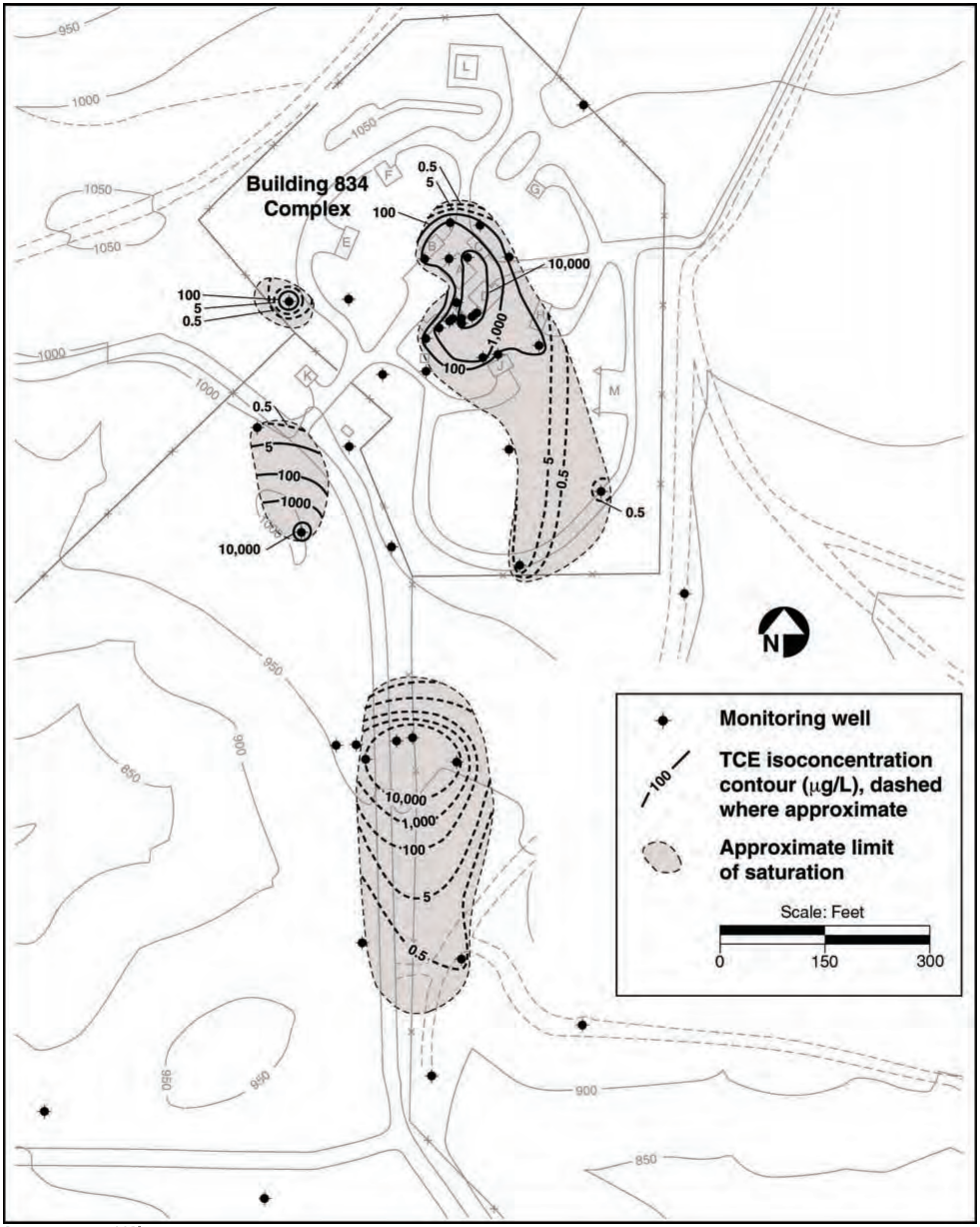
Source: LLNL 2003l.

FIGURE 4.17.1.1–1.—*Map and Cross Section of the Livermore Site Showing Hydrostratigraphic Units and the Locations of Treatment Facilities as of 2002*



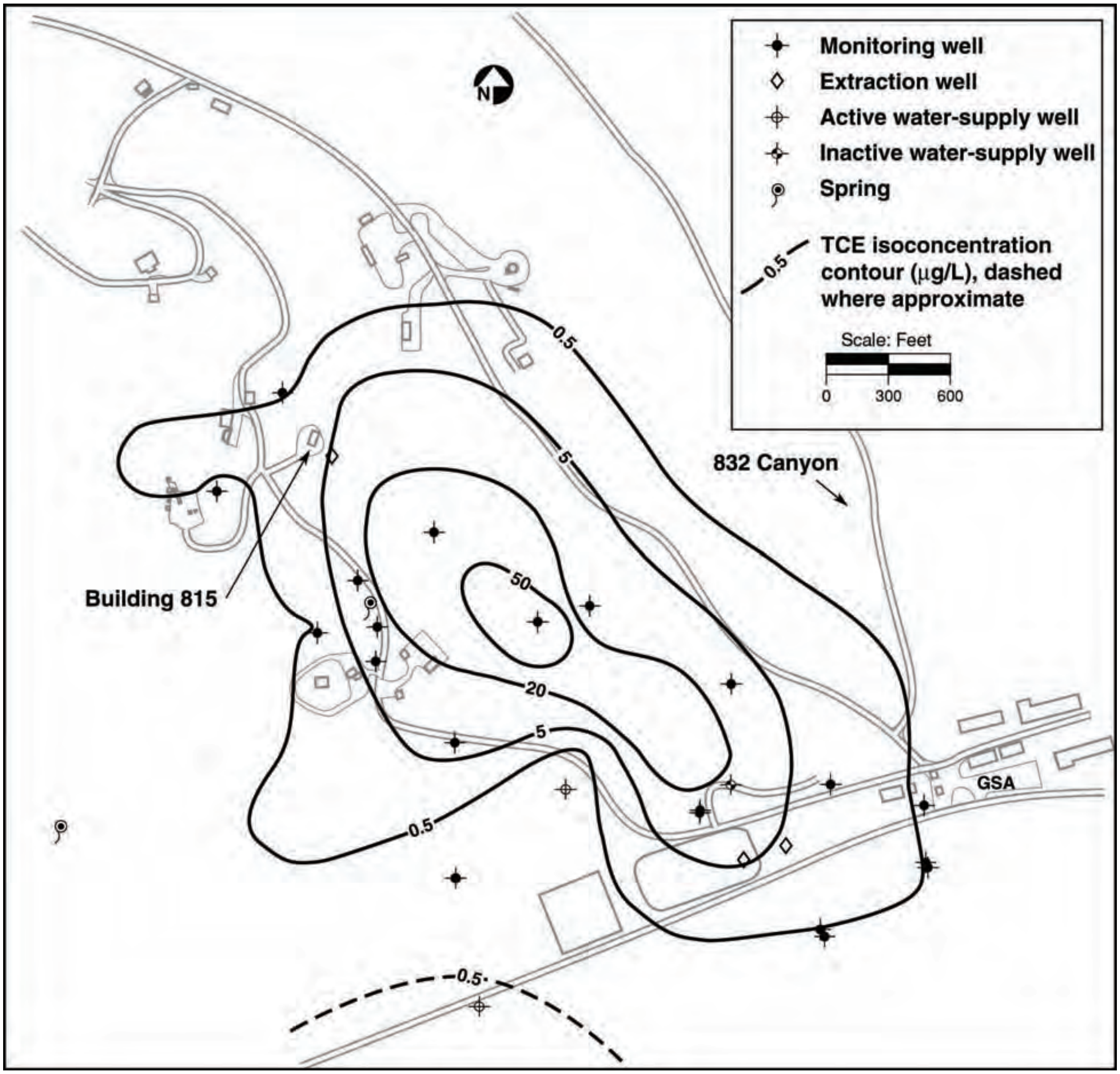
Sources: LLNL 1997e, LLNL 2003l.

FIGURE 4.17.1.3–1.—LLNL *Comparison of Total VOC Concentrations between 1996 and 2002 at the Livermore Site (Hydrostratigraphic Unit 2)*



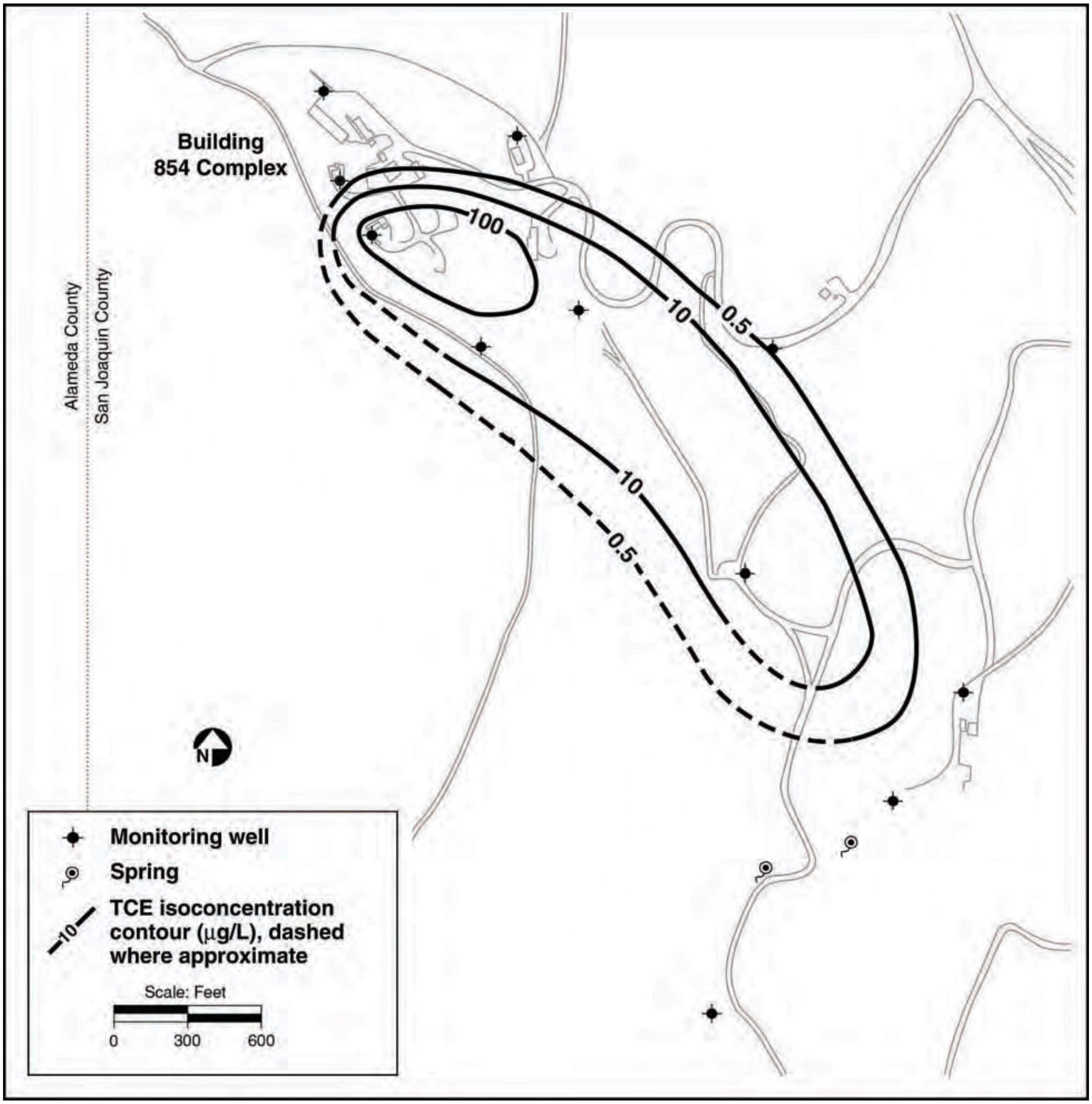
Source: LLNL 2003l.

FIGURE 4.17.2.2–3.—*Distribution of TCE in Groundwater at the Building 834 Complex (Second Quarter, 2002)*



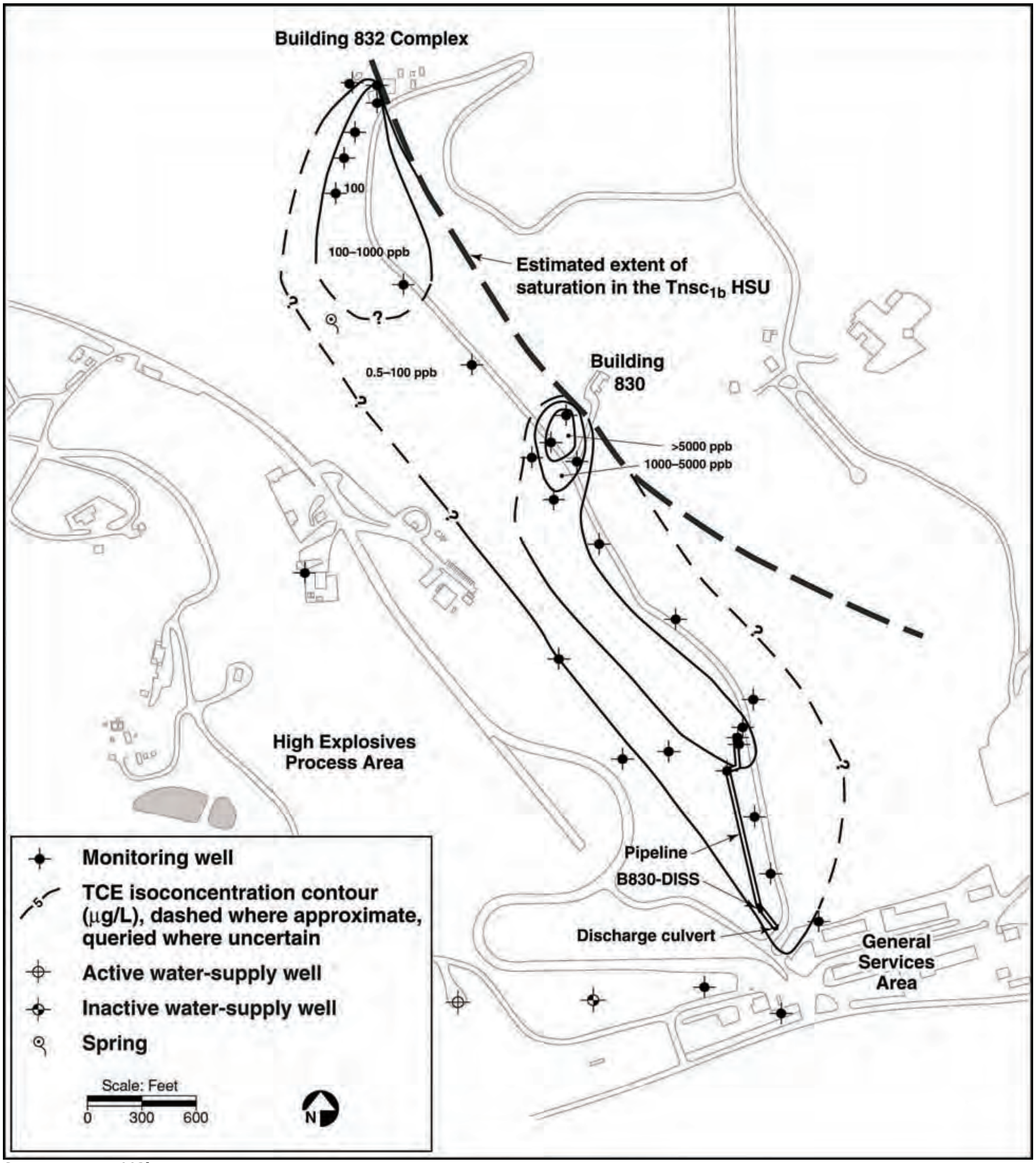
Source: LLNL 2003l.

FIGURE 4.17.2.2–4.—*Distribution of TCE in Groundwater in the High Explosives Process Area (Second Quarter, 2002)*



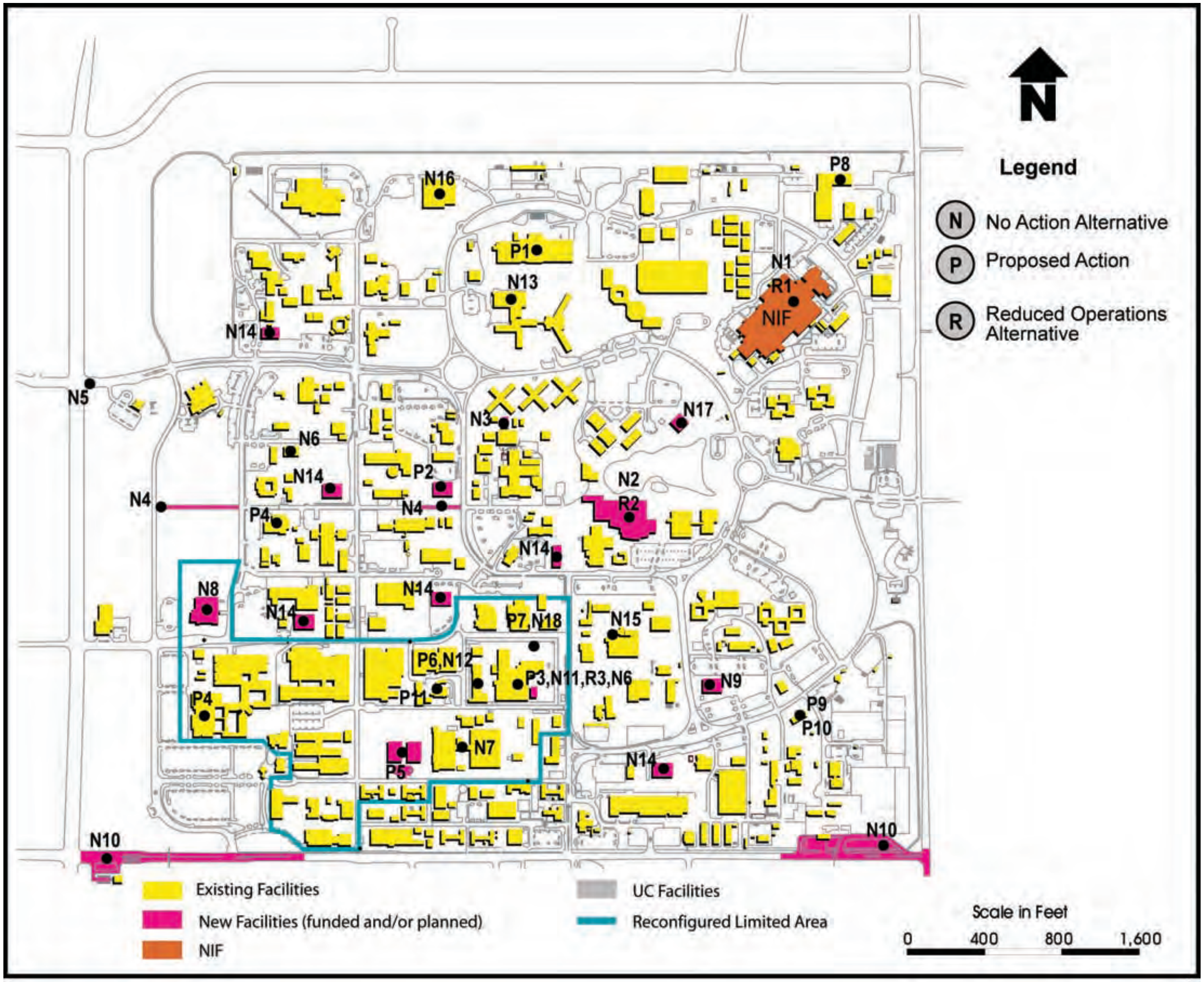
Source: LLNL 2003l.

FIGURE 4.17.2.2–6.—*Distribution of TCE in Groundwater in the Building 854 Area (Second Quarter, 2002)*



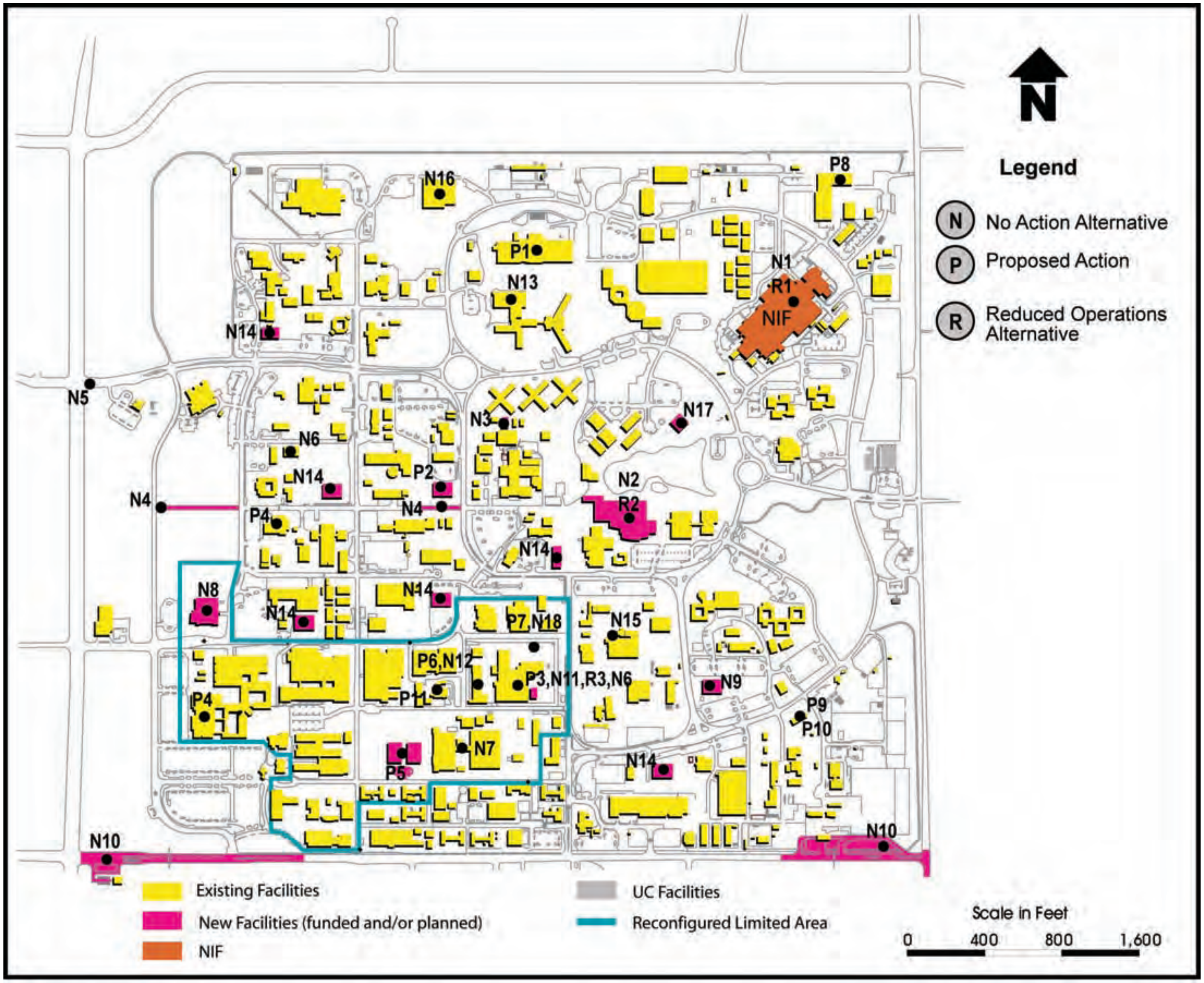
Source: LLNL 2003l.

FIGURE 4.17.2.2–8.—*Distribution of TCE in Groundwater in the Building 832 Canyon*



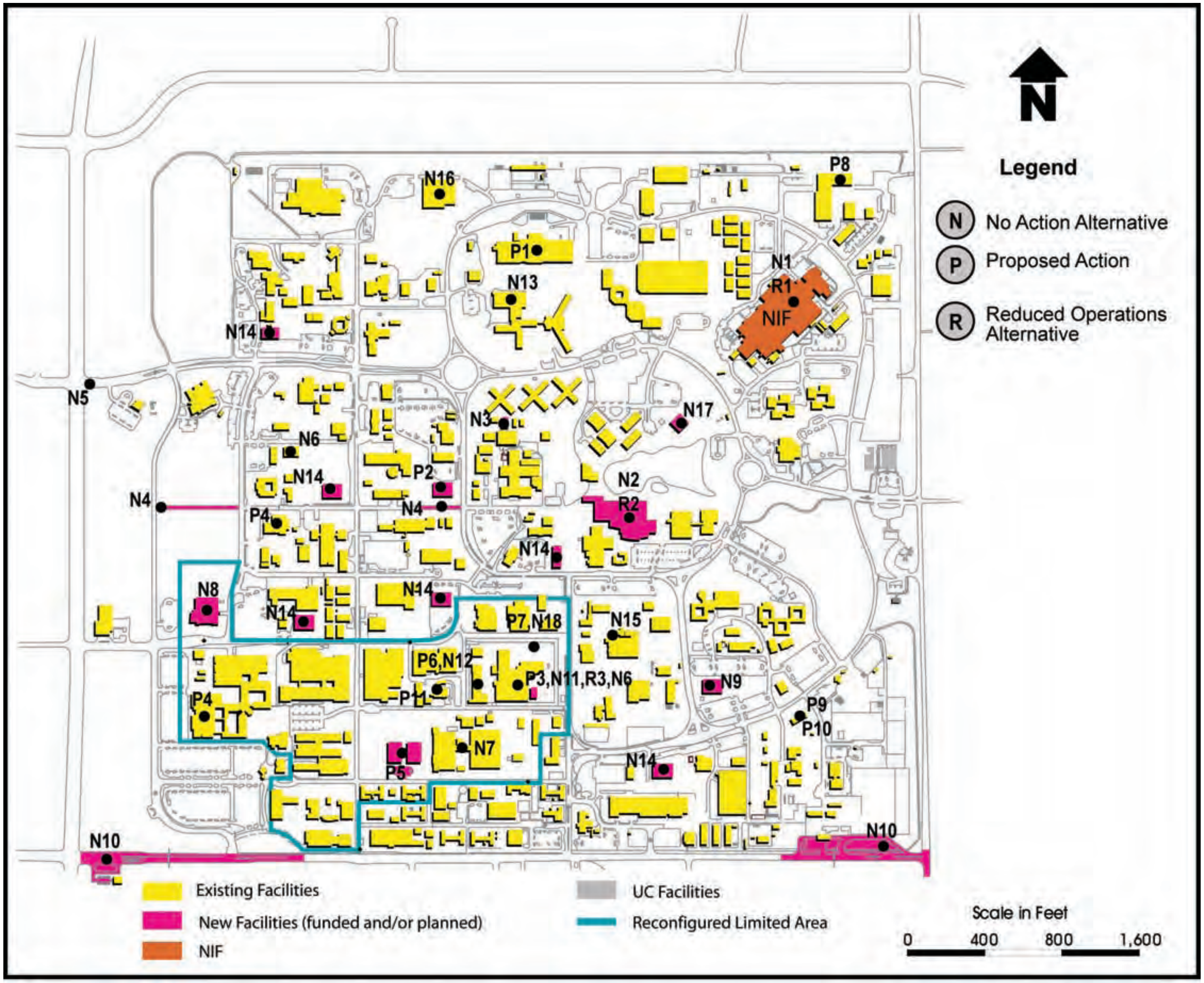
Source: LLNL 2003o.

FIGURE 5.2.1.2–1.—*Locations of New Facilities Under the No Action Alternative*



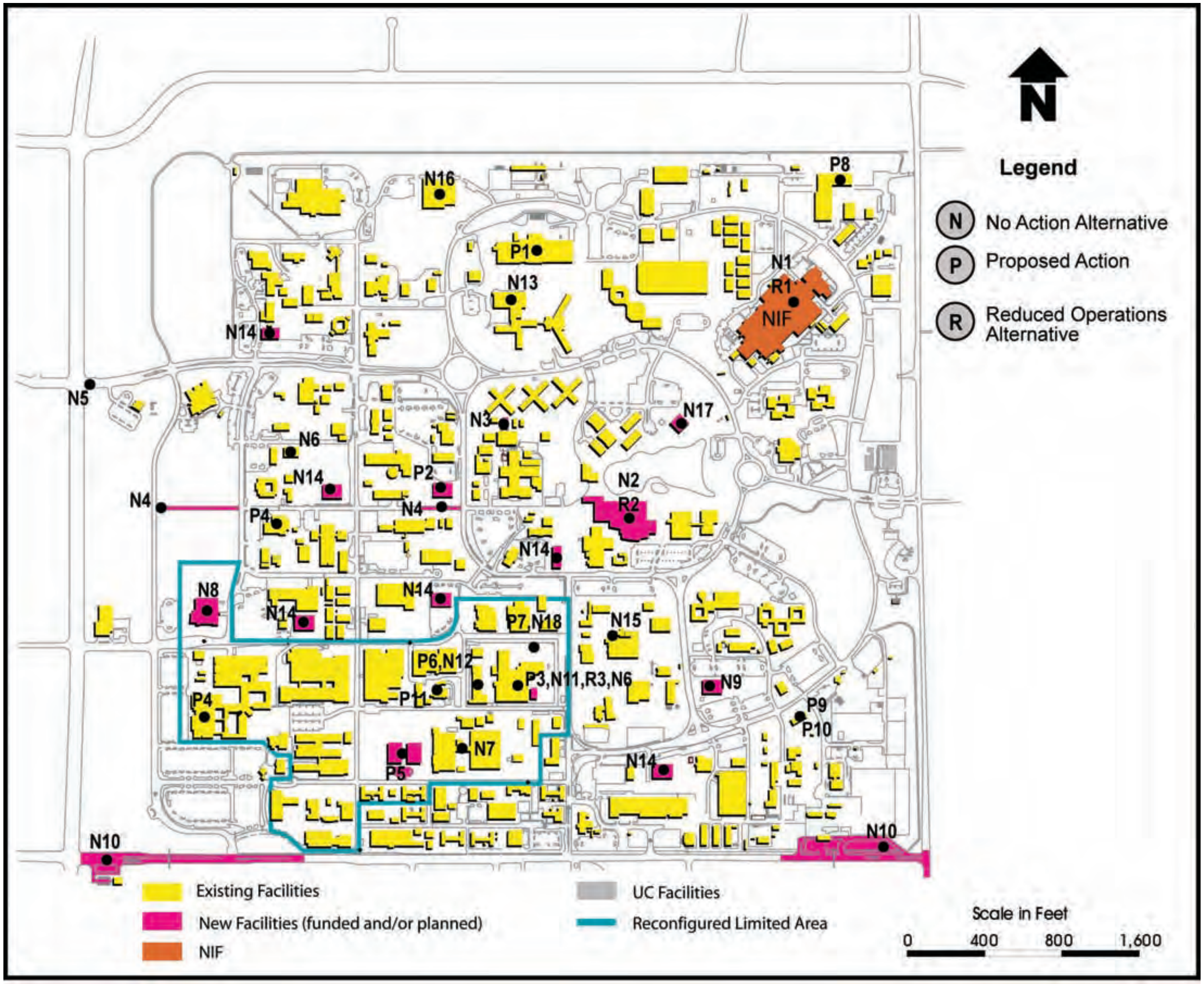
Source: LLNL 2003o.

FIGURE 5.2.6.1–1.—*Location of New Facilities Under the No Action Alternative, Including Those in Undeveloped Areas*



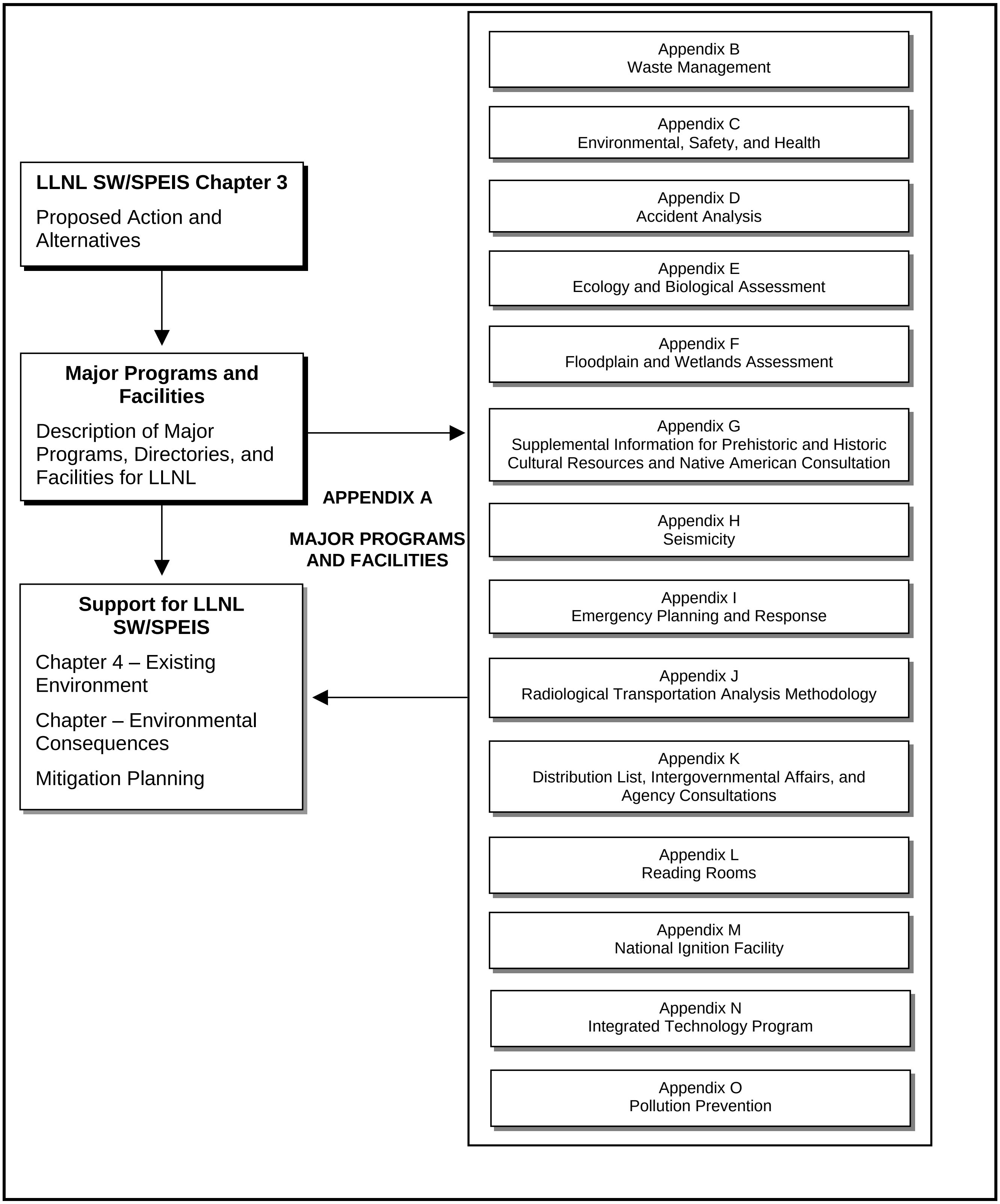
Source: LLNL 2003o.

FIGURE 5.3.1.2–1.—*Location of New Facilities Under the Proposed Action*



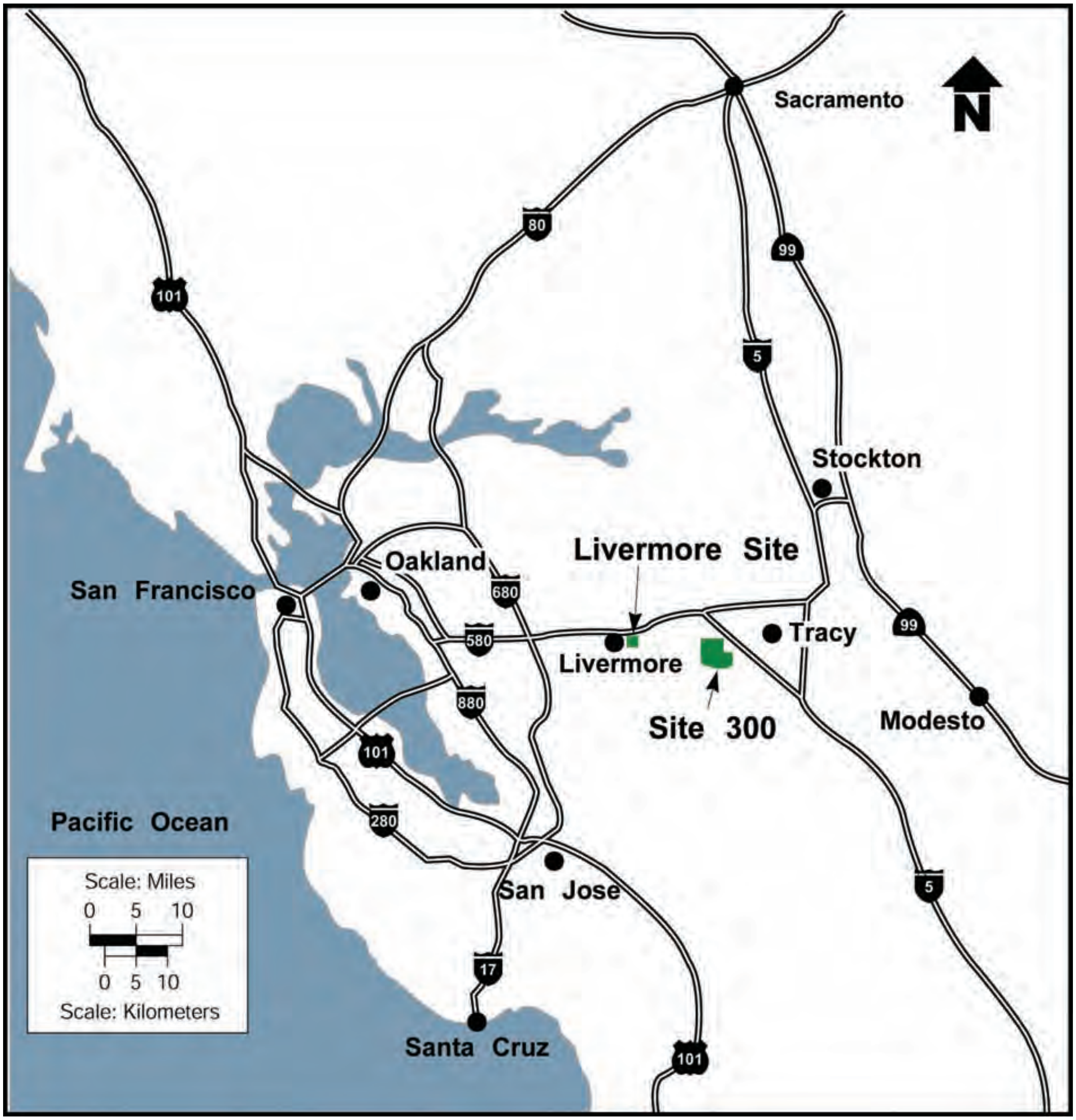
Source: LLNL 2003o.

FIGURE 5.3.6.1–1.—*Location of New Facilities in Undeveloped Areas Under the Proposed Action*



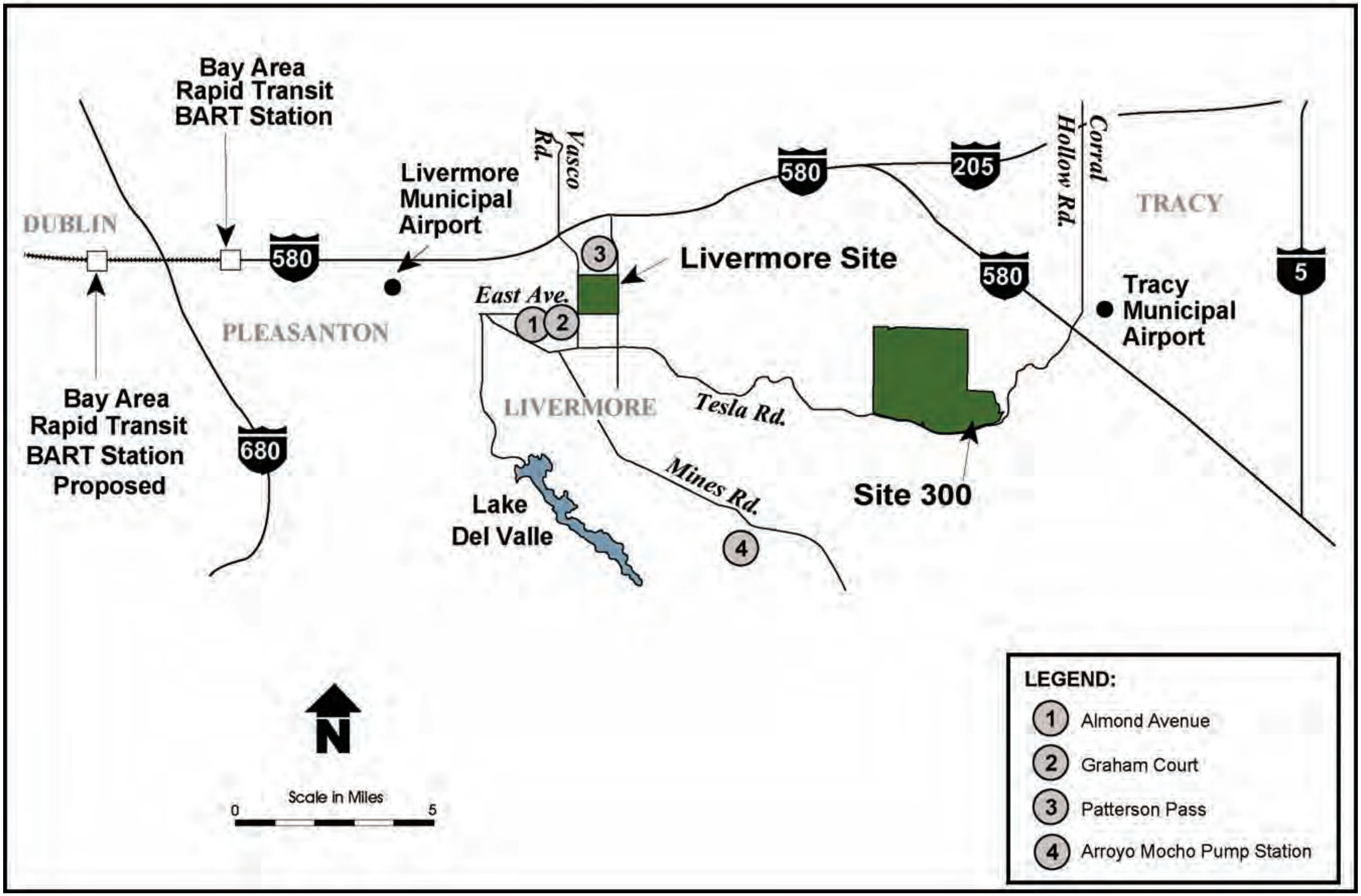
Source: Adapted From LLNL 1992a.

FIGURE A–1.—*Crosswalk of Appendix A in Relation to Site-wide/Supplemental Programmatic Environmental Impact Statement*



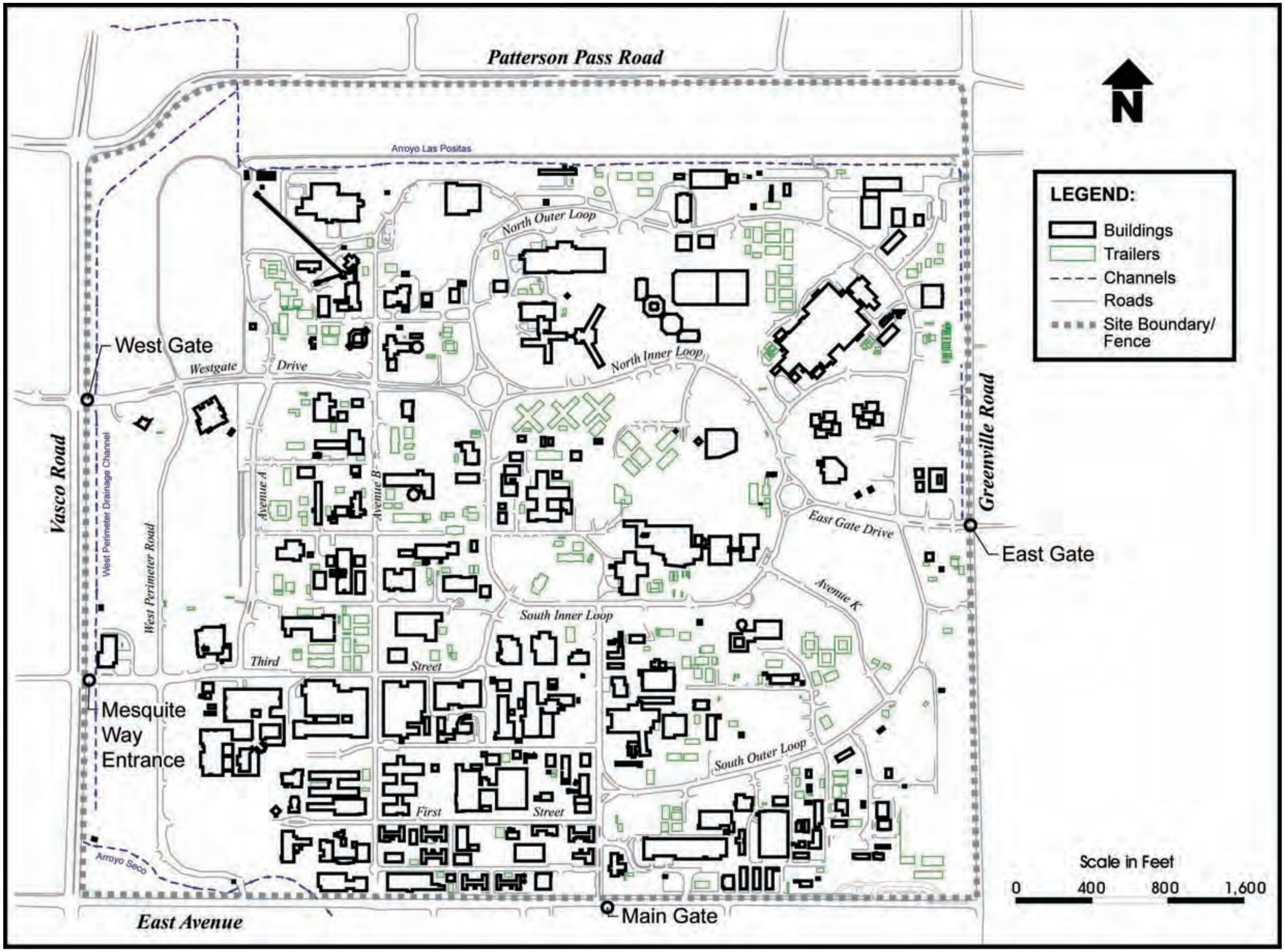
Source: LLNL 2003l.

FIGURE A–2.—*Regional Locations of the Livermore Site and Site 300*



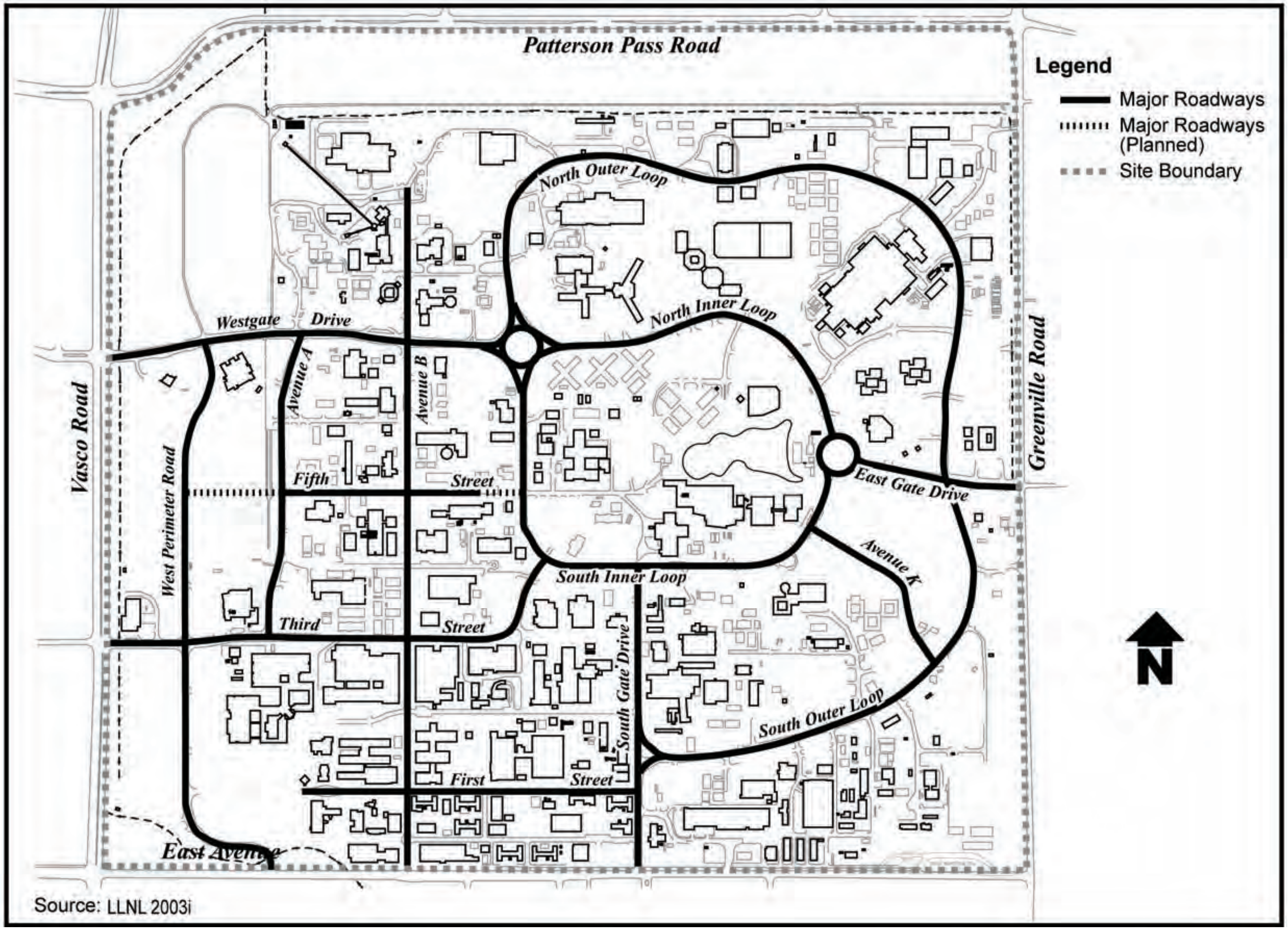
Source: LLNL 2003cj.

FIGURE A–3.—*Locations of Livermore Site, Site 300, and Offsite Facilities Relative to Surrounding Communities*



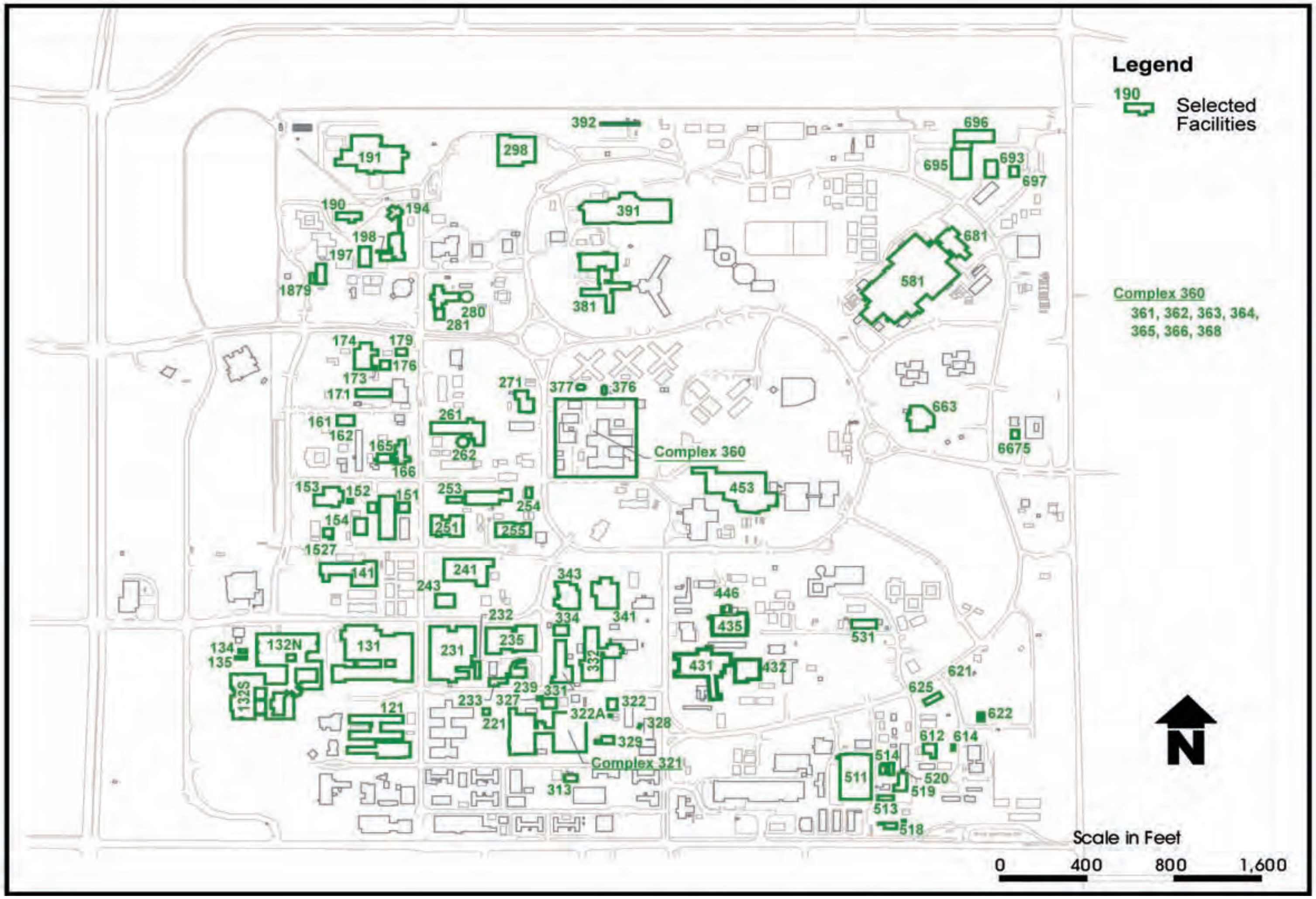
Source: LLNL 2003o.

FIGURE A.2.1–1.—*Livermore Site Map*



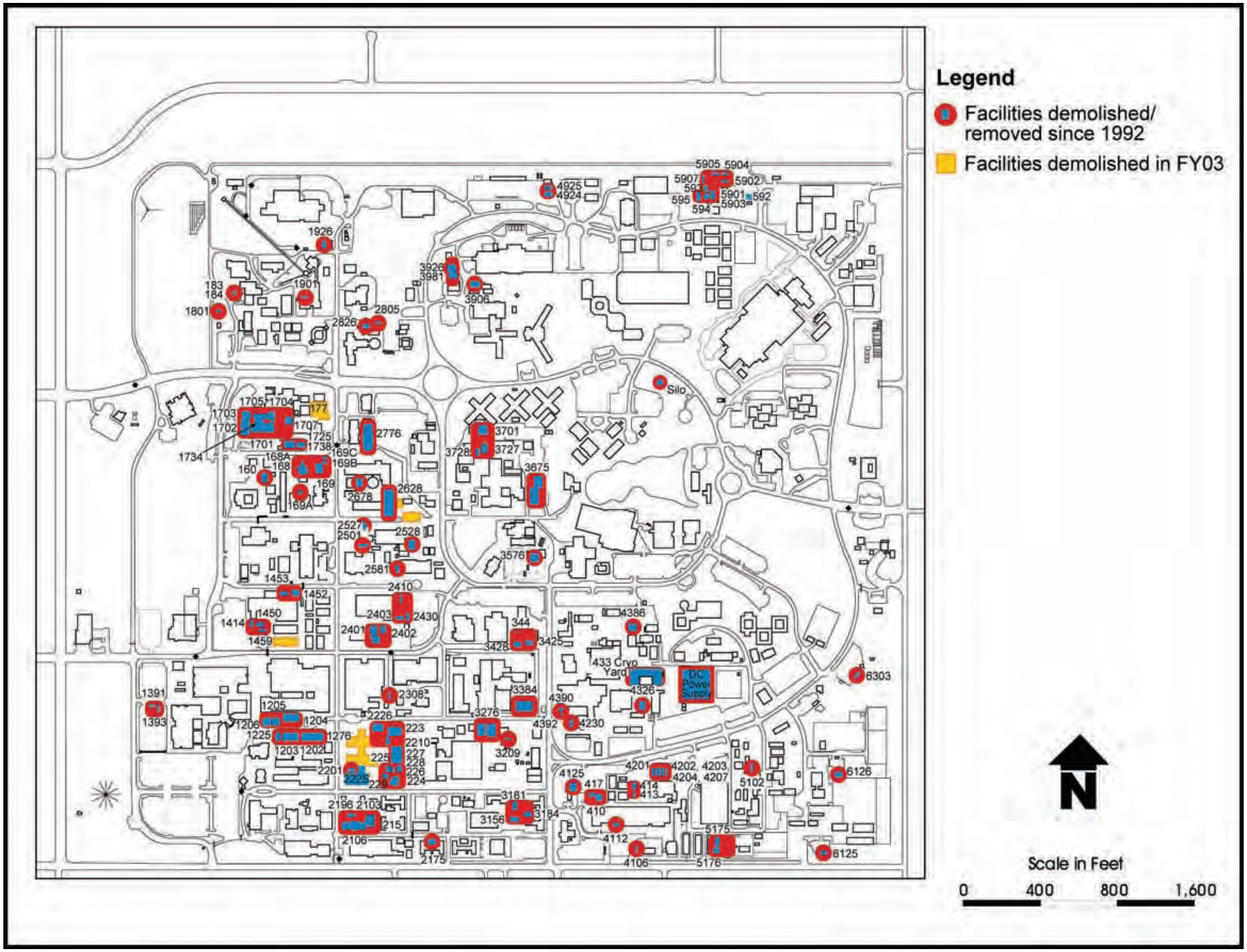
Source: LLNL 2003o.

FIGURE A.2.1–2.—*Major Roadways at the Livermore Site*



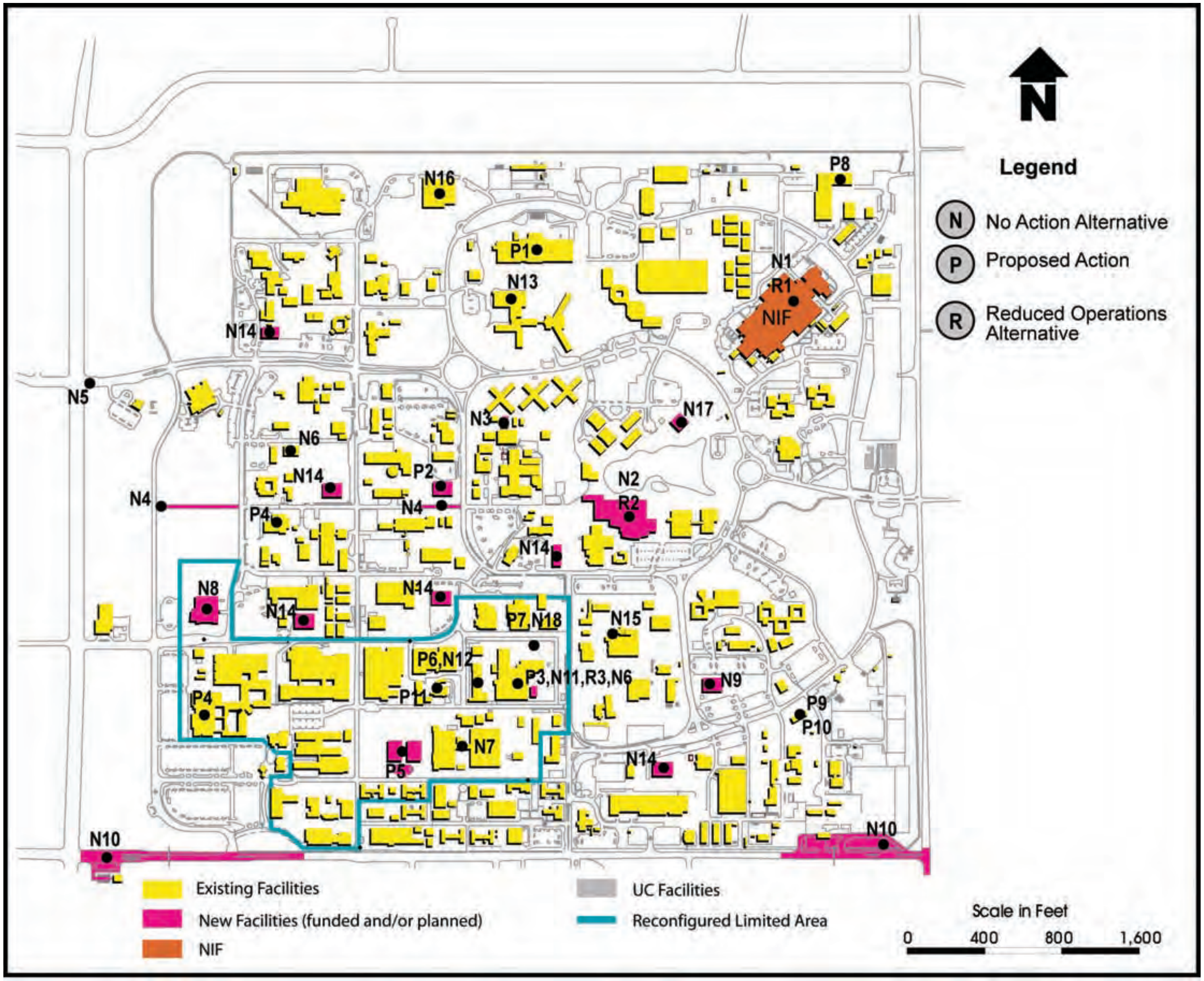
Source: LLML 2003o.

FIGURE A.2.2–1.—*Selected Facility Locations at the Livermore Site*



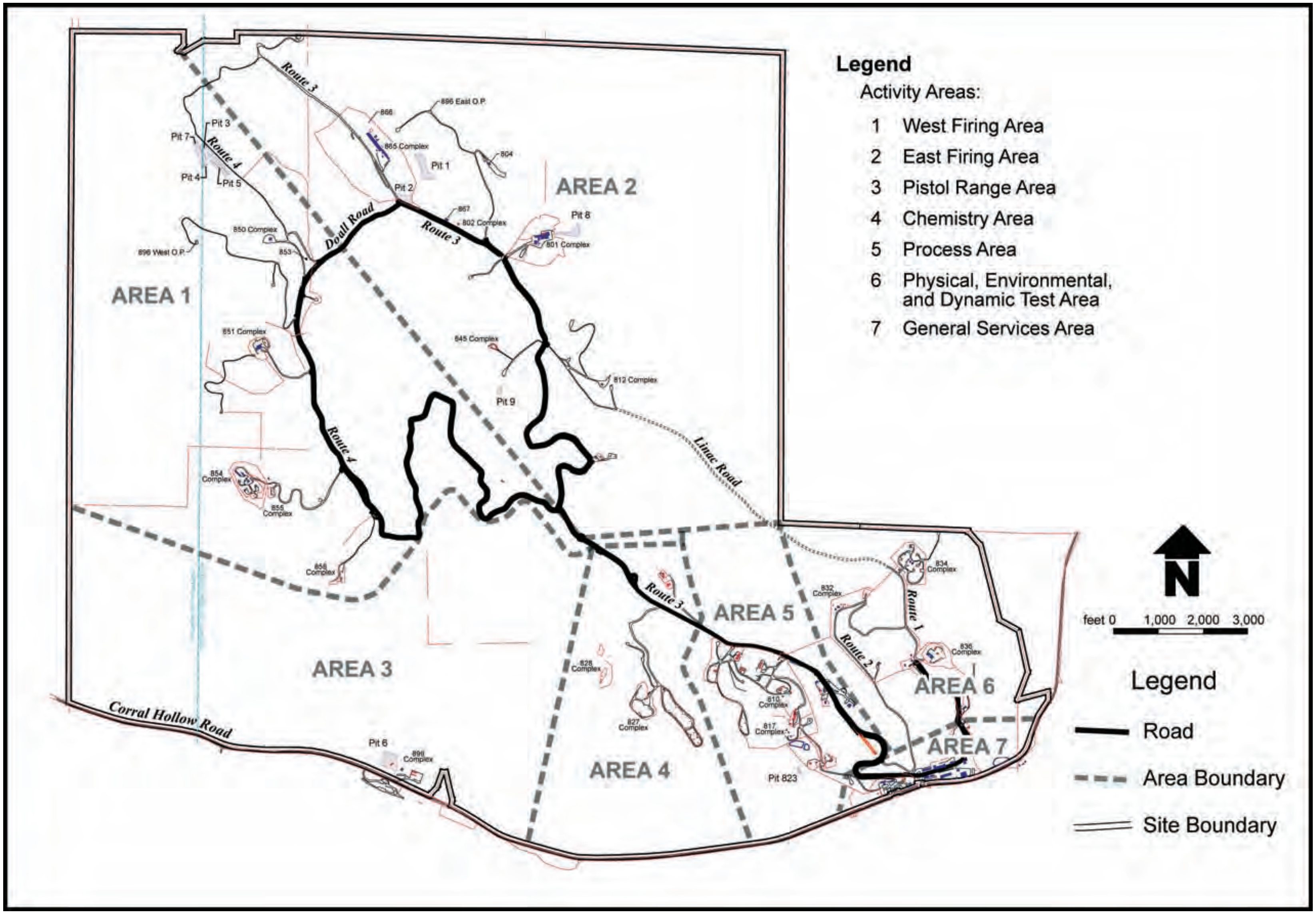
Source: LLNL 2003cj.

FIGURE A.2.2–2.— *Facilities Demolished Since 1992 Environmental Impact Statement/Environmental Impact Report at the Livermore Site*



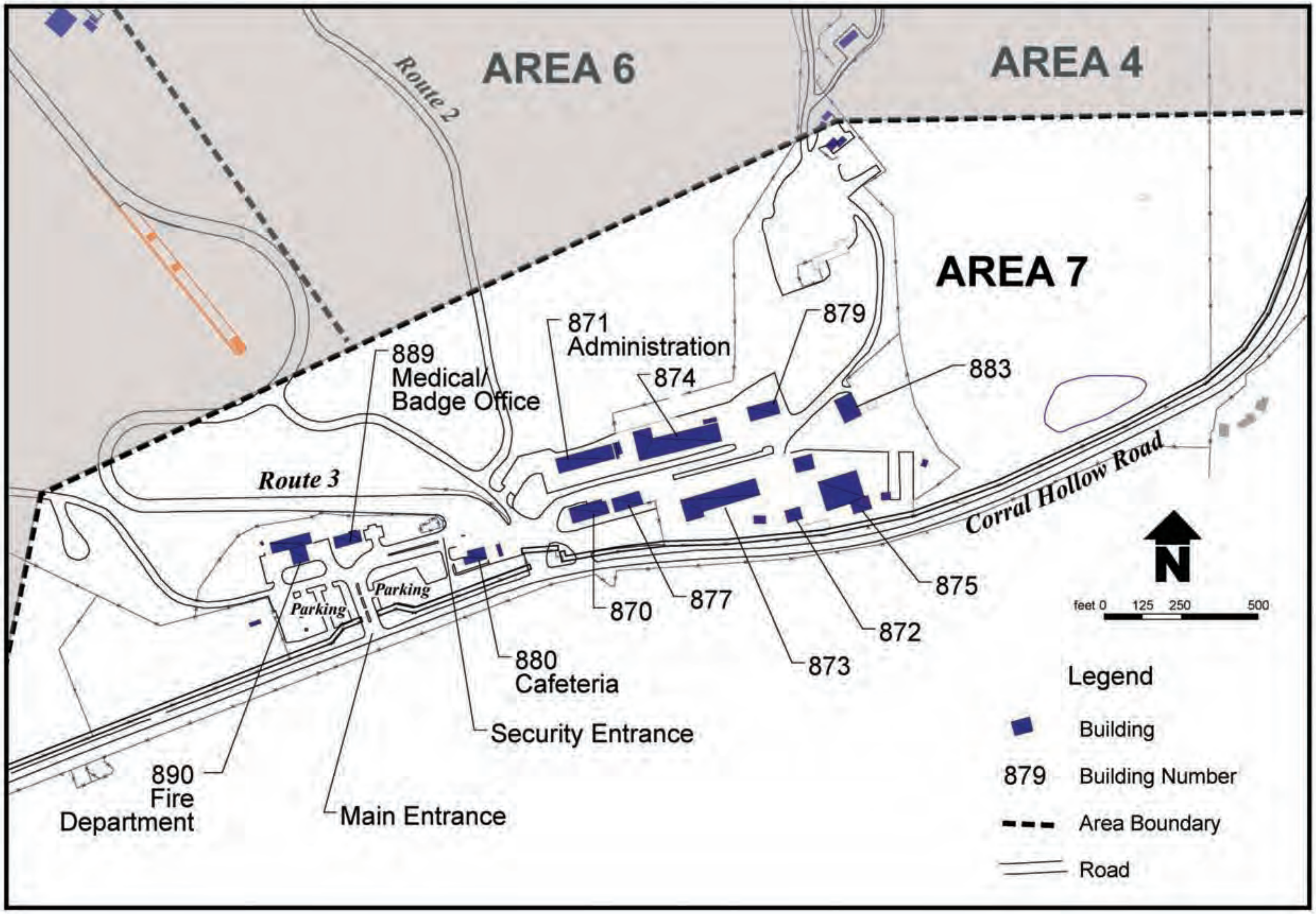
Source: LLNL 2003o.

FIGURE A.2.3–1.—*Program Projections at the Livermore Site*



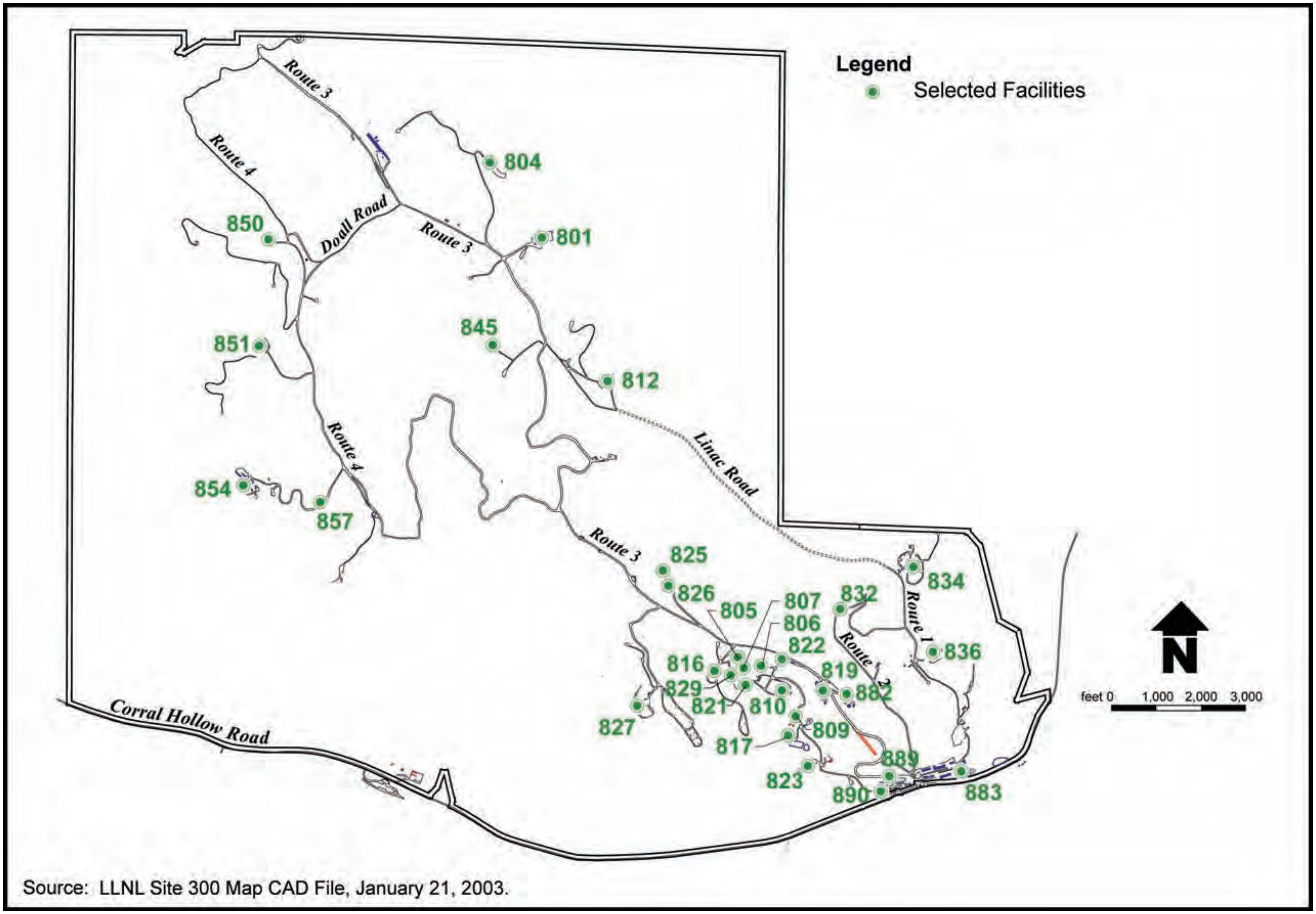
Source: LLNL 2003p.

FIGURE A.3–1.—*Site Map of Site 300*



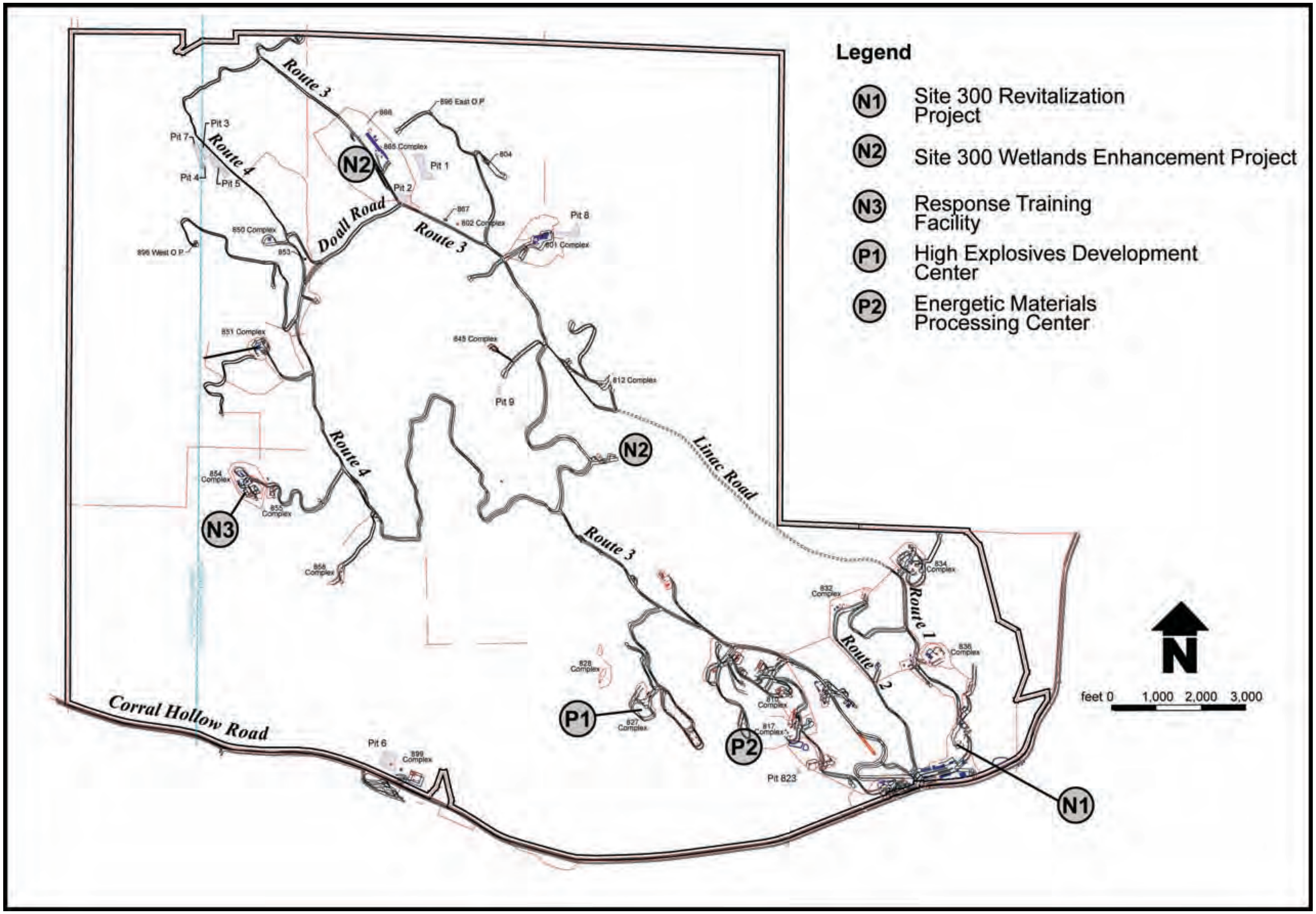
Source: LLNL 2003p.

FIGURE A.3–2.—*Site 300 General Services Area*



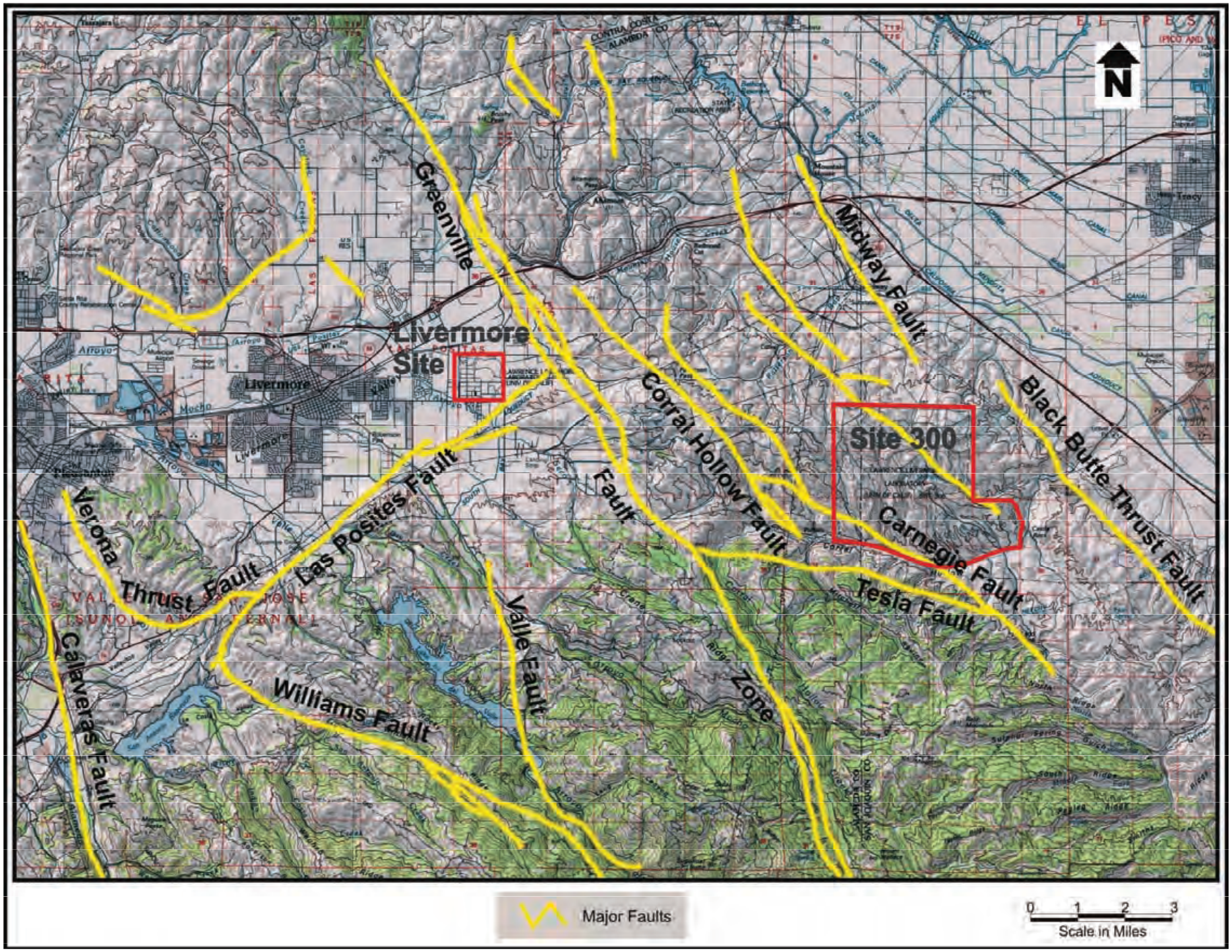
Source: LLNL 2003p.

FIGURE A.3.2–1.—*Selected Facilities Locations at Site 300*



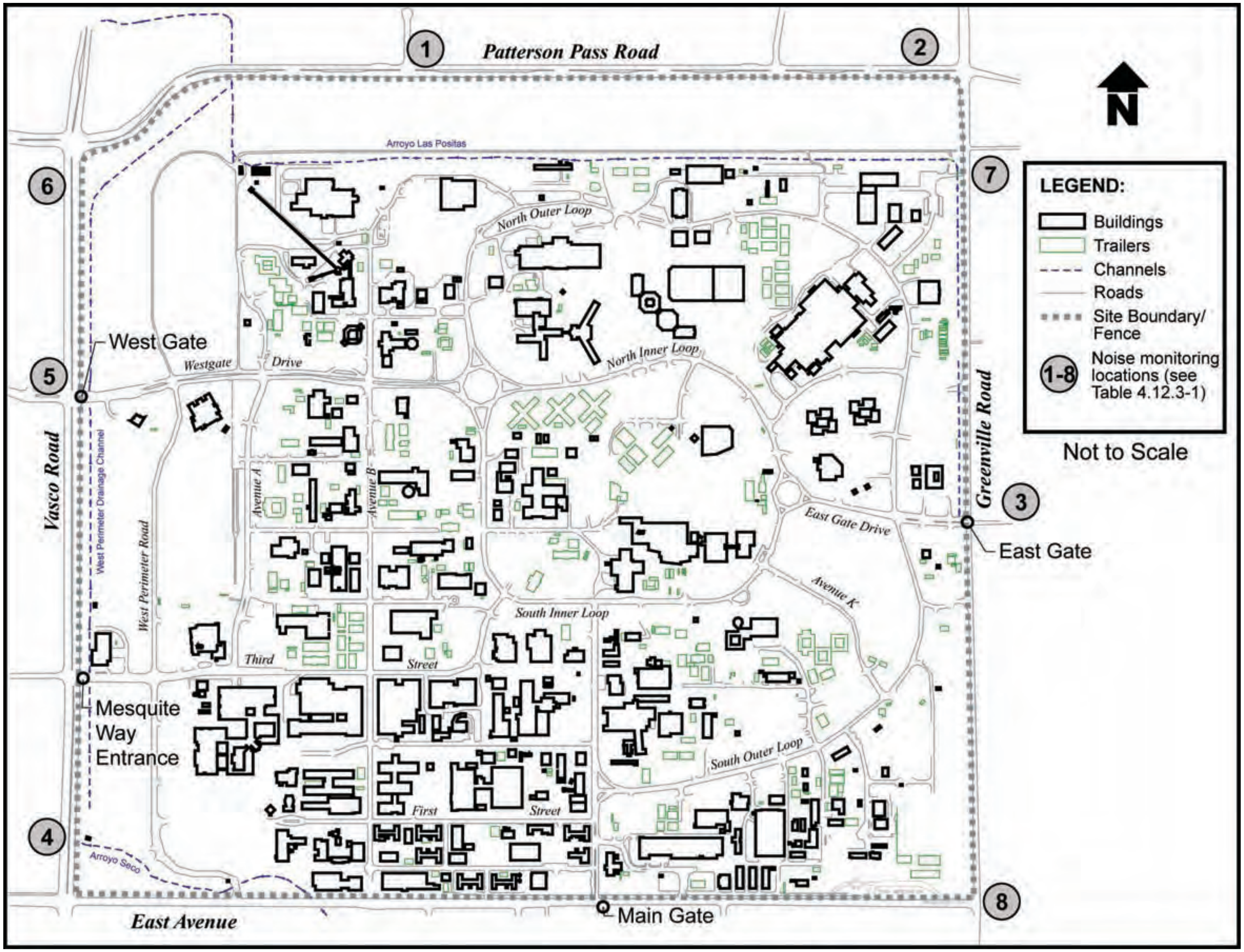
Source: Original.

FIGURE A.3.3–1.—*Site 300 Program Projections Project Locations*



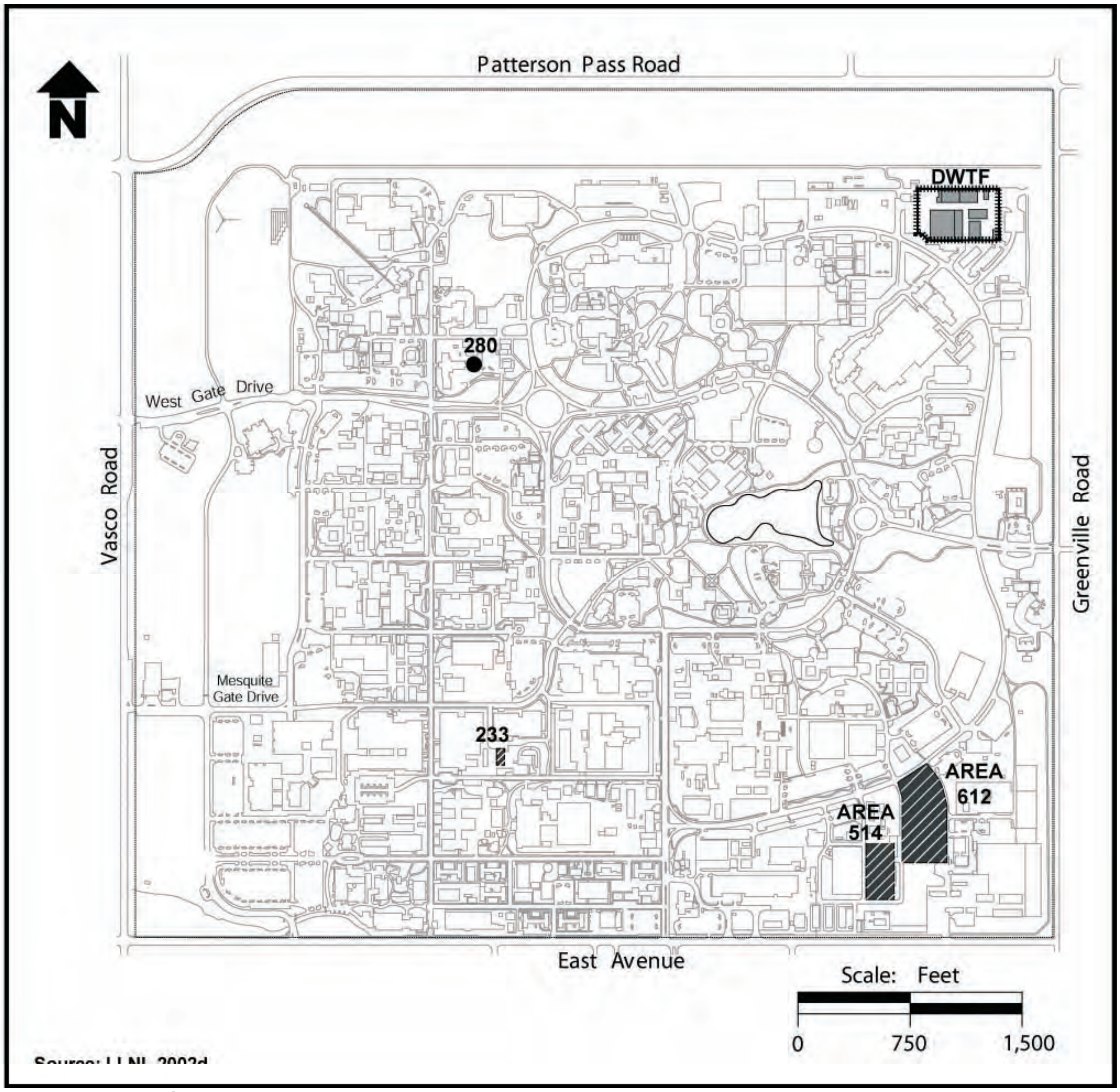
Source: LLNL 1992a.

FIGURE B.4.8.1–1.—*Location of the Major Faults Adjacent to the Livermore Site and Site 300*



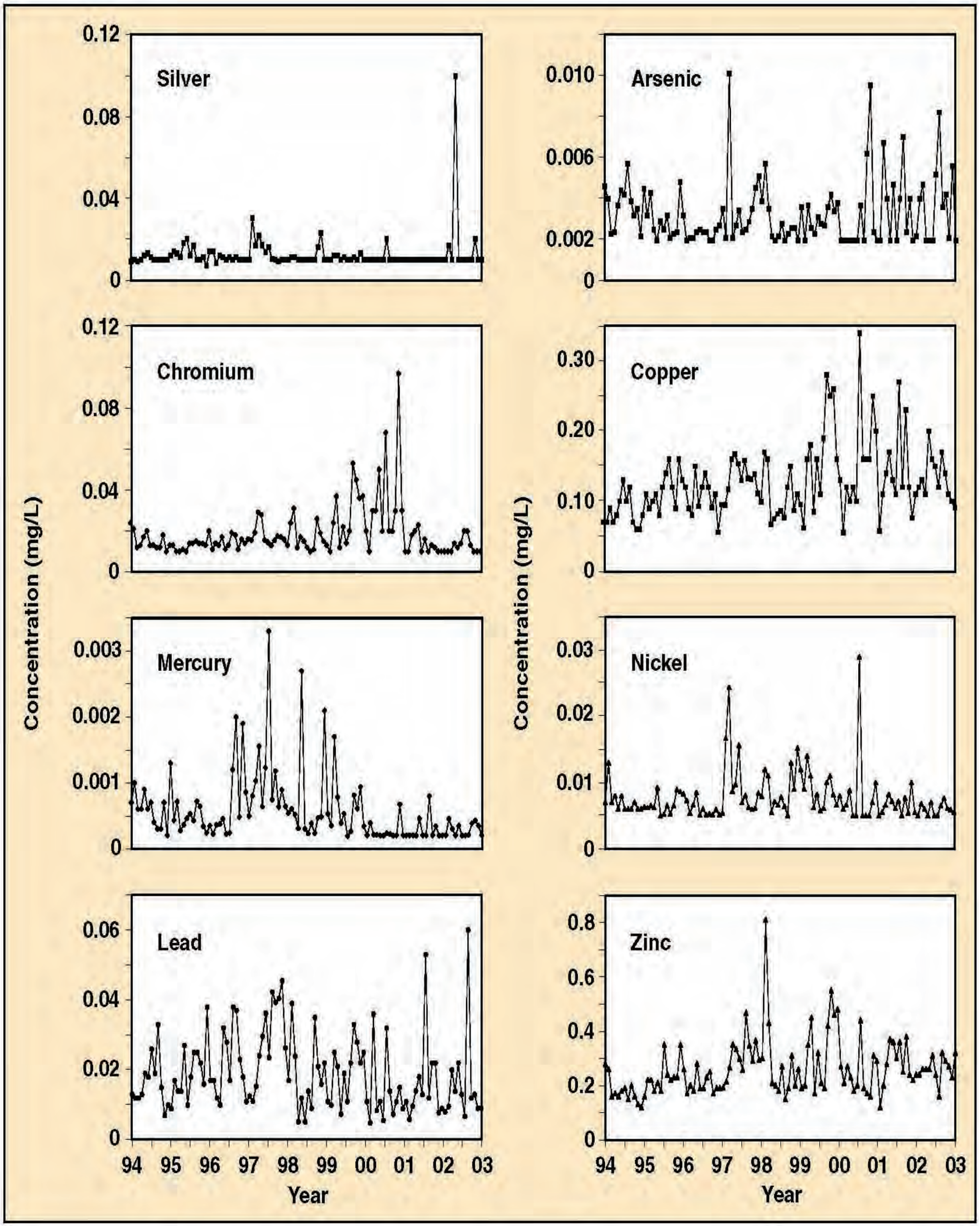
Source: LLNL 1992a.

FIGURE B.4.12–1.—*Noise Monitoring Locations Near the Livermore Site*



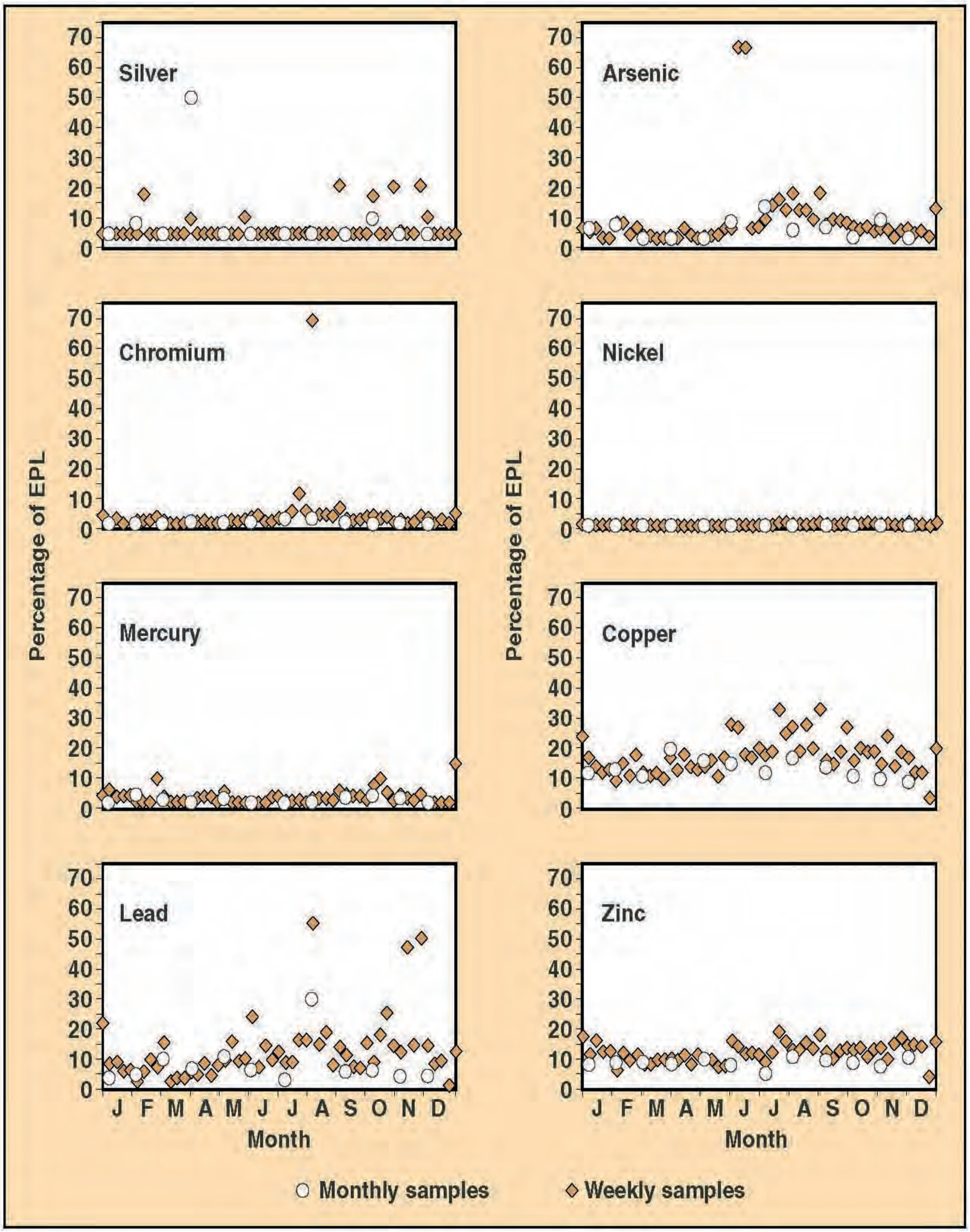
Source: LLNL 2002d.

FIGURE B.4.15.2–1.—*Livermore Site Map Showing Locations of the DWTF and Other Radioactive and Hazardous Waste Management Facilities*



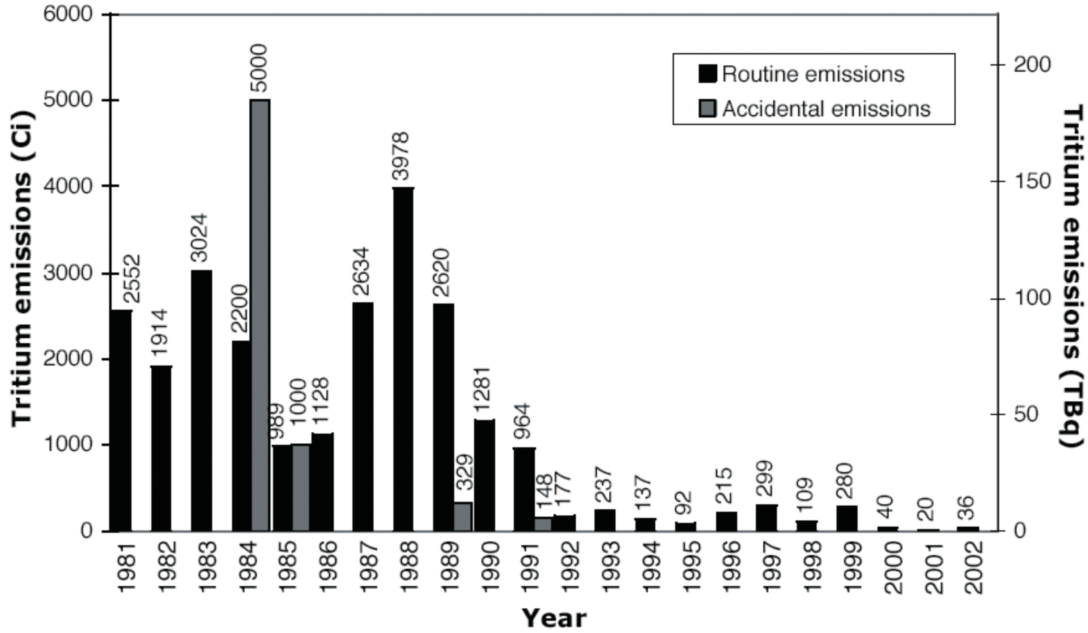
Source: LLNL 2003l.

FIGURE C.4.1–1.—*Monthly 24-Hour Composite Sample Concentrations for Regulated Metals in Lawrence Livermore National Laboratory Sanitary Sewer Effluent Showing Trends from 1994 to 2002*



Source: LLNL 2003l.

FIGURE C.4.1–2.—*Results as Percentages of Effluent Pollutant Limits for Regulated Metals in Lawrence Livermore National Laboratory Sewage, 2002*

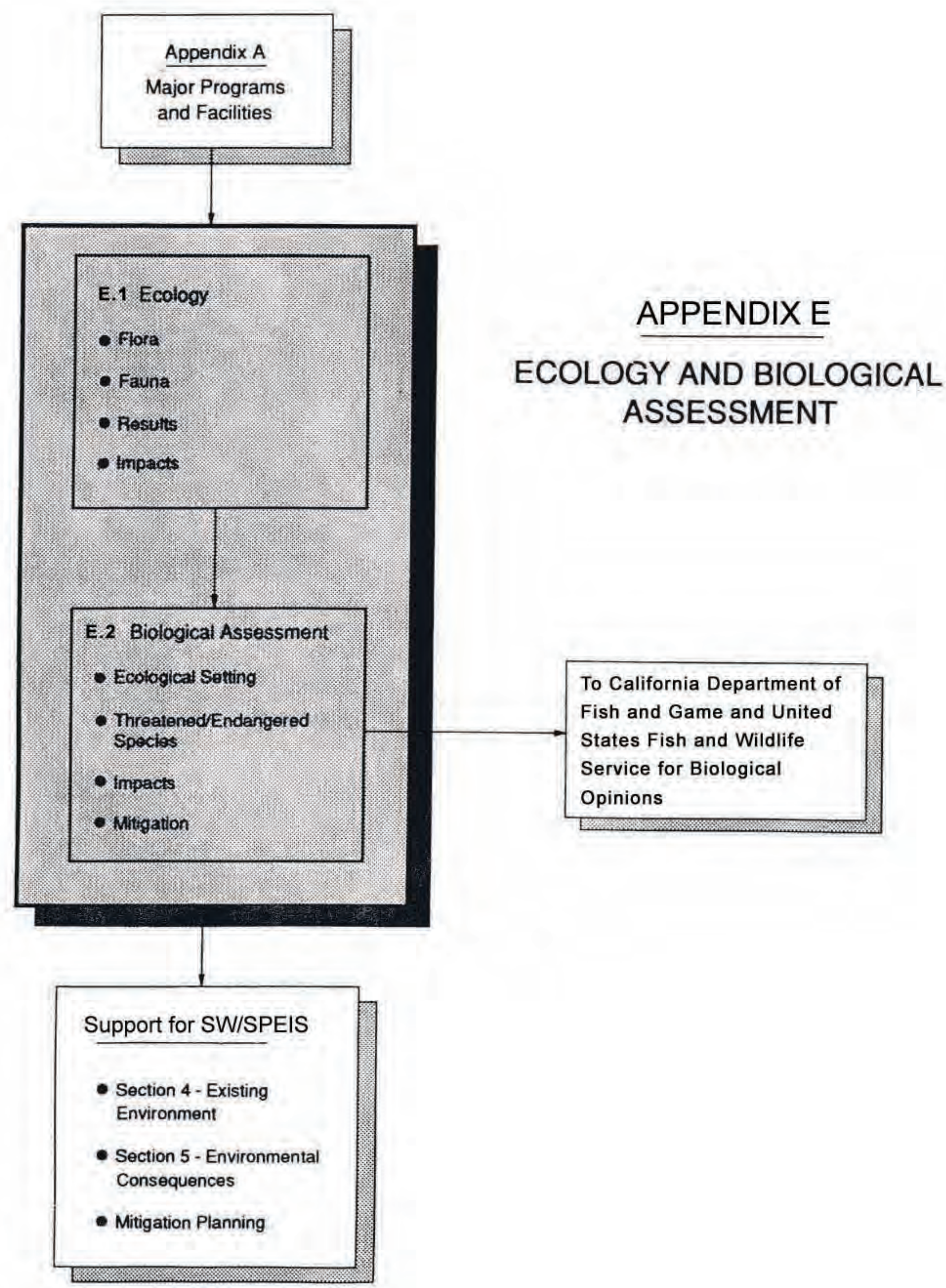


Source: LLNL 2003z.

FIGURE C.4.2.2–1.—*Recent Tritium Emissions From the Tritium Facility, 1981 – 2002*

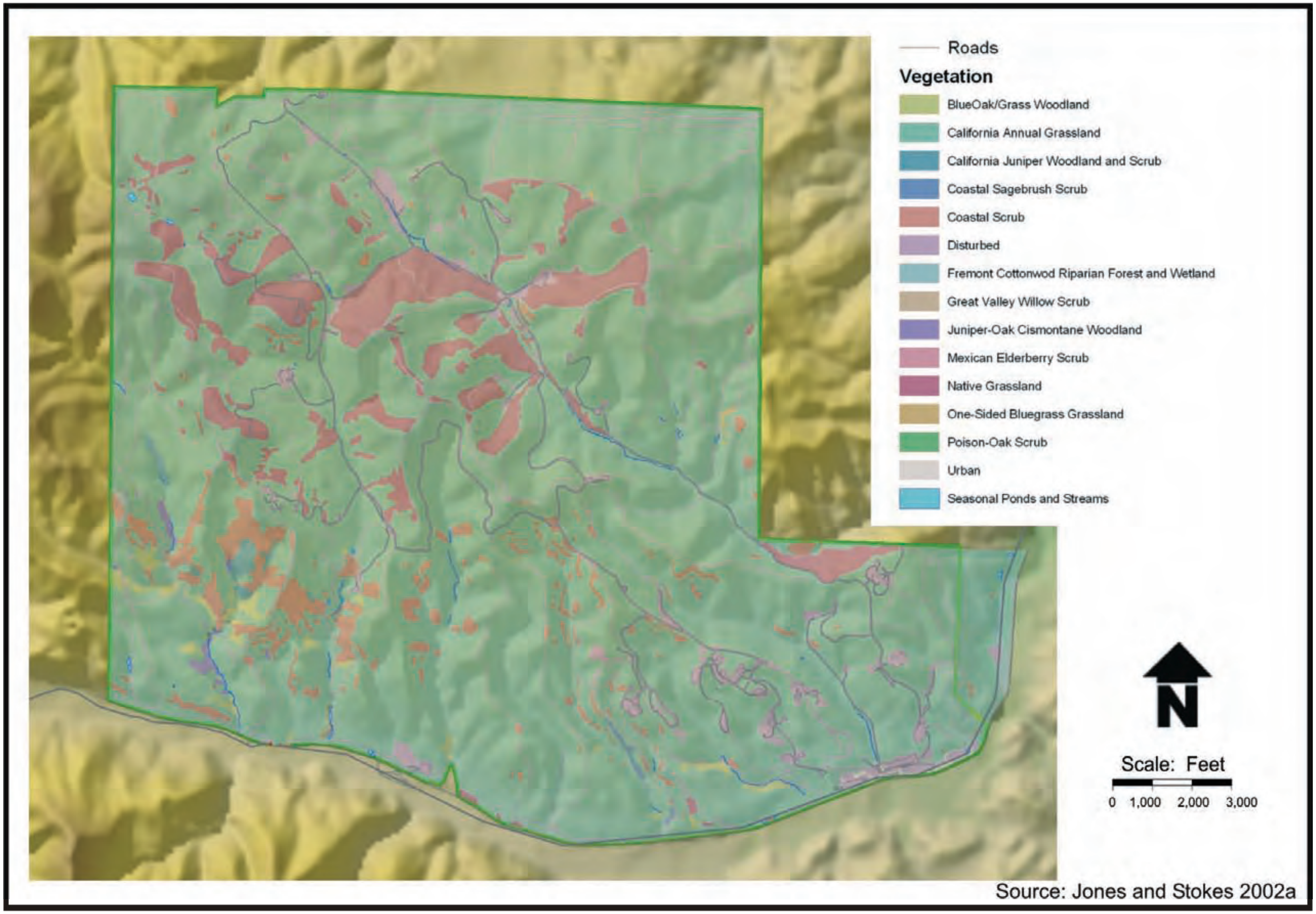
TABLE C.4.2.2–1.—*Curies of Important Radionuclides Released From Lawrence Livermore National Laboratory*

Site and Type of Radioactive Airborne Effluent Released	Curies Released Annually		
	No Action Alternative	**Proposed Action**	**Reduced Operation Alternative**
Livermore Site			
Tritium			
Building 612 yard	2	2	2
Building 331 stacks	210	210	210
Outside Building 331 (contaminated equipment awaiting storage)	1	1	1
Site 300			
Tritium	194	194	145
Uranium-234	0.0058	0.0058	0.0058
Uranium-235	0.00080	0.00080	0.0008
Uranium-238	0.062	0.062	0.062



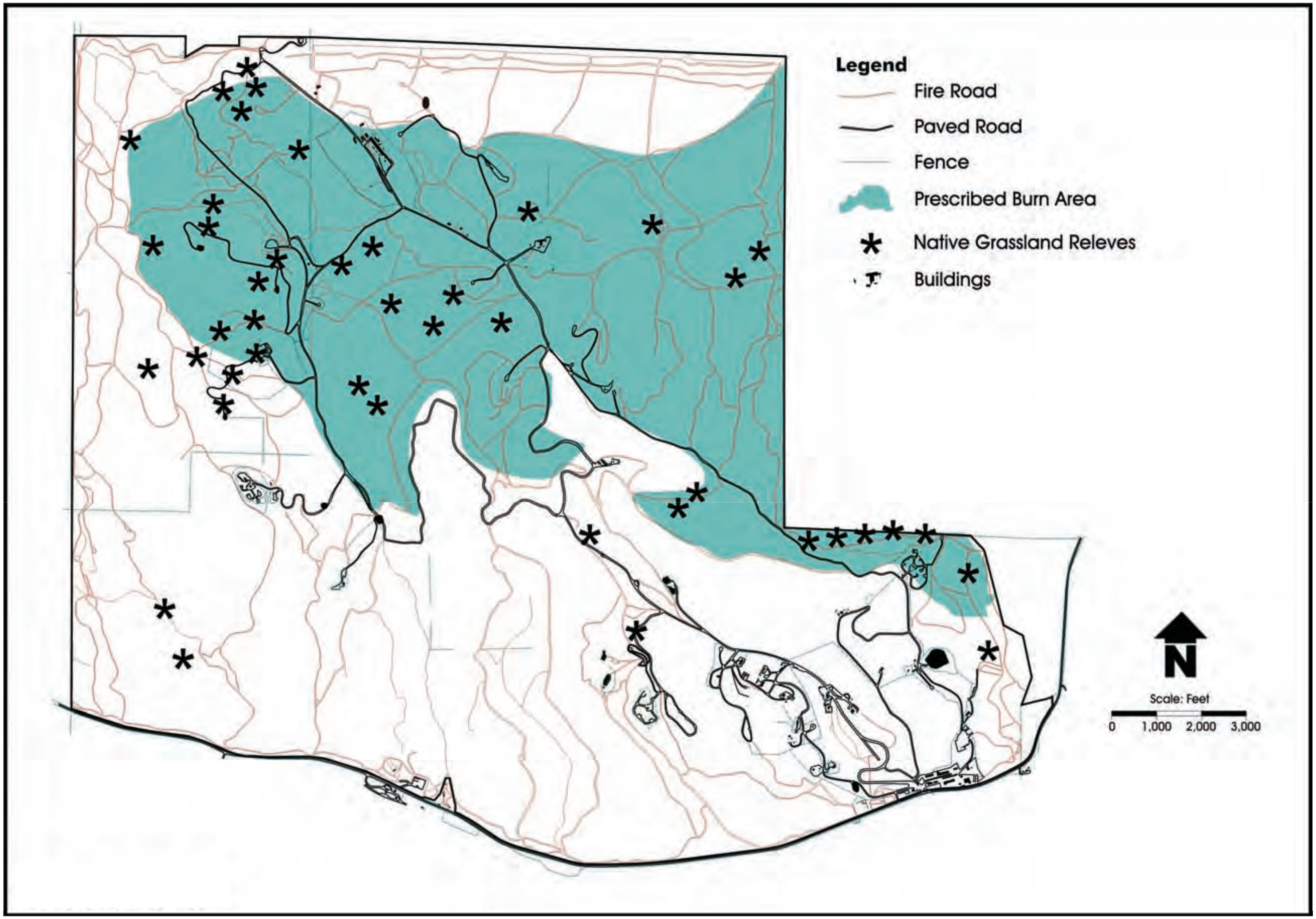
Source: LLNL 1992a.

FIGURE E–1.—*Appendix E Interface with Other Site-wide Environmental Impact Statement Sections, Appendices, and Regulatory Reviews*



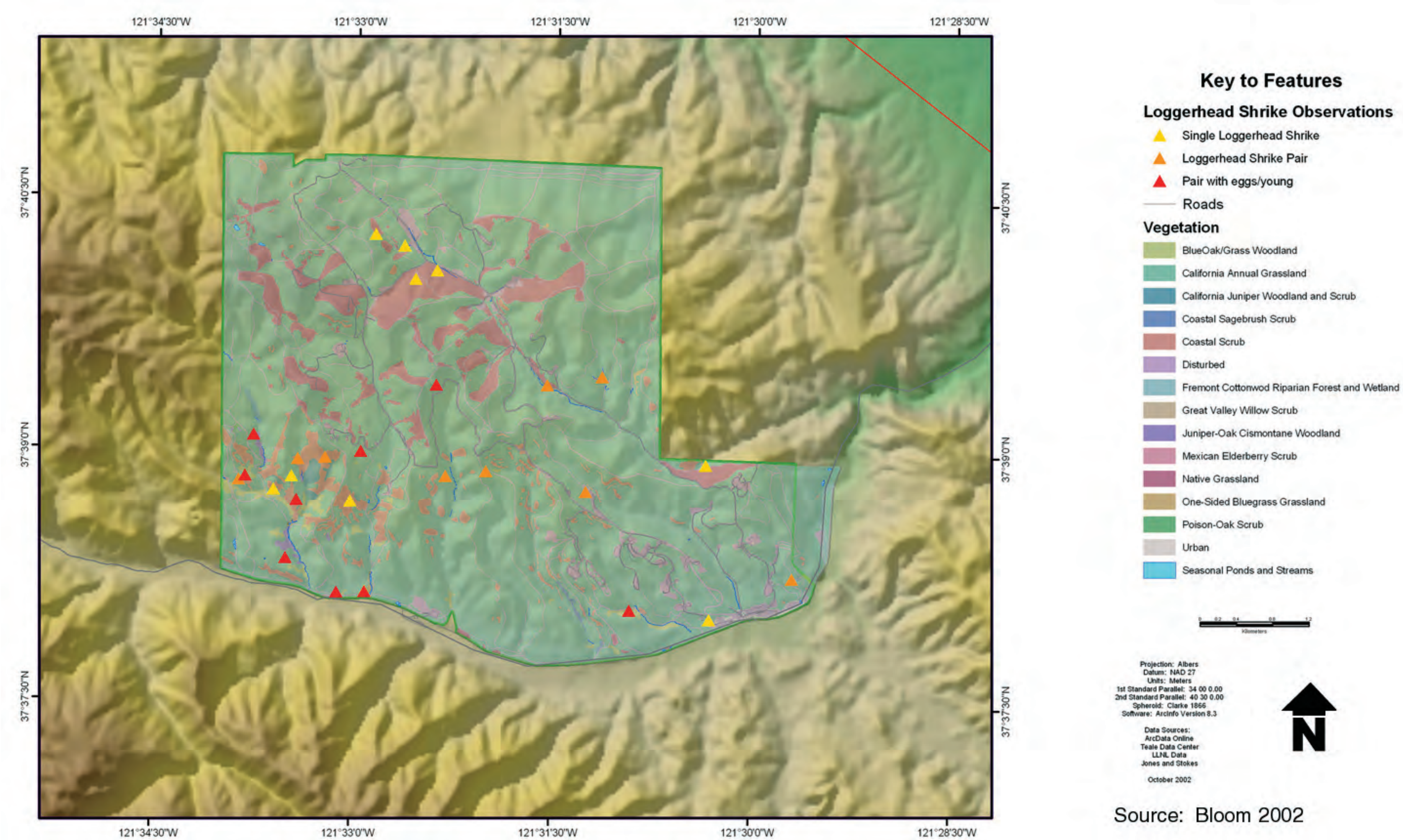
Source: Jones and Stokes 2002a.

FIGURE E.1.1.2–1.—*Plant Community Types Observed at Site 300 in 2002*



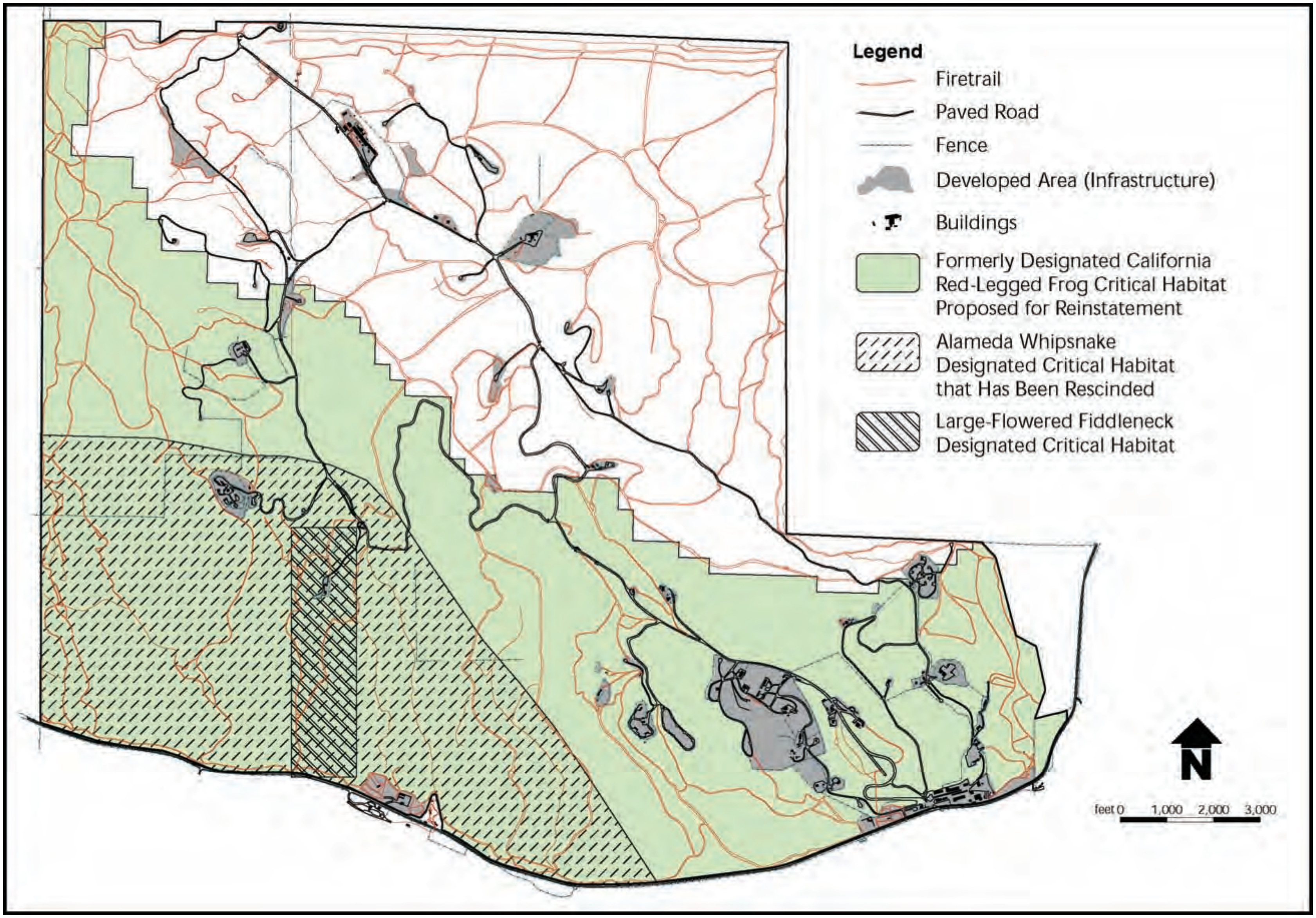
Source: BioSystems 1986a.

FIGURE E.1.1.3–1.—*Distribution of Native Grassland Plant Communities in Relation to Prescribed Burns at Site 300 in 1986*



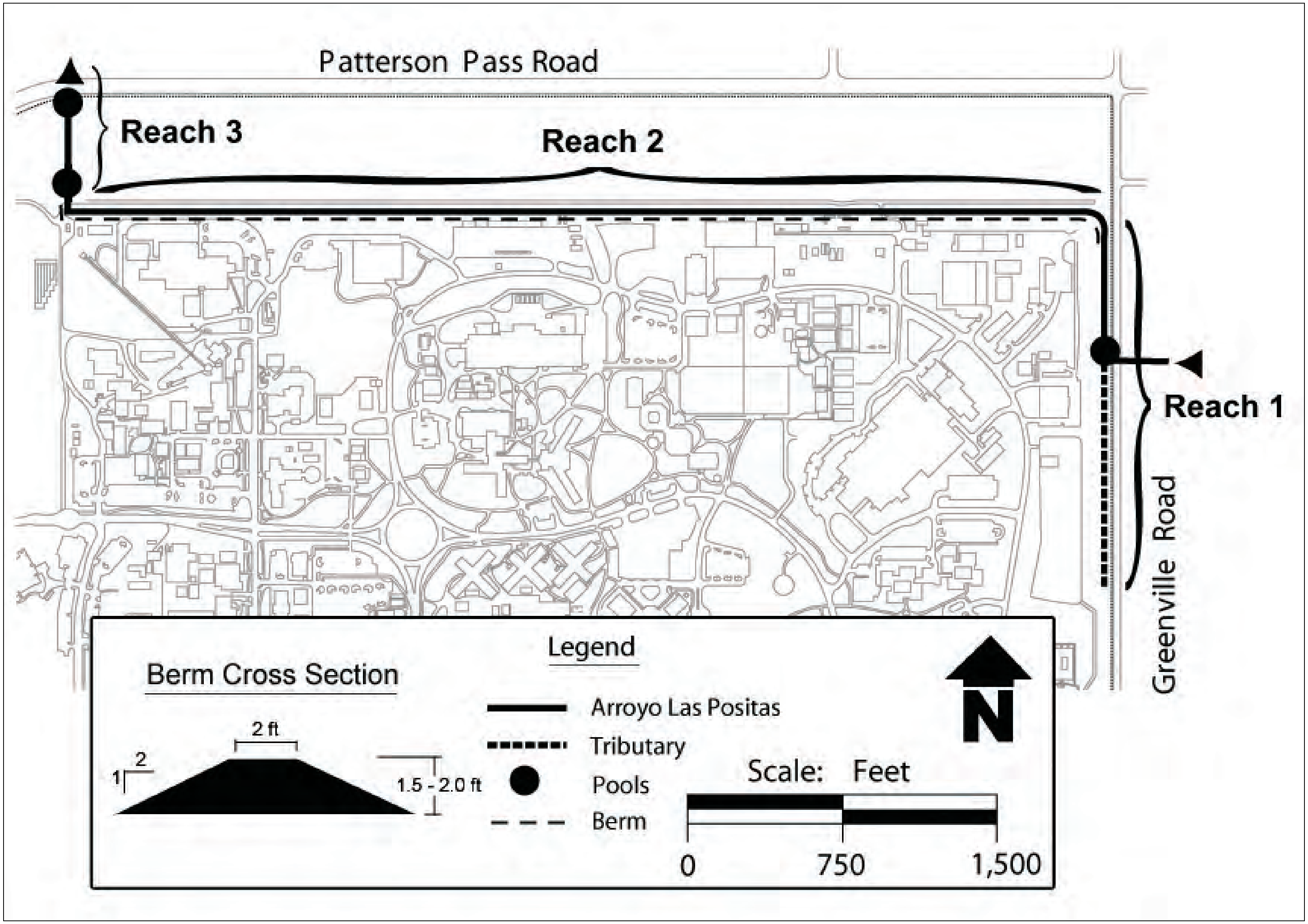
Source: Bloom 2002.

FIGURE E.1.2.2–1.—*Loggerhead Shrike Nesting Locations at Site 300 in 2002*



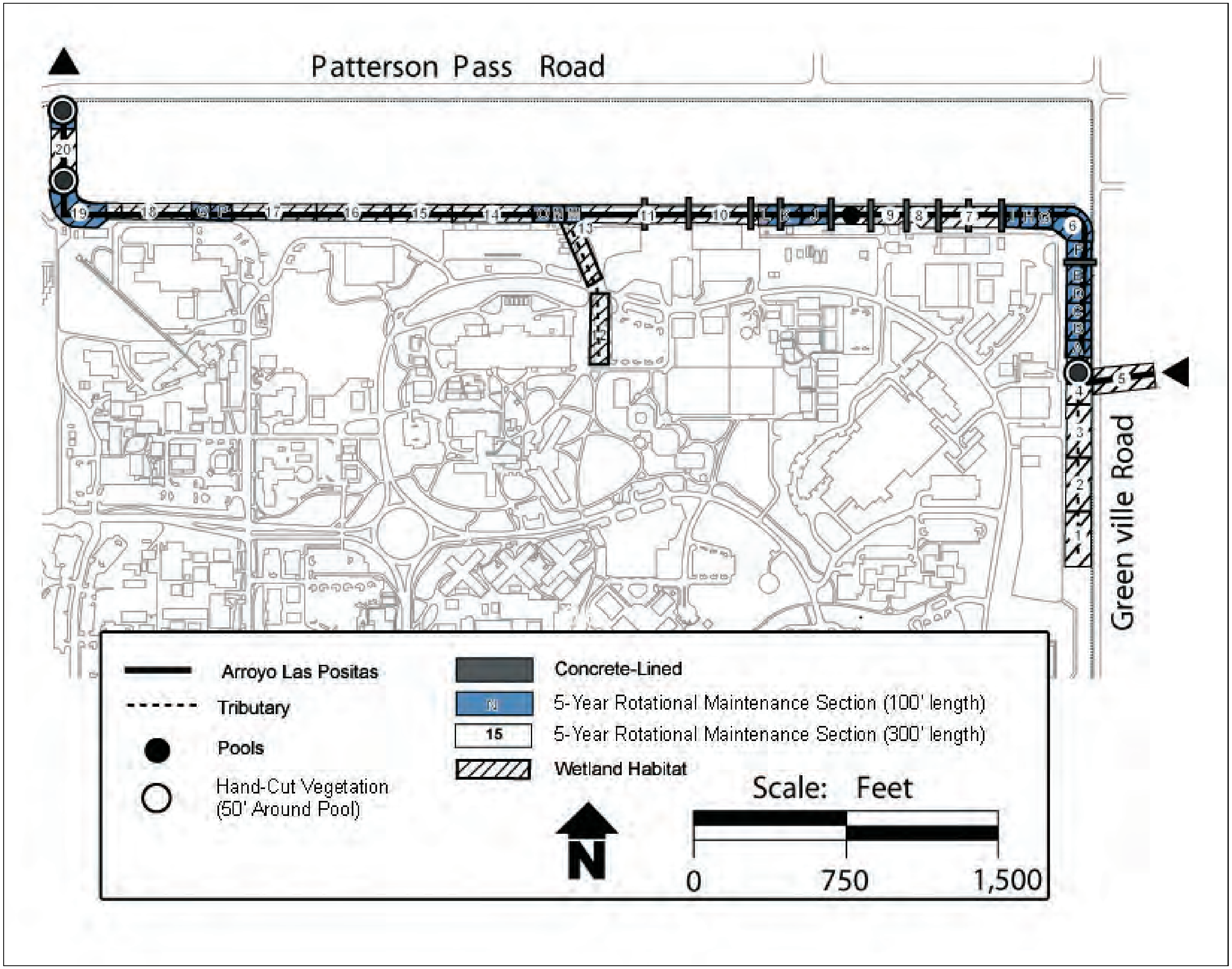
Source: Jones and Stokes 2001.

FIGURE E.2.2.2–1.—*Status of Designated Critical Habitat for Three Species at Site 300*



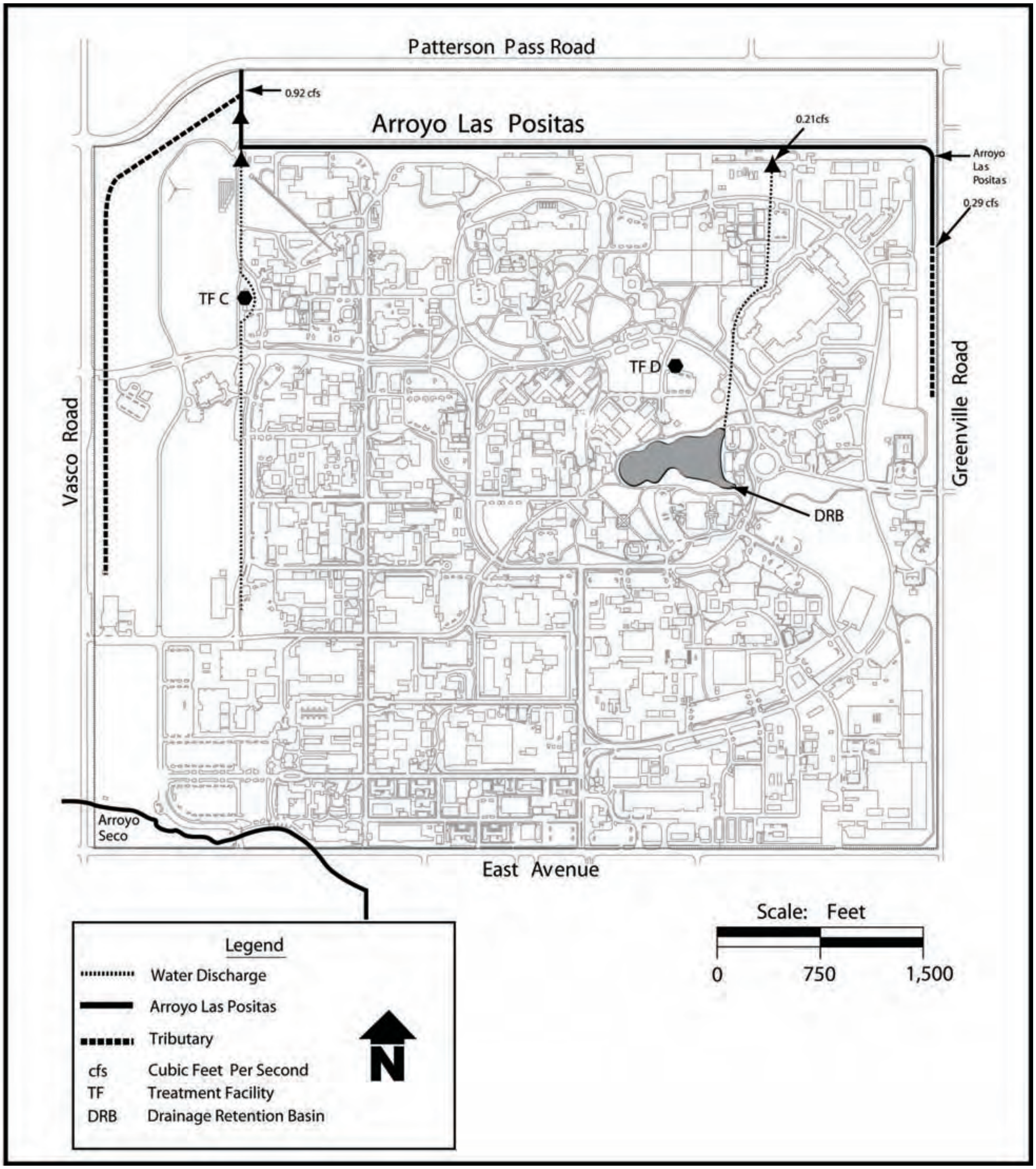
Source: LLNL 1998a.

FIGURE E.2.1.5.1–1.—*Arroyo Las Positas Maintenance Project, Reach 2 Berm Design*



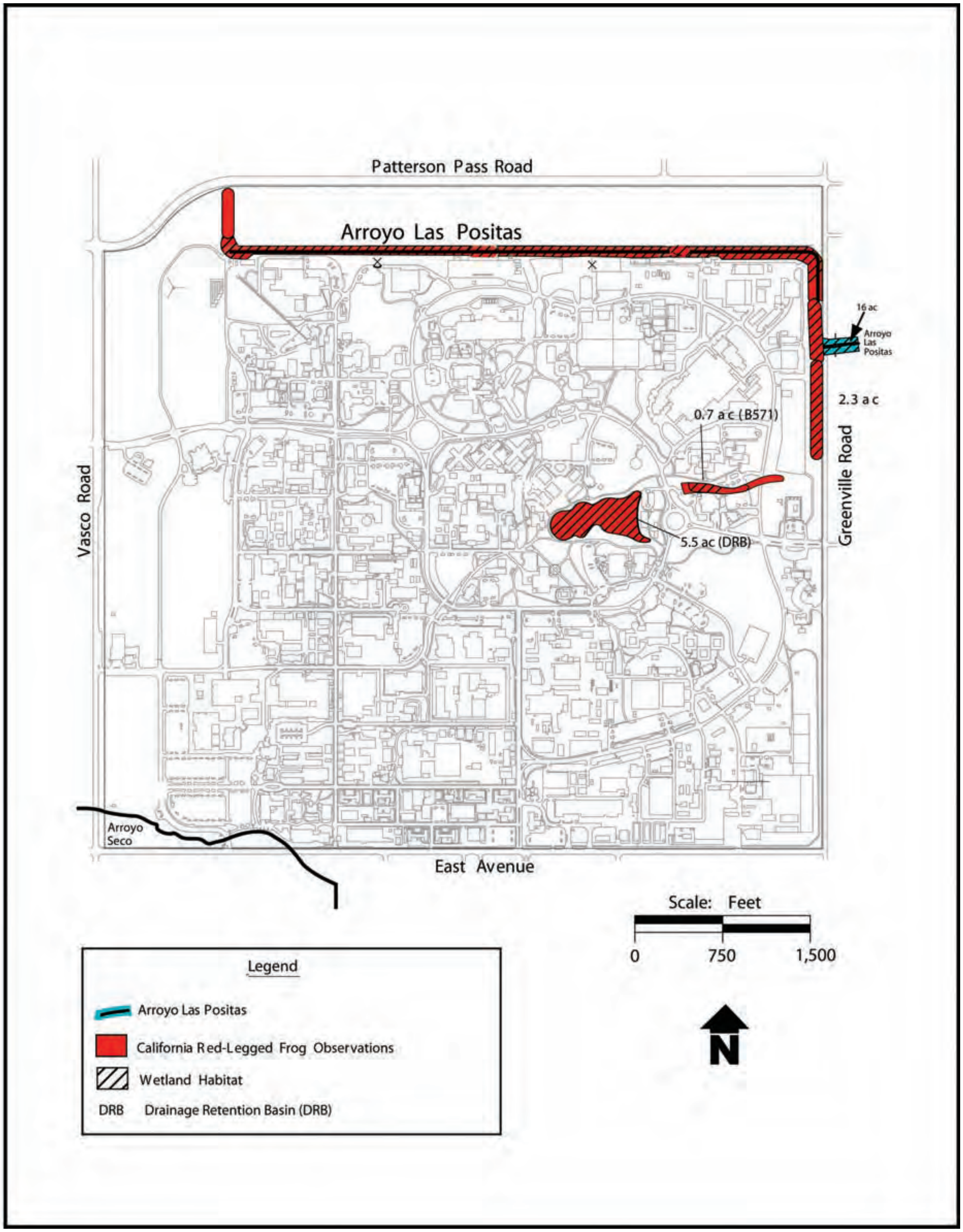
Source: LLNL 1998a.

FIGURE E.2.1.5.1–2.—*Arroyo Las Positas Maintenance Project (Wetland Features)*



Source: LLNL 1998a.

FIGURE E.2.1.5.1–3.—*Arroyo Flows and Augmentations in June 1998*



Source: Adapted from LLNL 1998a, LLNL 2003ab.

FIGURE E.2.1.5.2–1.—*Special Status Species Locations and Wetland Acreage in 2002*

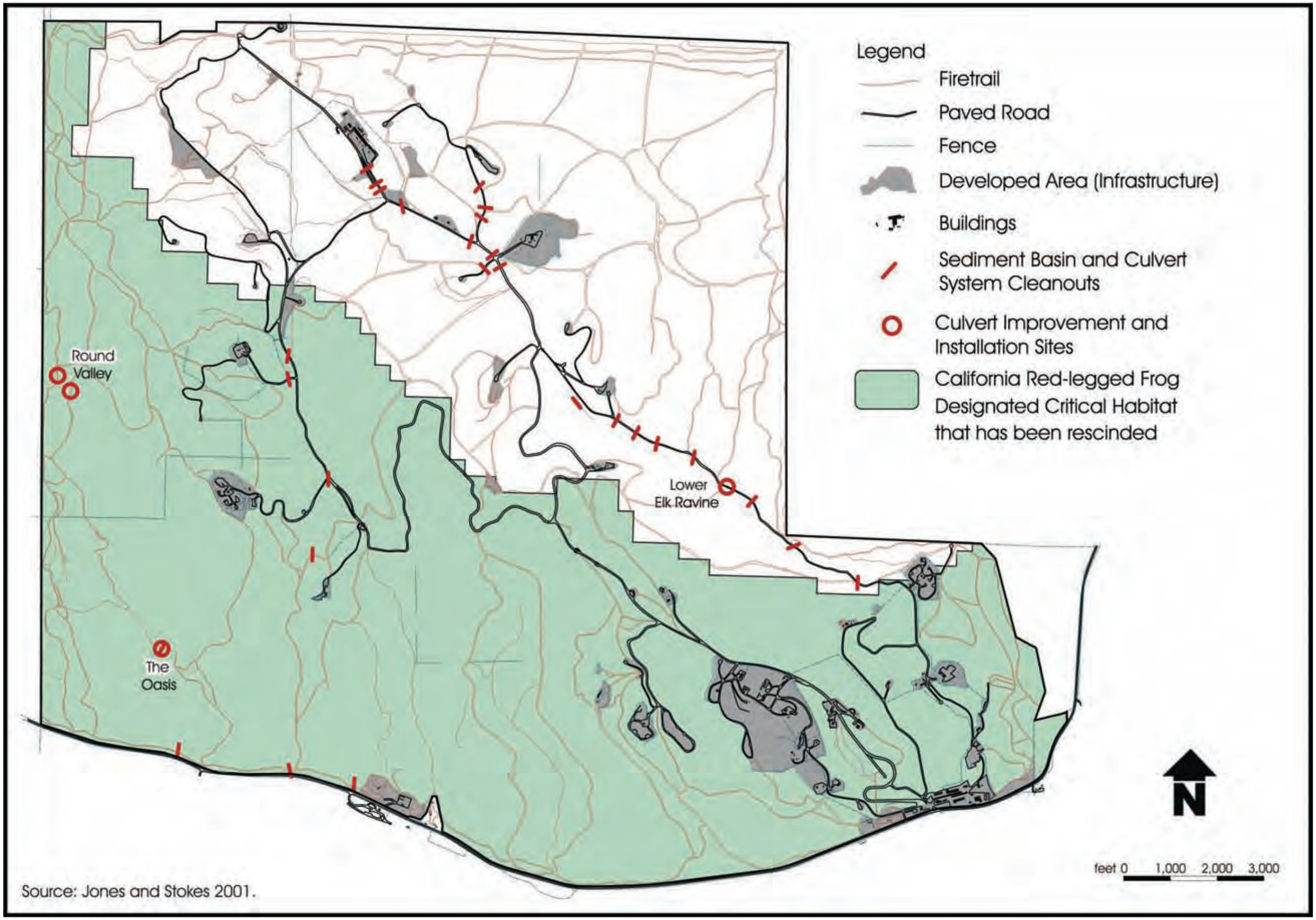
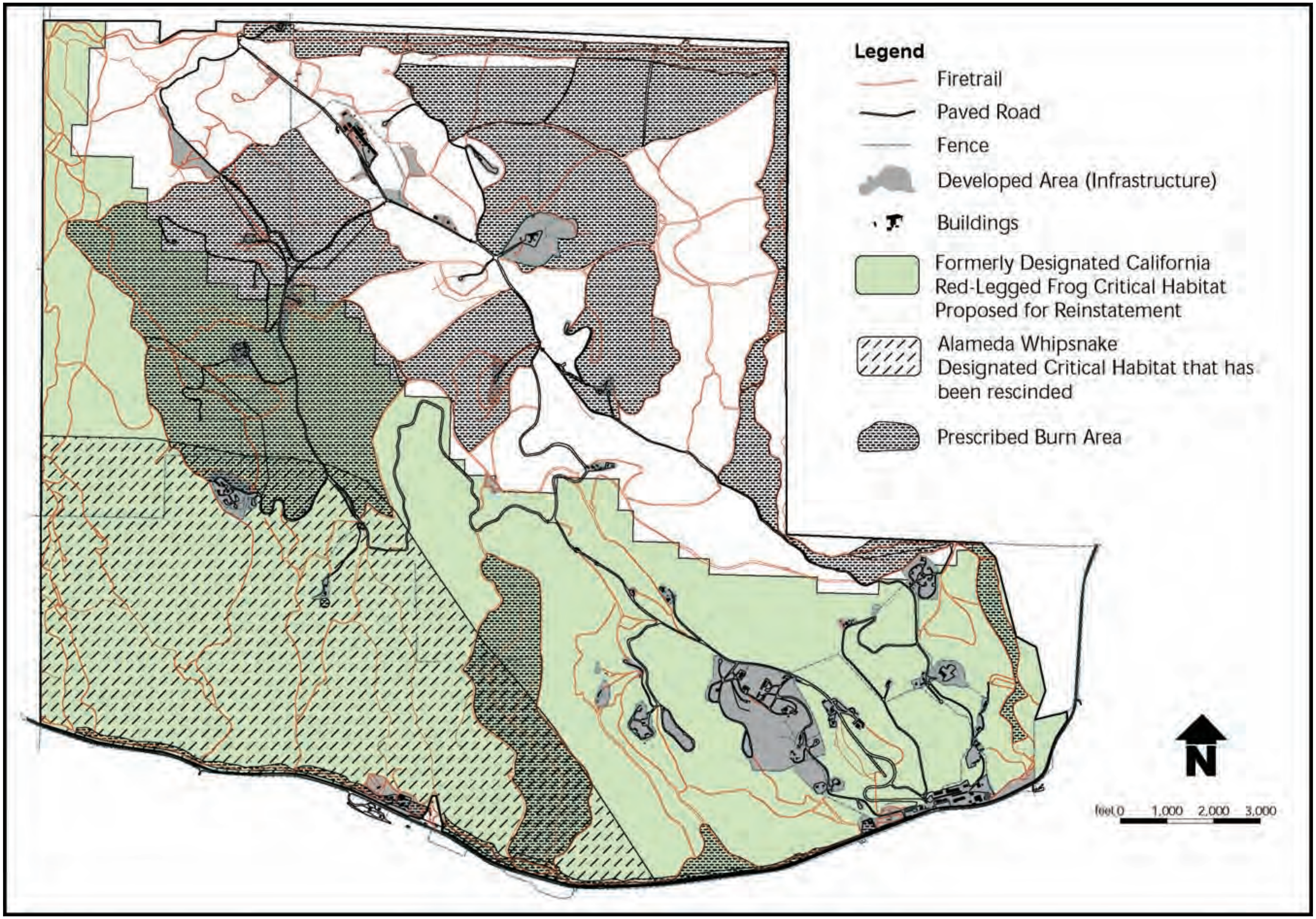


FIGURE E.2.2.5.2–1.—*Culvert Repair and Installation at Site 300*



Source: Jones and Stokes 2001.

FIGURE E.2.2.5.4–1.—*Prescribed Burn Areas at Site 300*

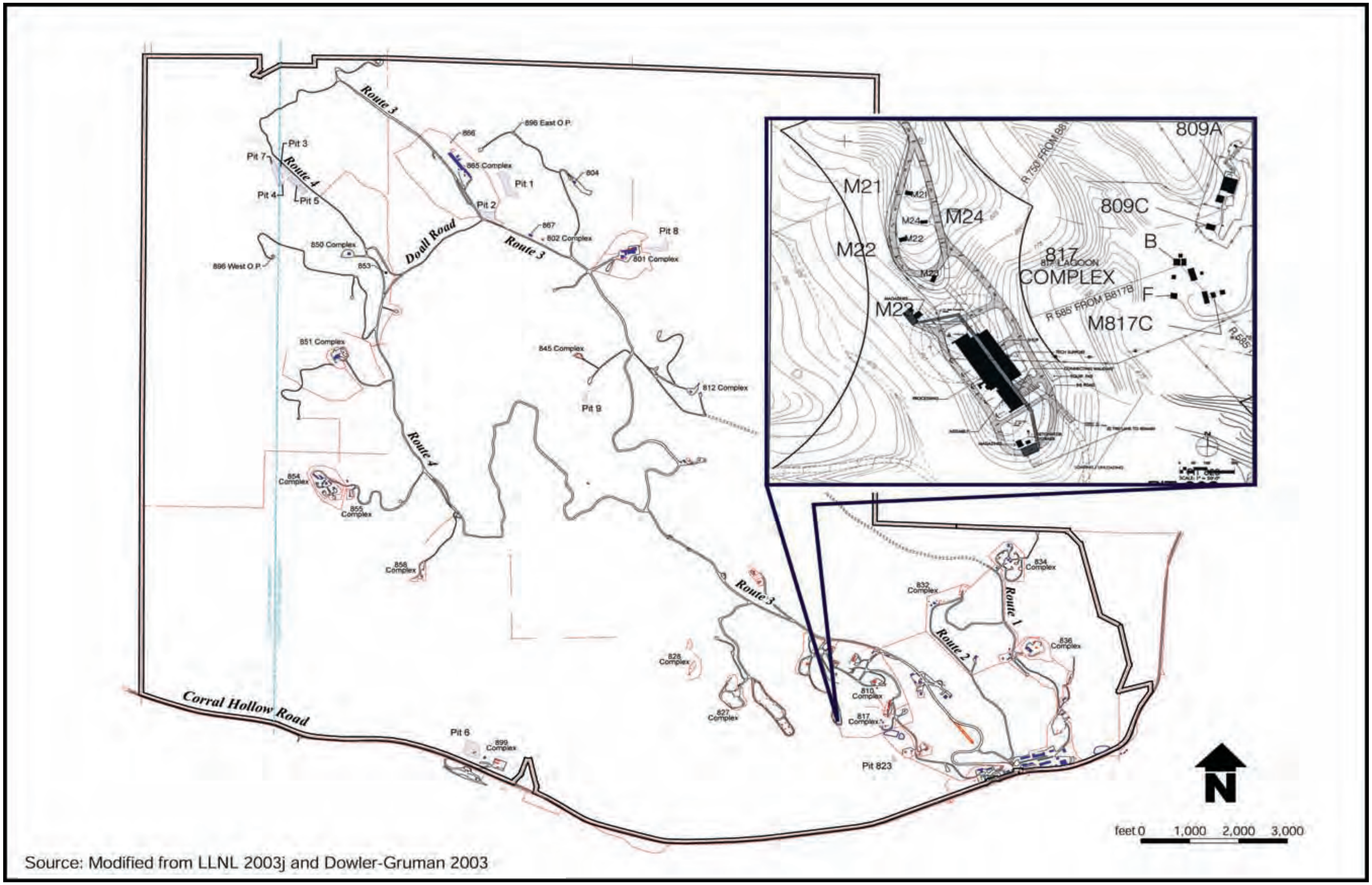
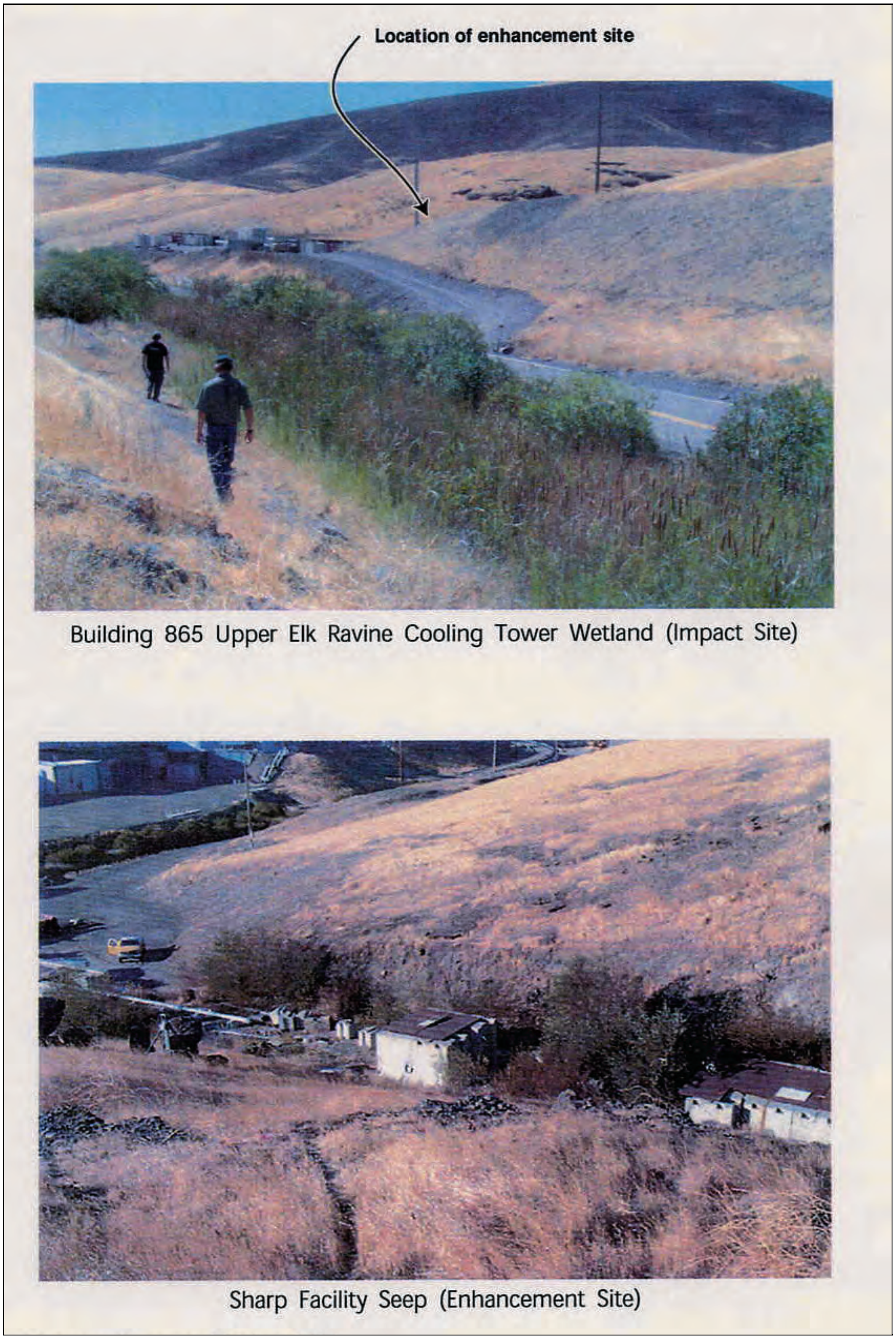


FIGURE E.2.2.5.6–1.— *Proposed Energetics Materials Processing Center at Site 300*



Building 865 Upper Elk Ravine Cooling Tower Wetland (Impact Site)

Sharp Facility Seep (Enhancement Site)

Source: Jones and Stokes 2001.

FIGURE E.2.2.6.1.1.4–1.—*Photographs of Upper Elk Ravine Area (Enhancement and Impact Area)*

Source: LLNL 2003ad.

FIGURE E.2.2.6.1.2.1–1.—*Erosion in Elk Ravine above Building 812*

E.2.2.6.1.3 Mitigation and Avoidance Measures

To protect the California red-legged frog and its habitat, the following avoidance and mitigation measures would be implemented at Site 300 during maintenance activities (Jones and Stokes 2001):

- The loss of breeding habitat for the California red-legged frog at Building 865 would be offset by plans to enhance California red-legged frog habitat onsite (see Section E.2.2.9).
- All storm drainage system maintenance would be performed during the dry season, or when water is not present in the work area. In the four areas scheduled for culvert improvement or installation, a preactivity survey would be conducted within 24 hours of construction. A qualified biologist would be present during construction to examine potential burrow sites within the work zone to determine if they are occupied by the California red-legged frog.
- Prior to fire trail grading, prescribed burning, storm drainage system maintenance, and culvert improvement and installation activities, a qualified biologist would provide worker awareness training to all project personnel. This training would include recognition of California red-legged frog and its habitat.

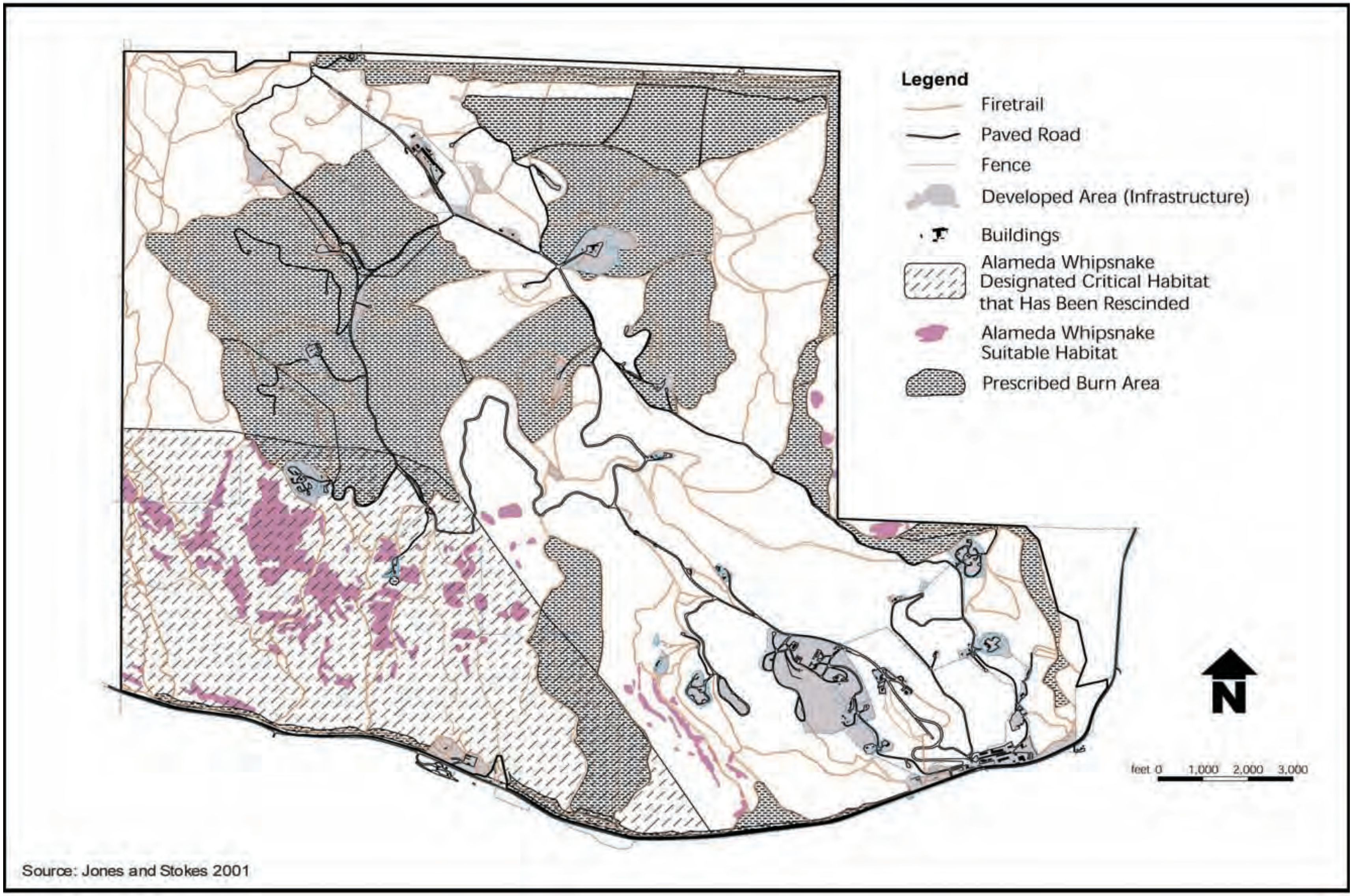
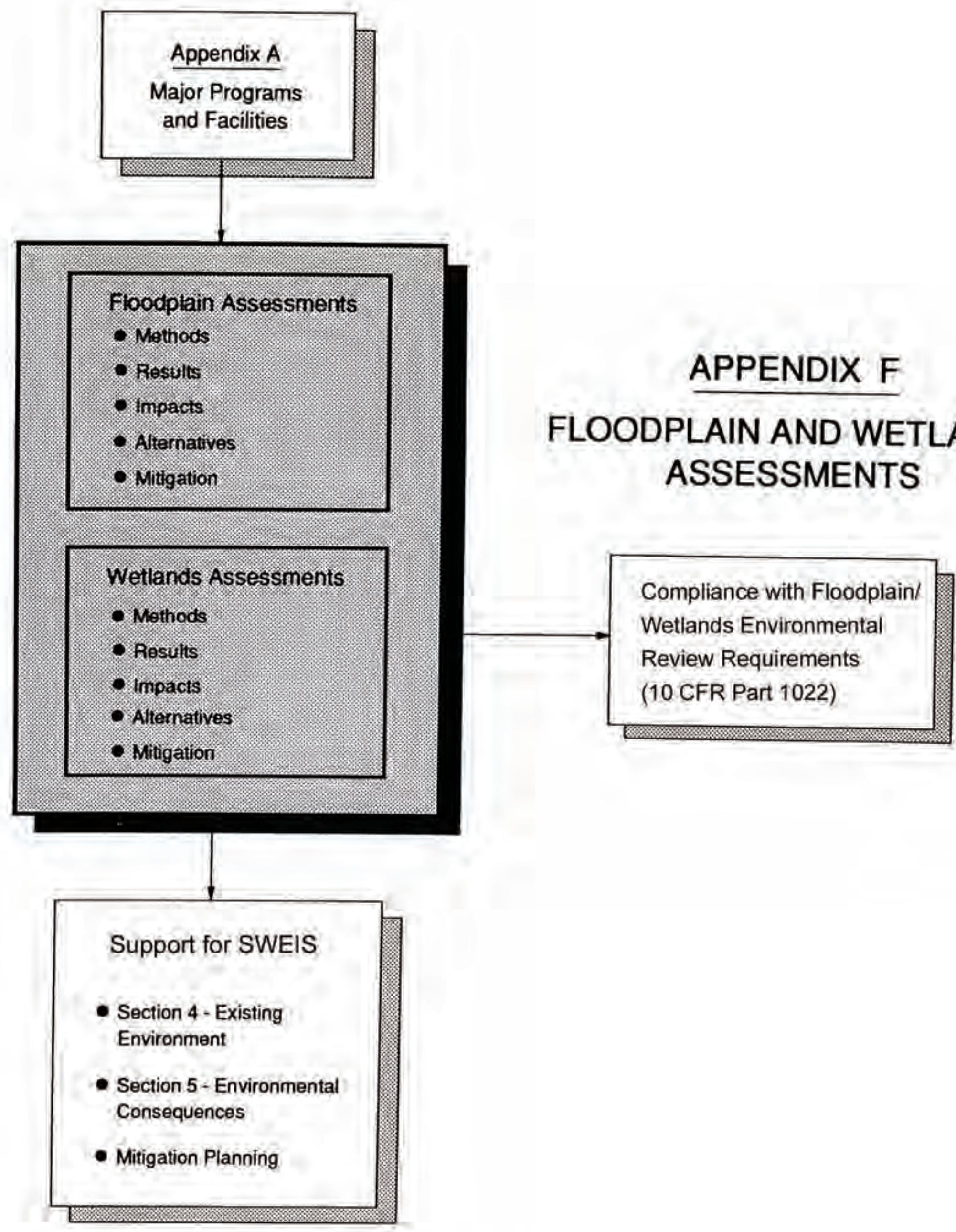
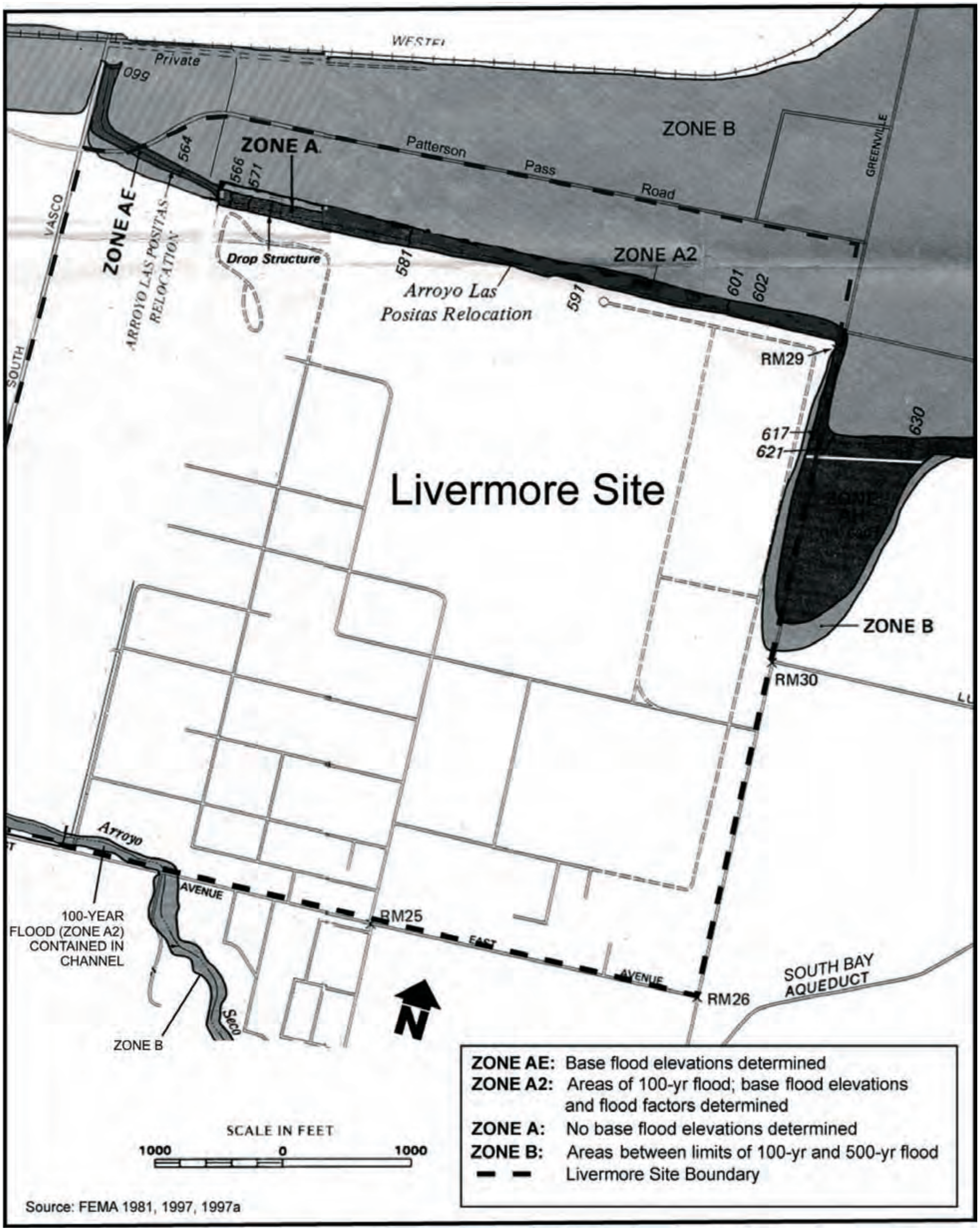


FIGURE E.2.2.6.2.1.3–1.—*Formerly Designated Critical Habitat and Suitable Habitat for the Alameda Whipsnake at Site 300*



Source: Original.

FIGURE F.1–1.—*Appendix F Interface with Site-wide Environmental Impact Statement Sections, Appendix A, and Regulatory Reviews*



Source: FEMA 1981, 1997a, 1997b.

FIGURE F.2.1–1.—*100- and 500-Year Floodplains at the Livermore Site*

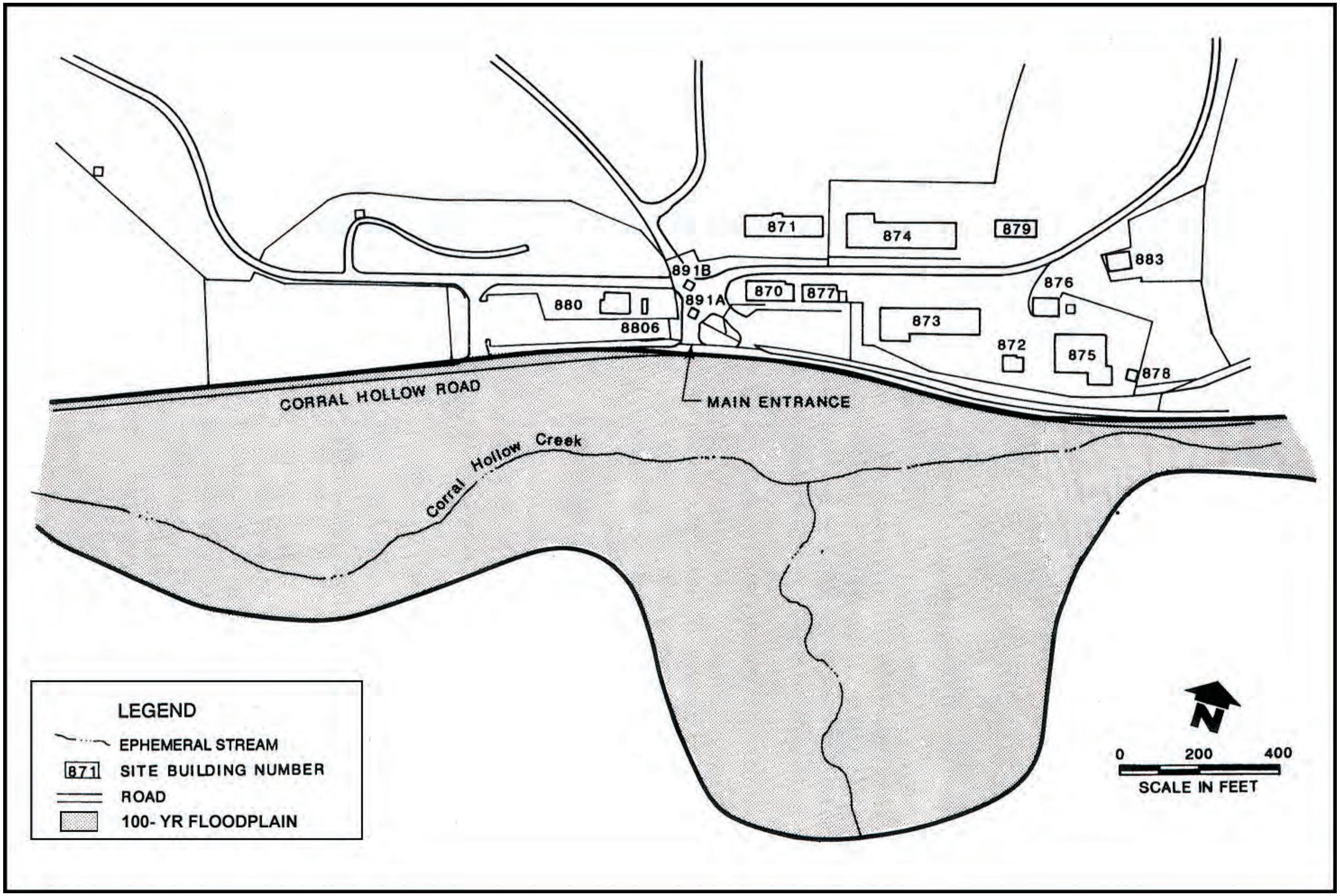
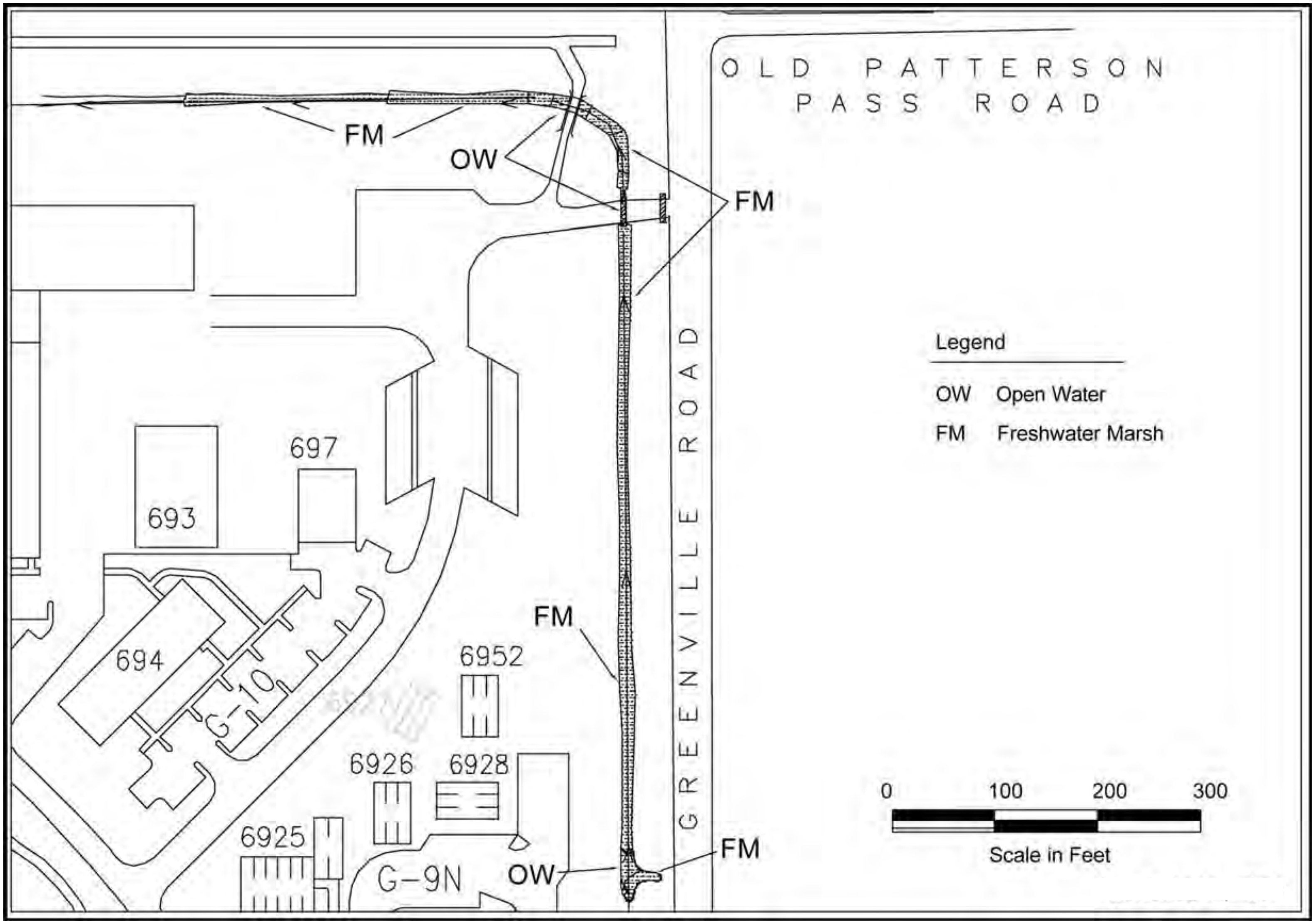
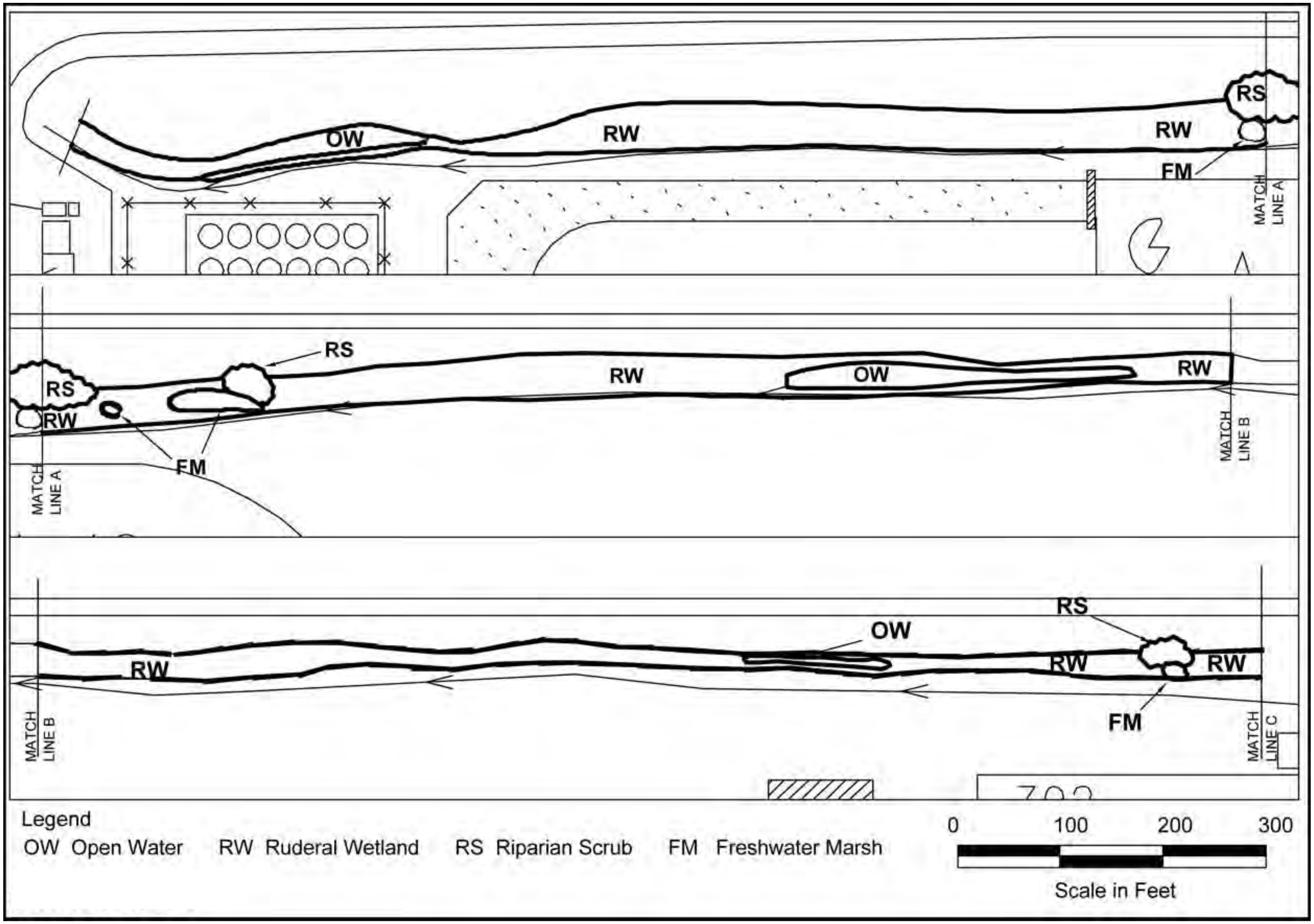


FIGURE F.2.1–2. —*100-Year Floodplain Along Corral Hollow Creek in the Area of Site 300 Main Entrance*



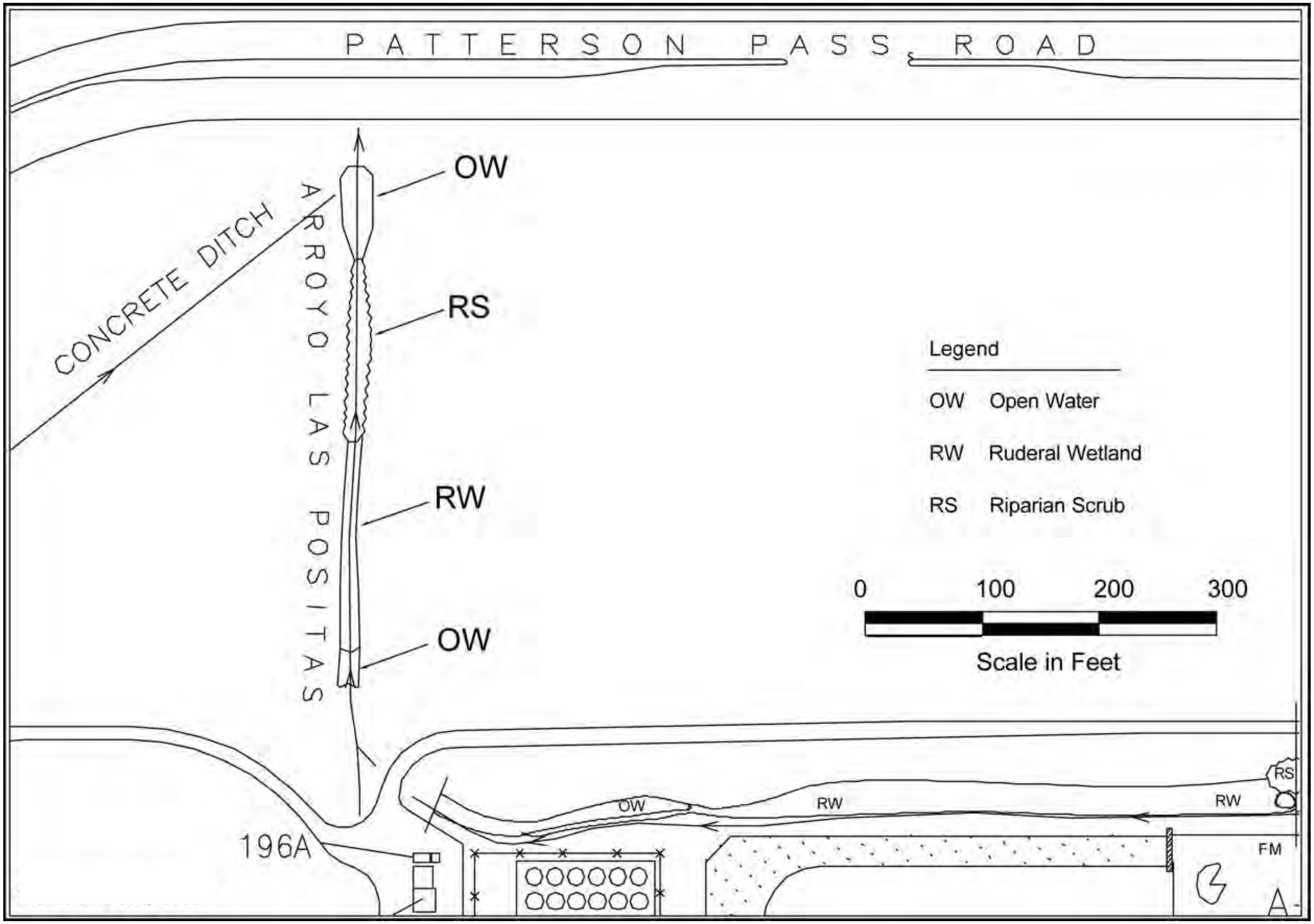
Source: Jones and Stokes 1997.

FIGURE F.3.1.1–1.—*Location of Wetlands in Arroyo Las Positas, North Arroyo (Map 1)*



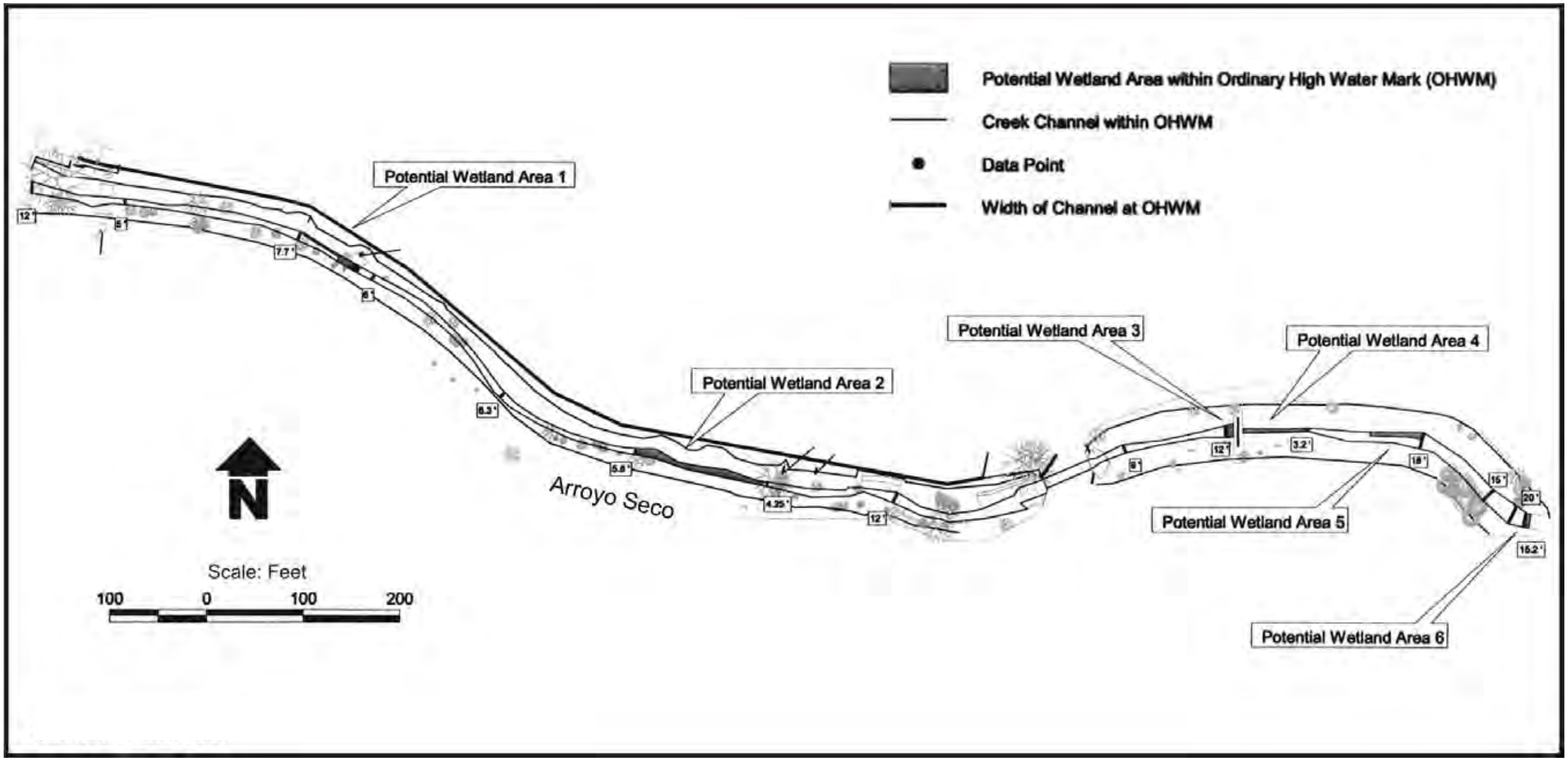
Source: Jones and Stokes 1997.

FIGURE F.3.1.1–2.—*Location of Wetlands in Arroyo Las Positas, North Arroyo (Map 2)*



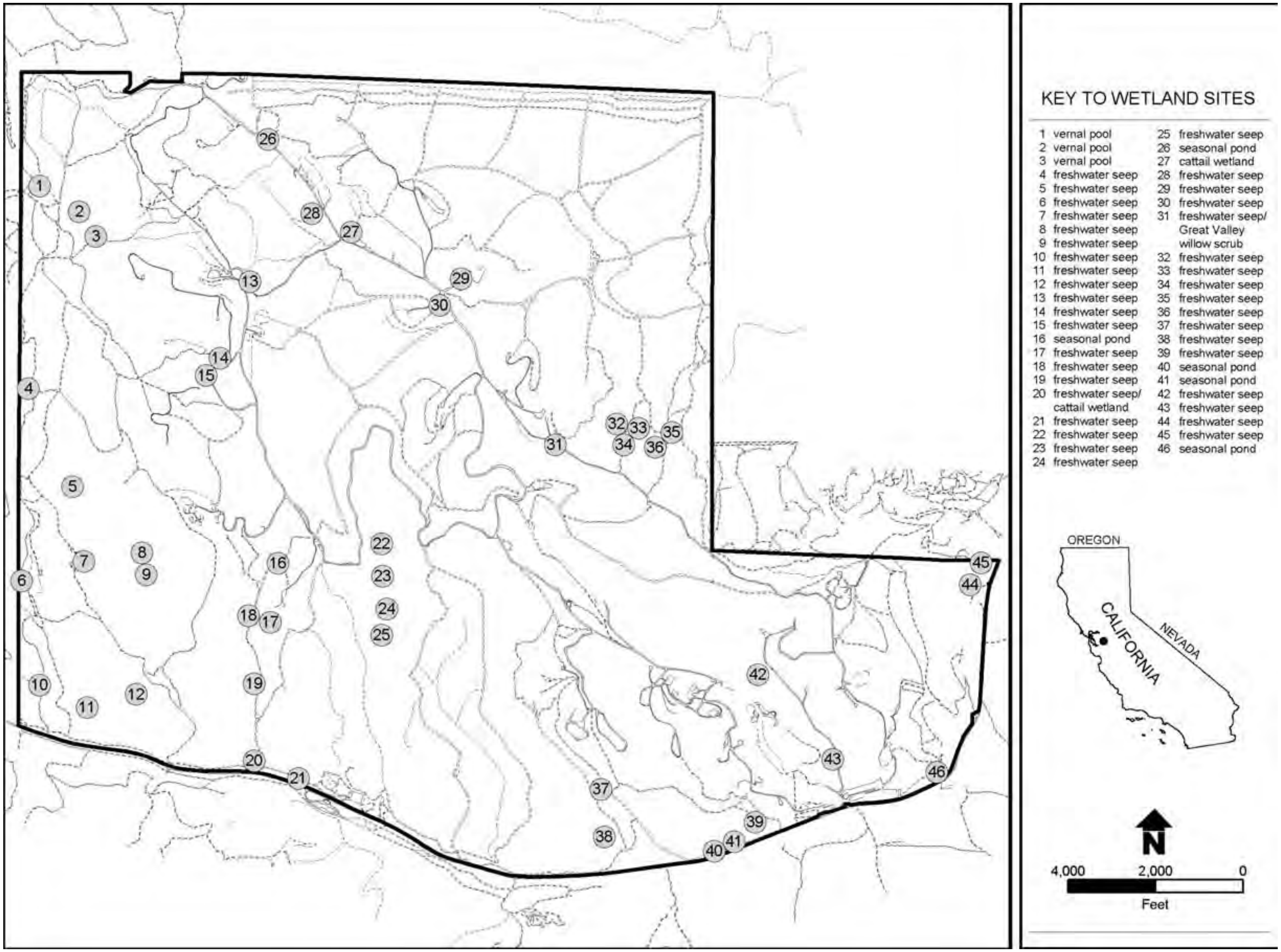
Source: Jones and Stokes 1997.

FIGURE F.3.1.1–3.—*Location of Wetlands in Arroyo Las Positas, Northwest Arroyo to Patterson Pass Road*



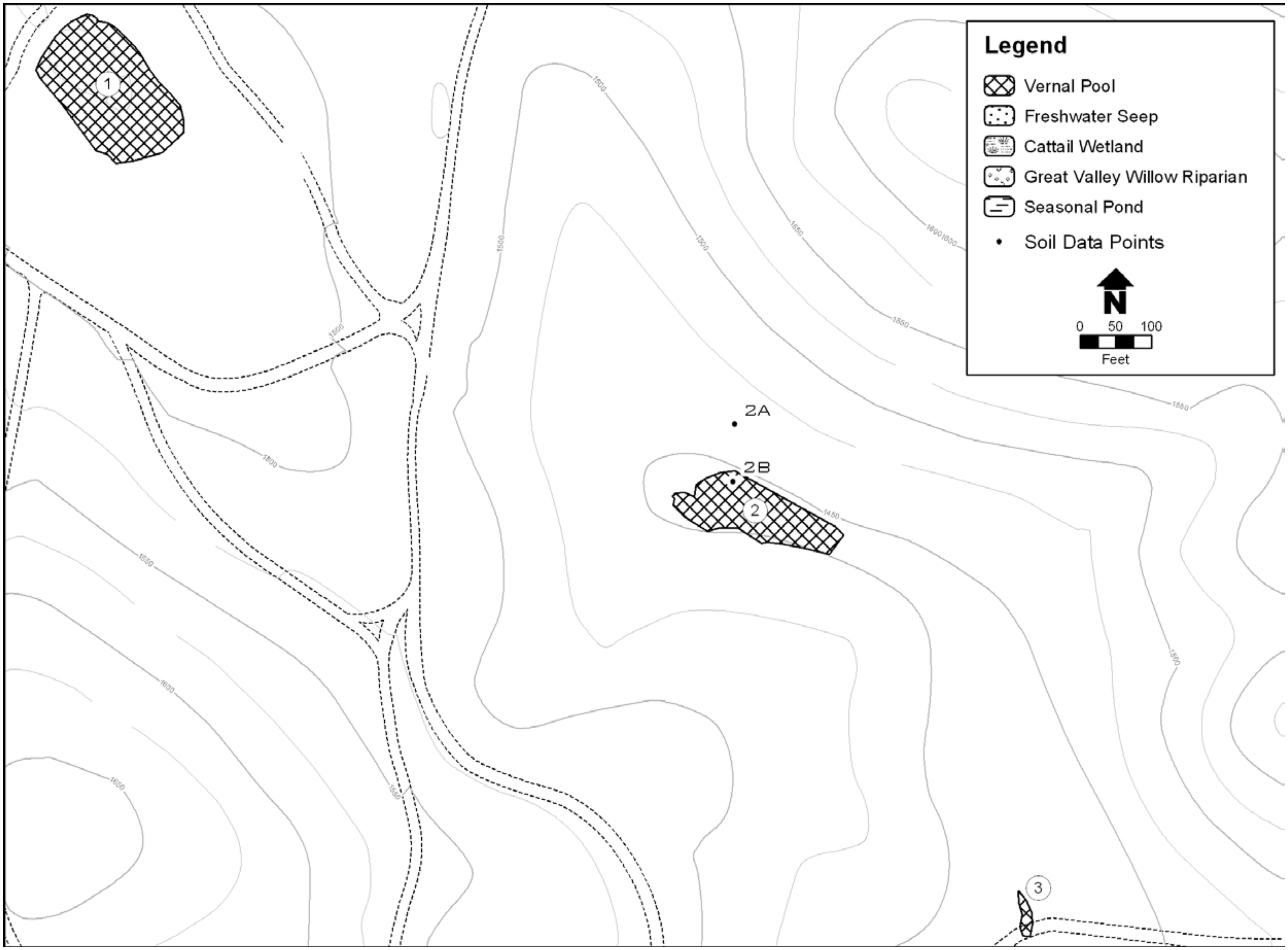
Source: LLNL 2001ap.

FIGURE F.3.1.1–4.—*Location of Potential Wetlands in Arroyo Seco*



Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–1.—*Index of Site 300 Wetlands*

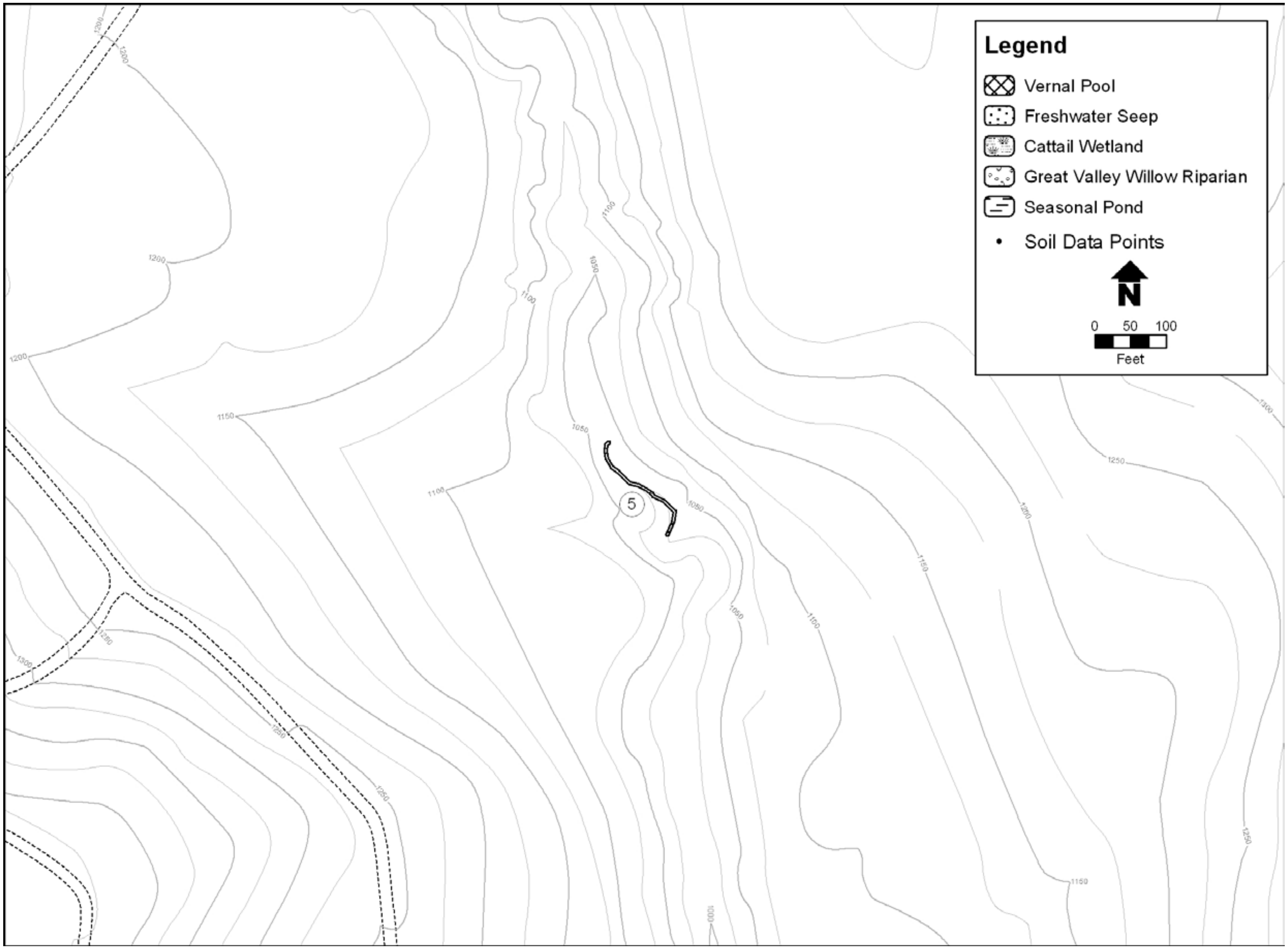


Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–2.—*Wetland Delineation (Wetlands 1, 2, and 3)*

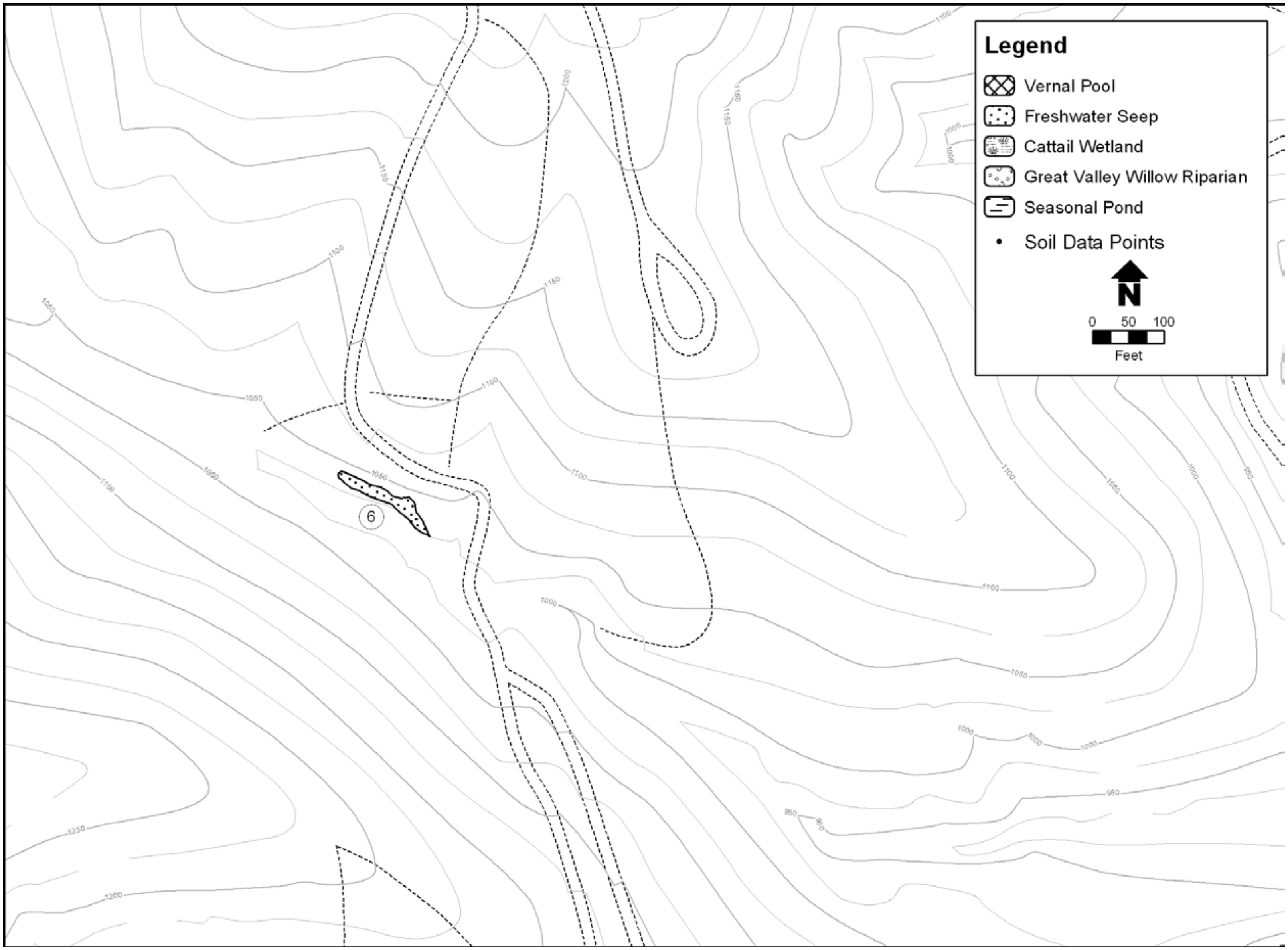
Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–3.—*Wetland Delineation (Wetland 4)*



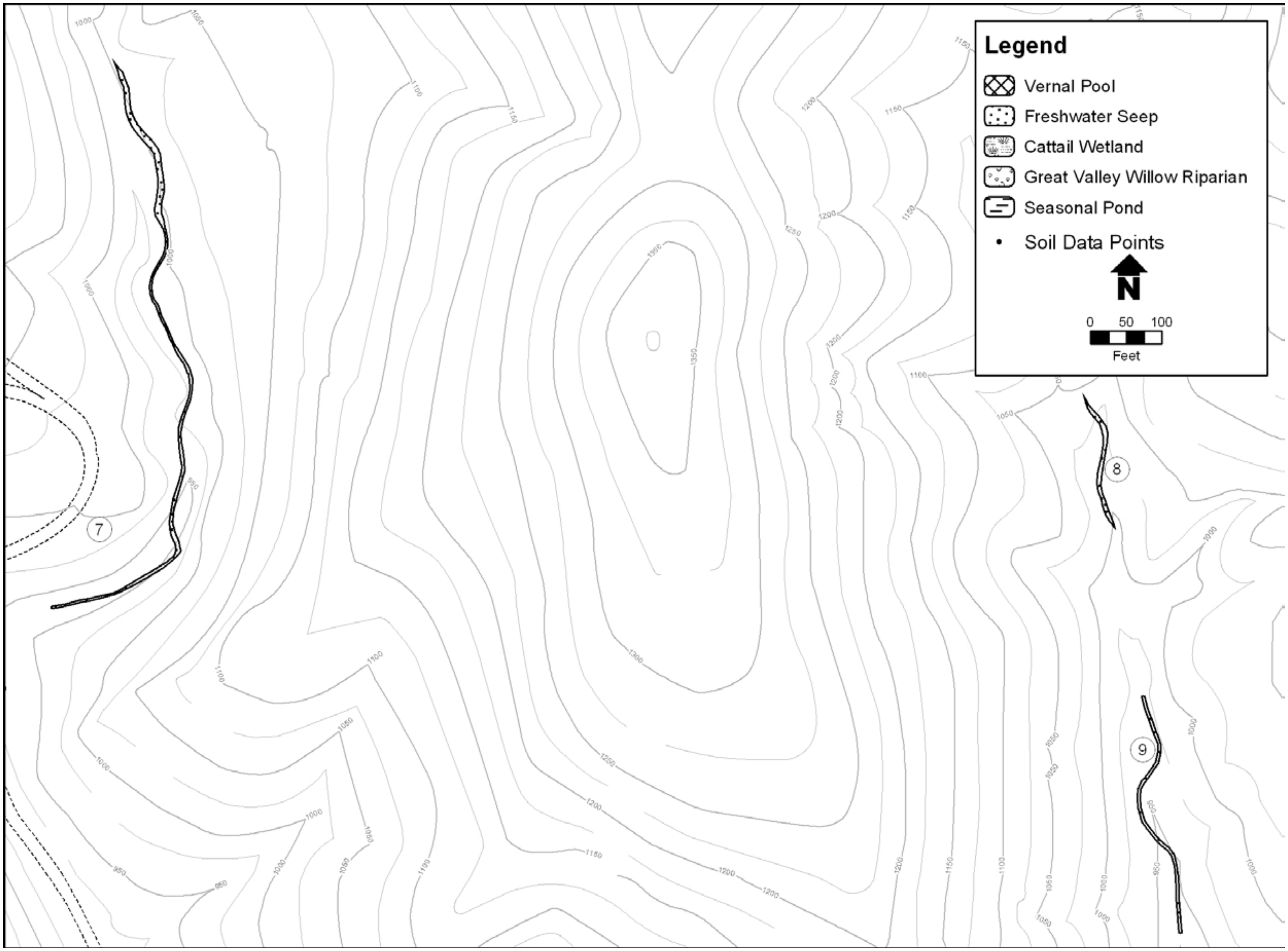
Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–4.—*Wetland Delineation (Wetland 5)*



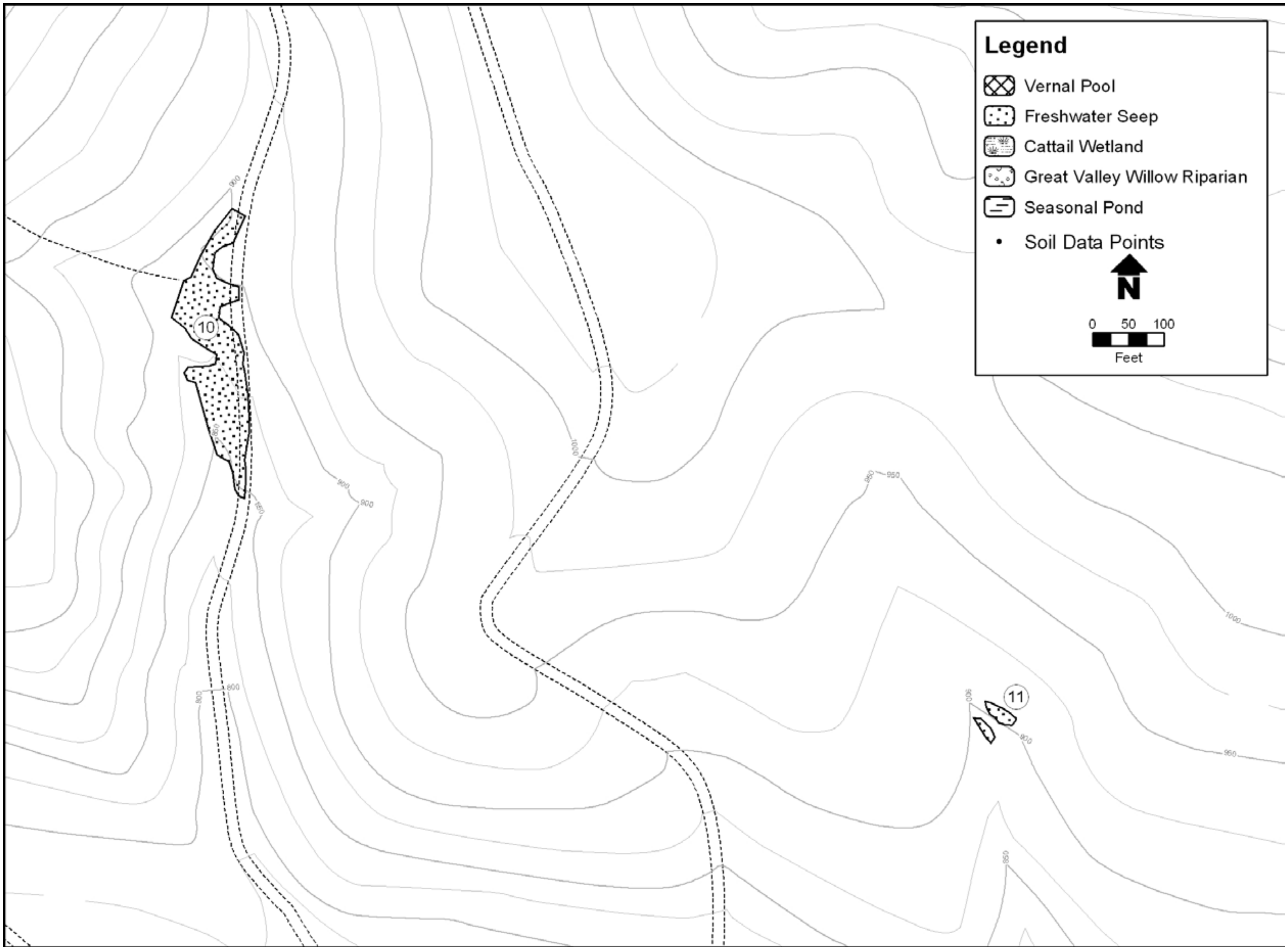
Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–5.—*Wetland Delineation (Wetland 6)*



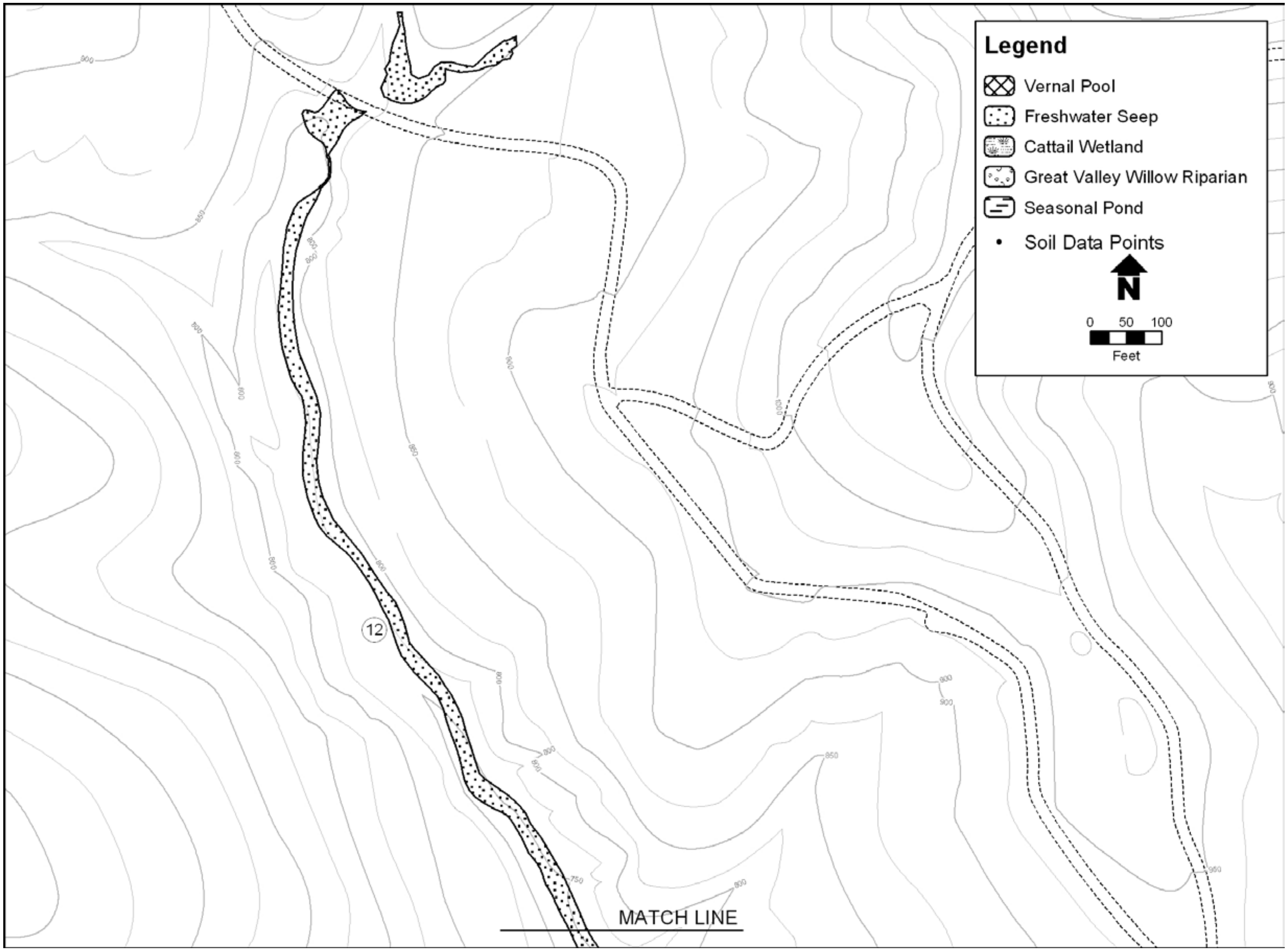
Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–6.—*Wetland Delineation (Wetlands 7, 8, and 9)*



Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–7.—*Wetland Delineation (Wetlands 10 and 11)*

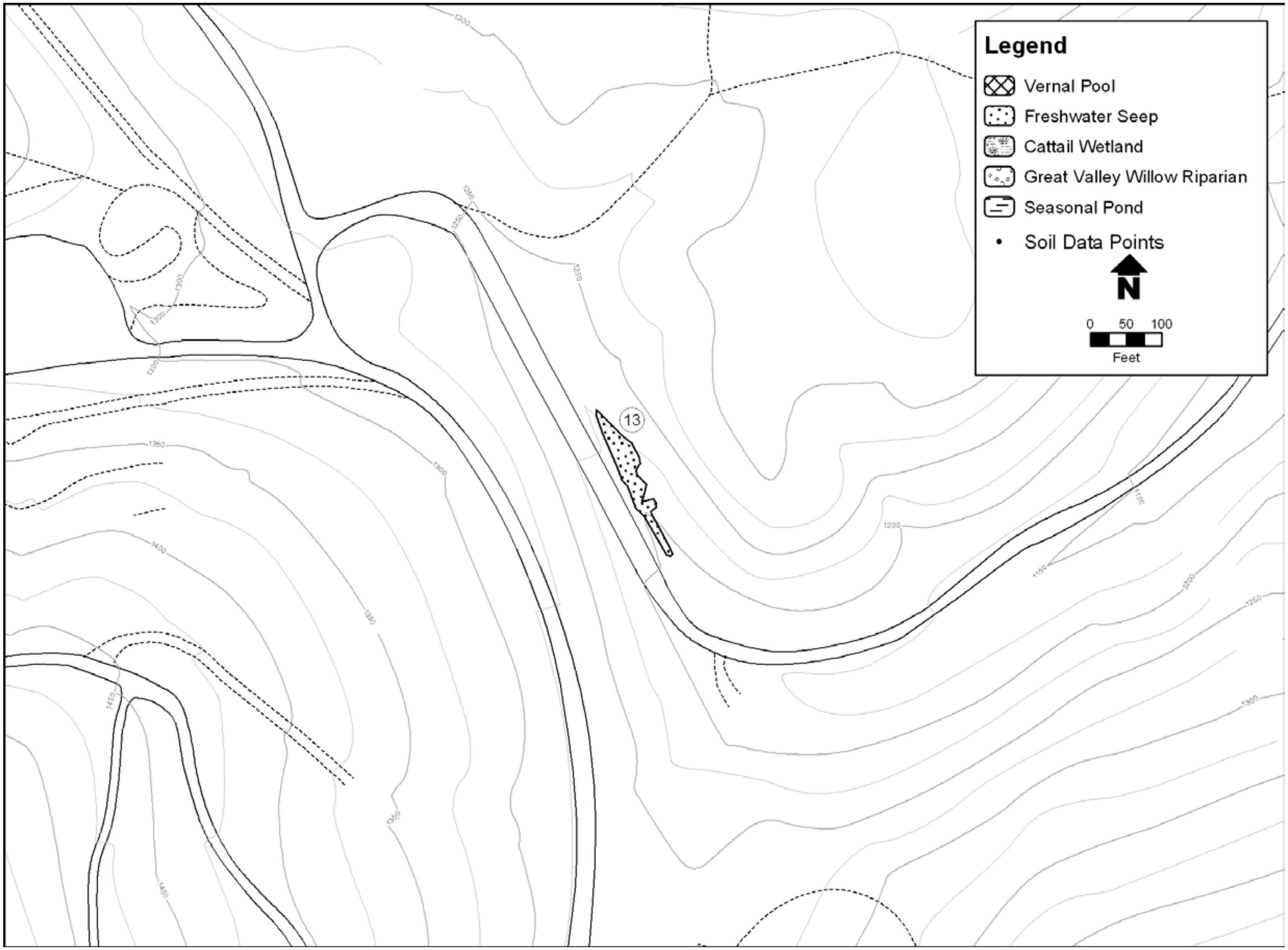


Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–8.—*Wetland Delineation (Wetland 12)*

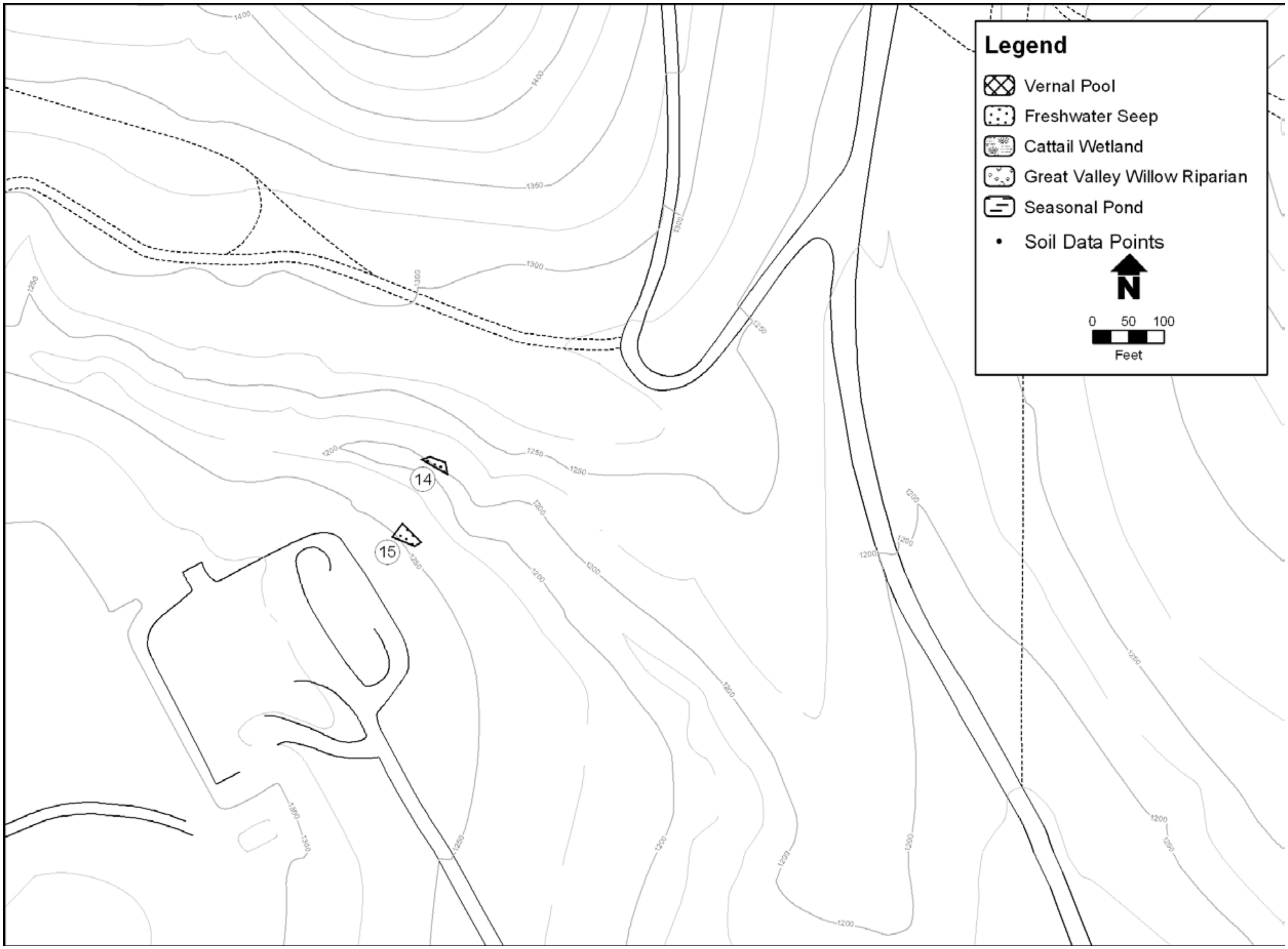
Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–9.—*Wetland Delineation (Wetland 12) (continued)*



Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–10.—*Wetland Delineation (Wetland 13)*

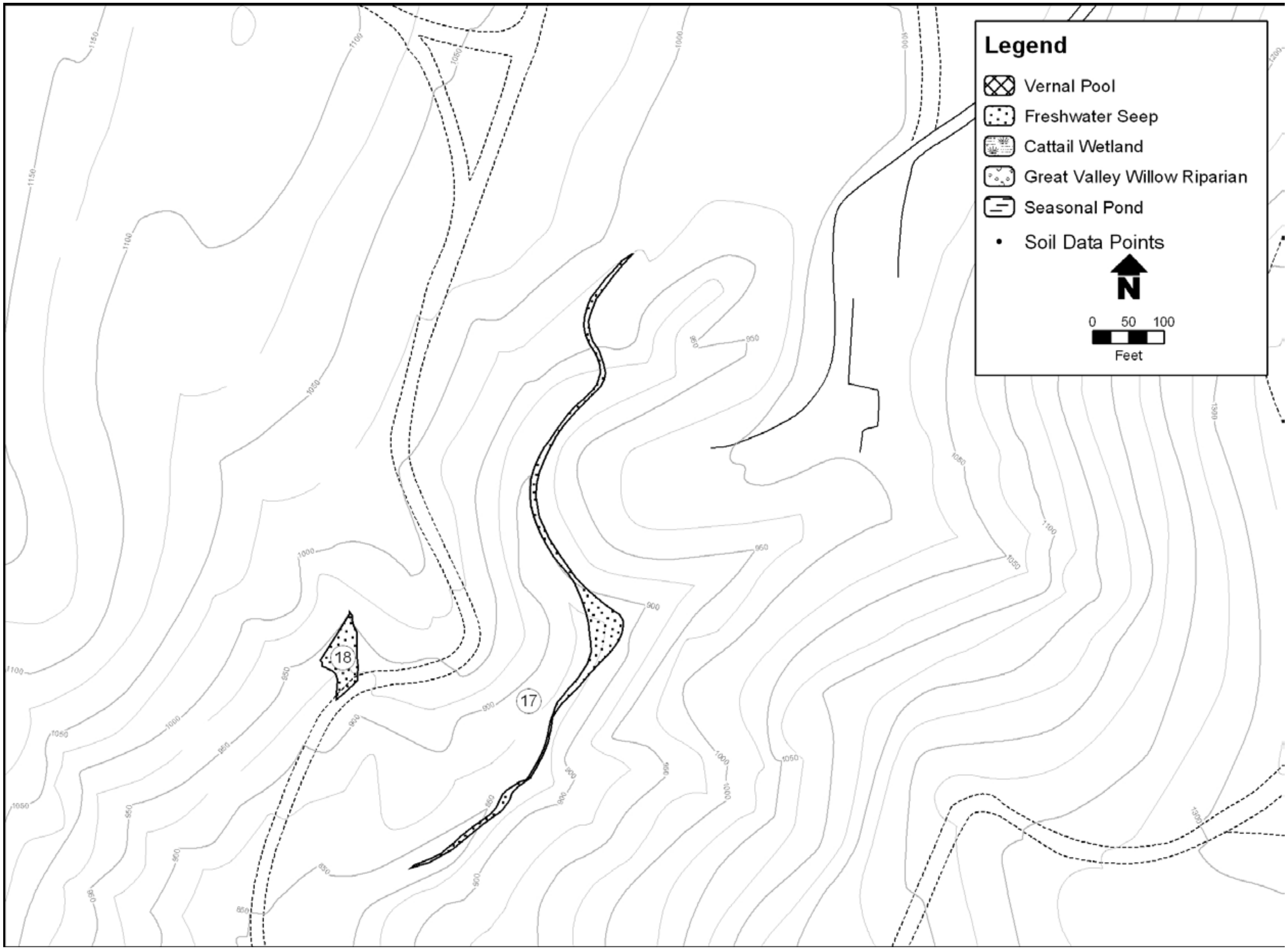


Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–11.—*Wetland Delineation (Wetlands 14 and 15)*

Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–12.—*Wetland Delineation (Wetland 16)*

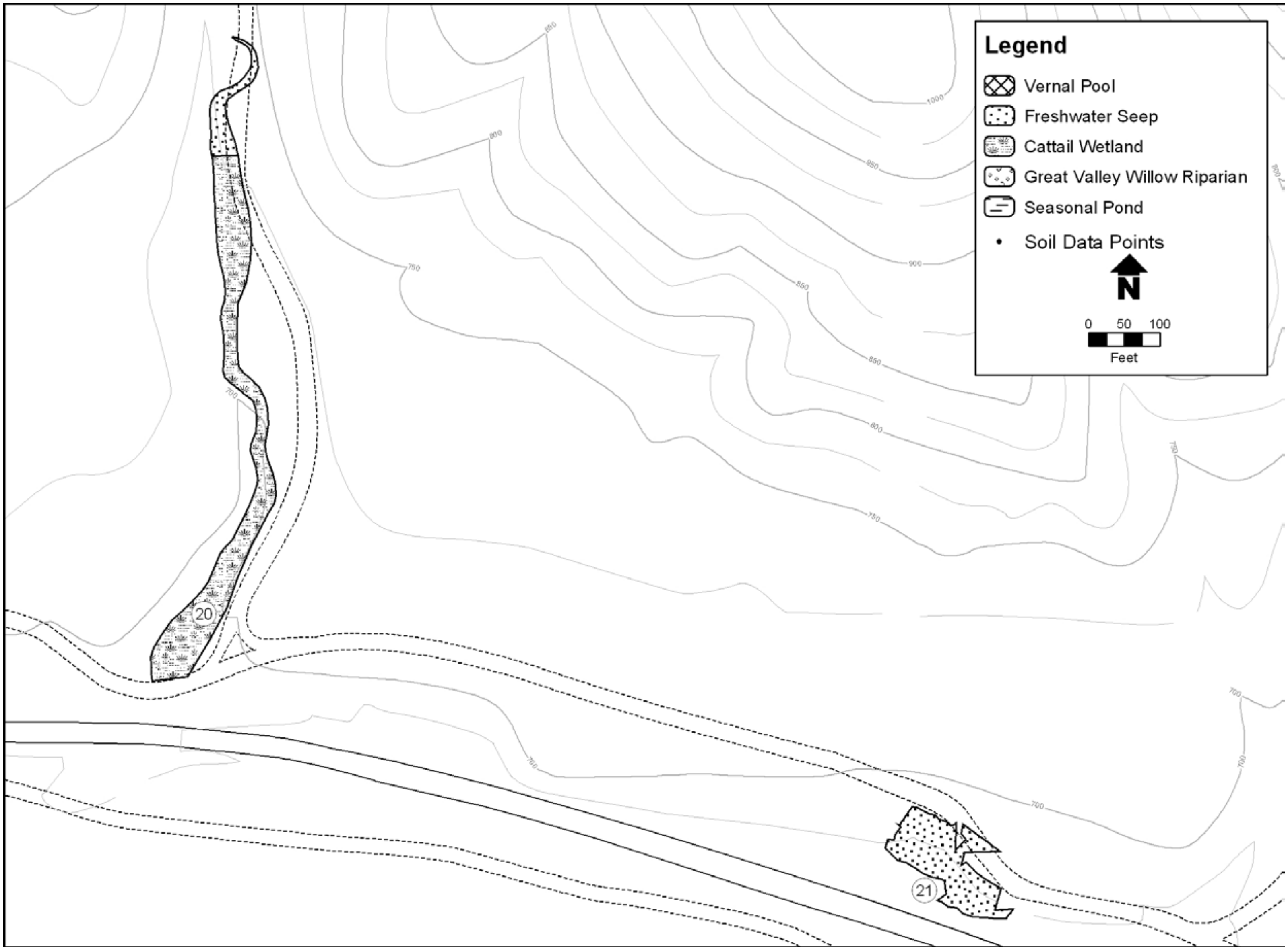


Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–13.—*Wetland Delineation (Wetlands 17 and 18)*

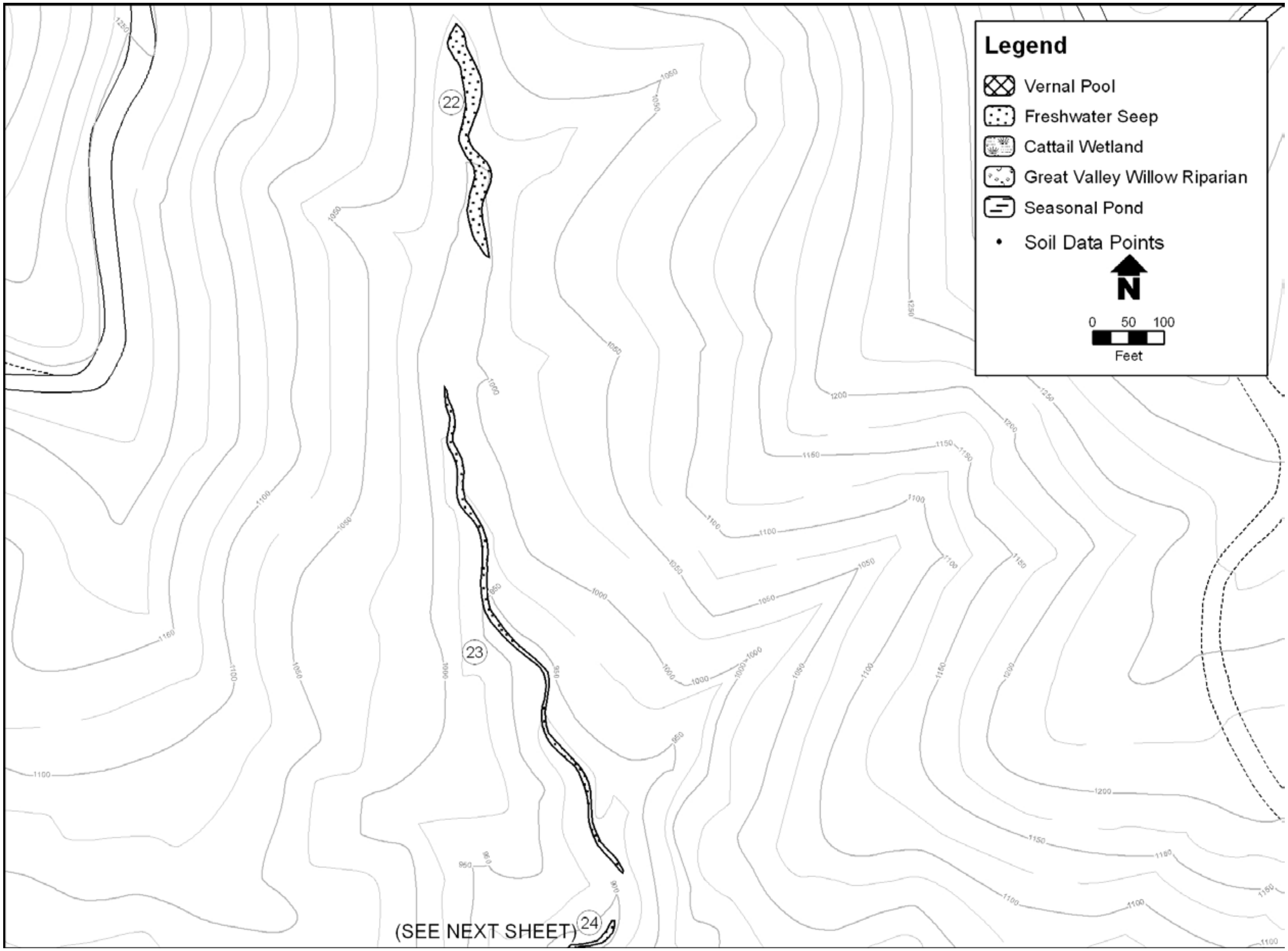
Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–14.—*Wetland Delineation (Wetland 19)*



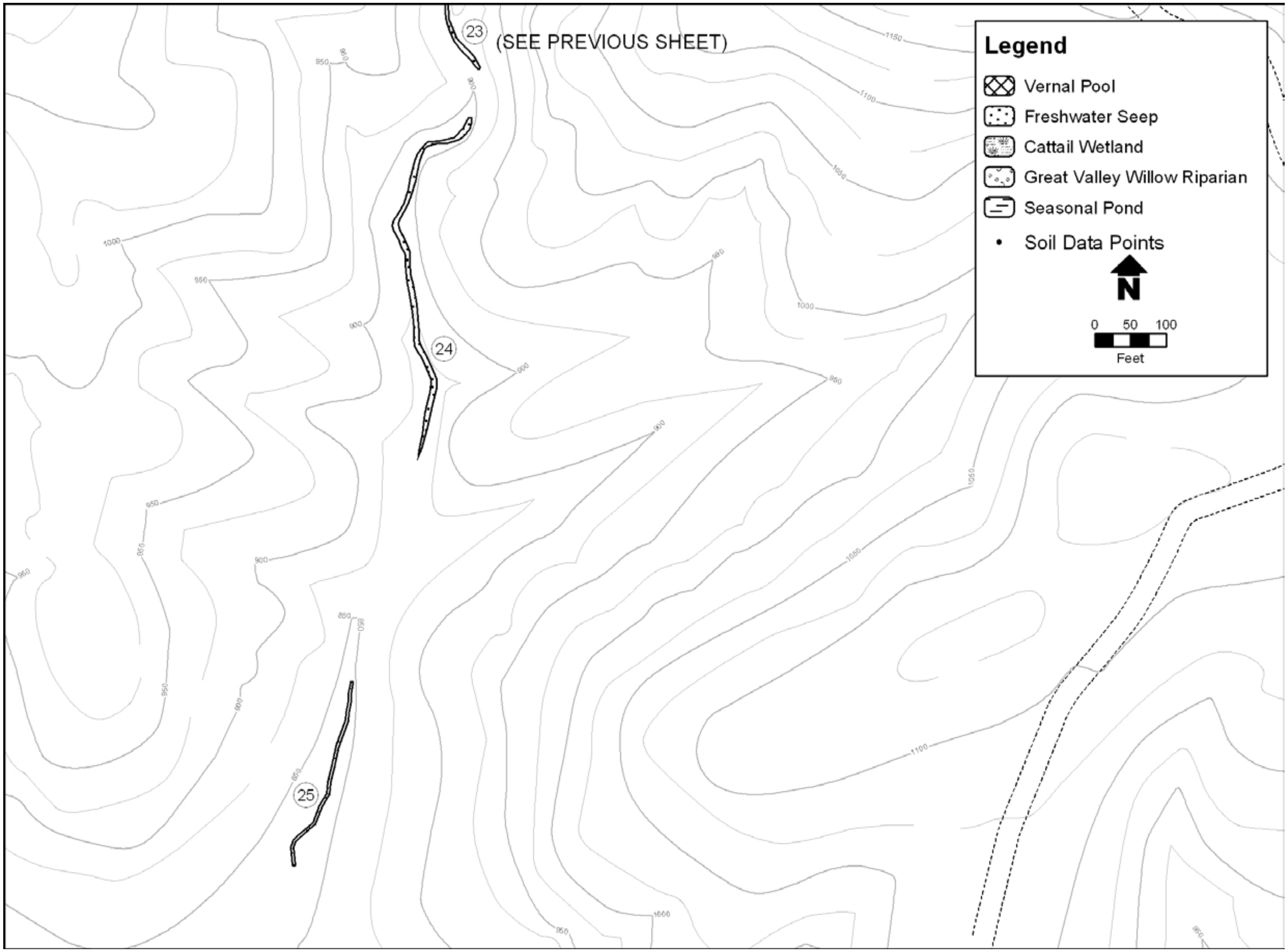
Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–15.—*Wetland Delineation (Wetlands 20 and 21)*



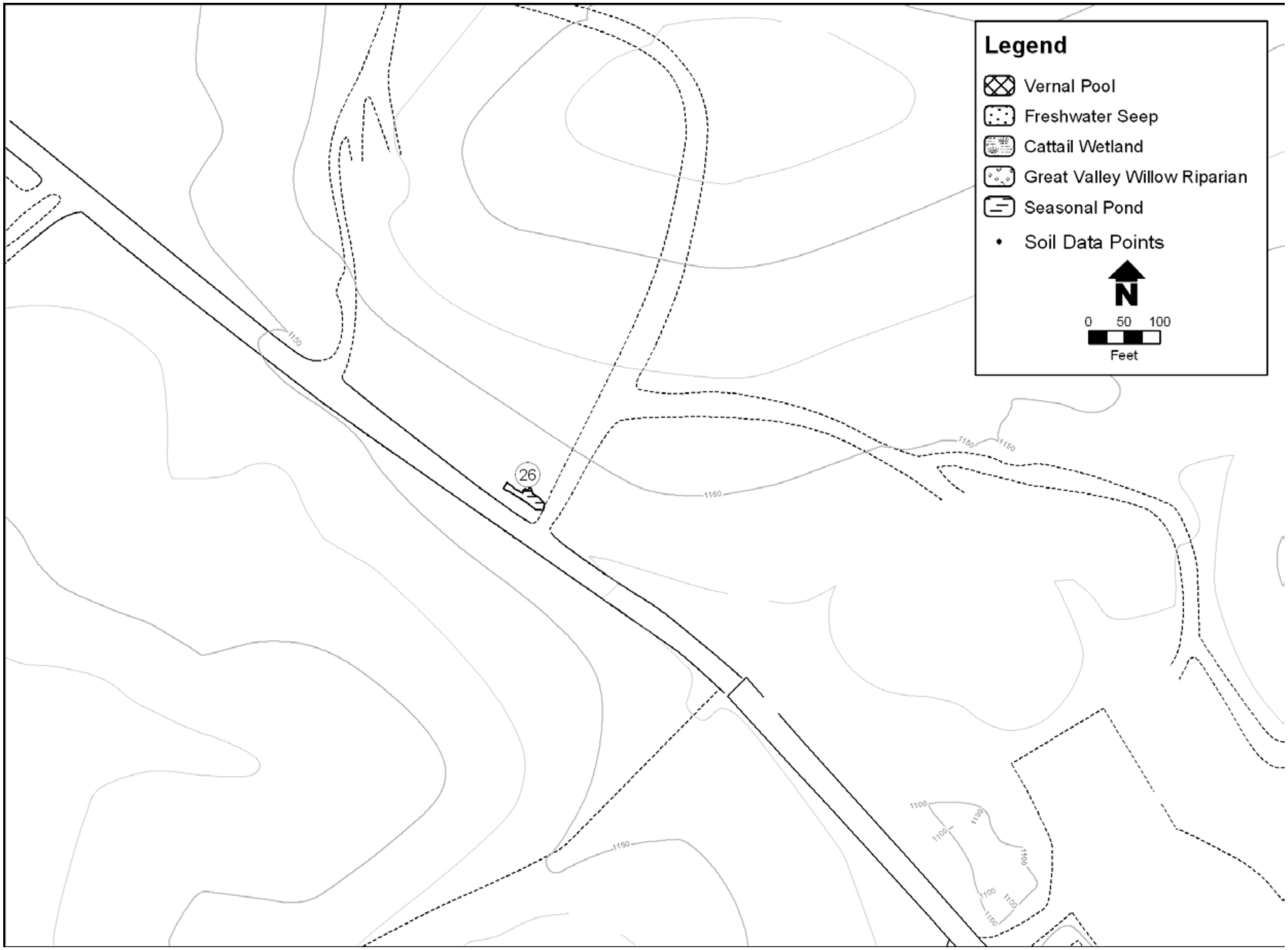
Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–16.—*Wetland Delineation (Wetlands 22, 23, and 24)*



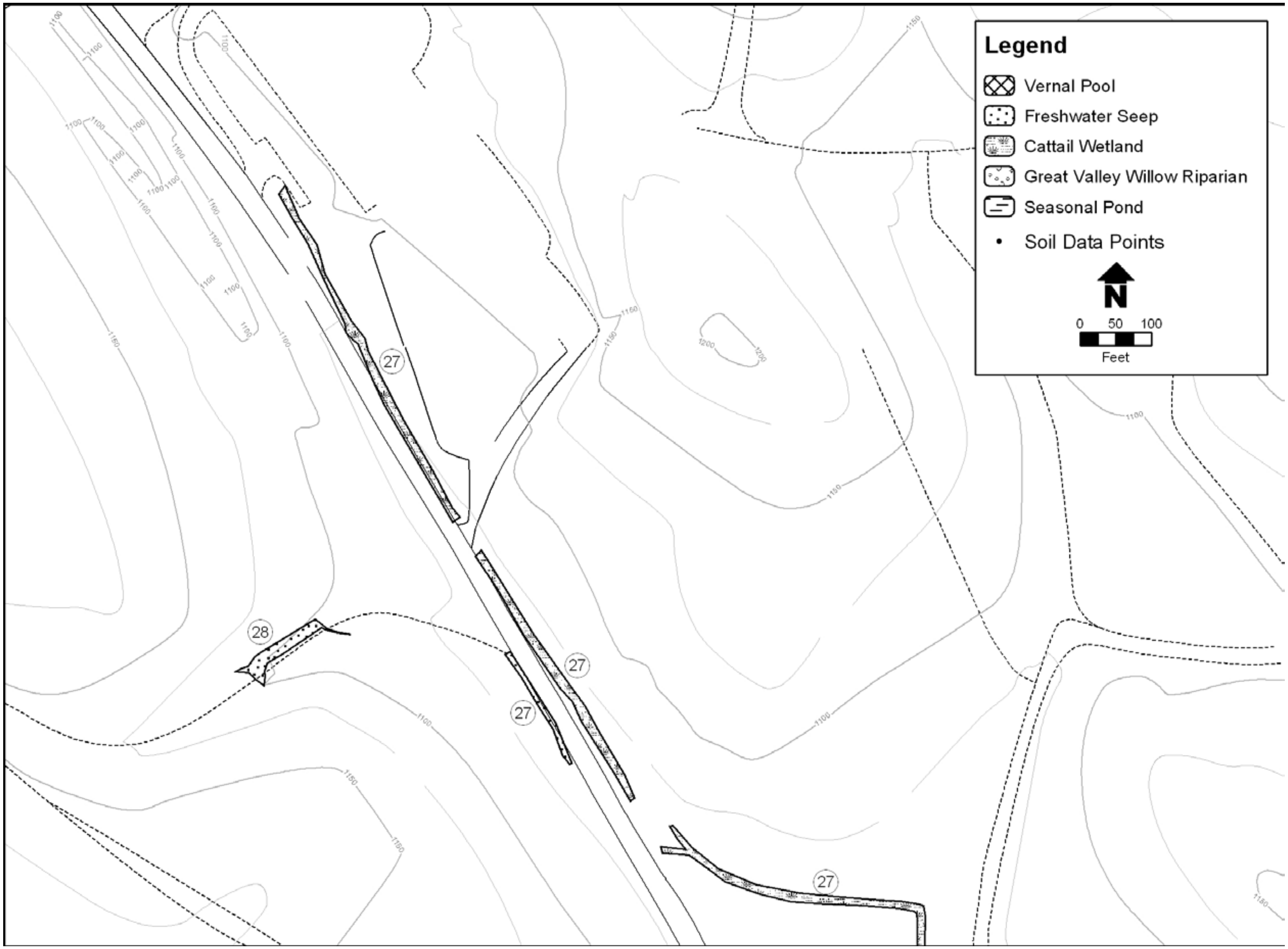
Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–17.—*Wetland Delineation (Wetlands 23, 24, and 25)*



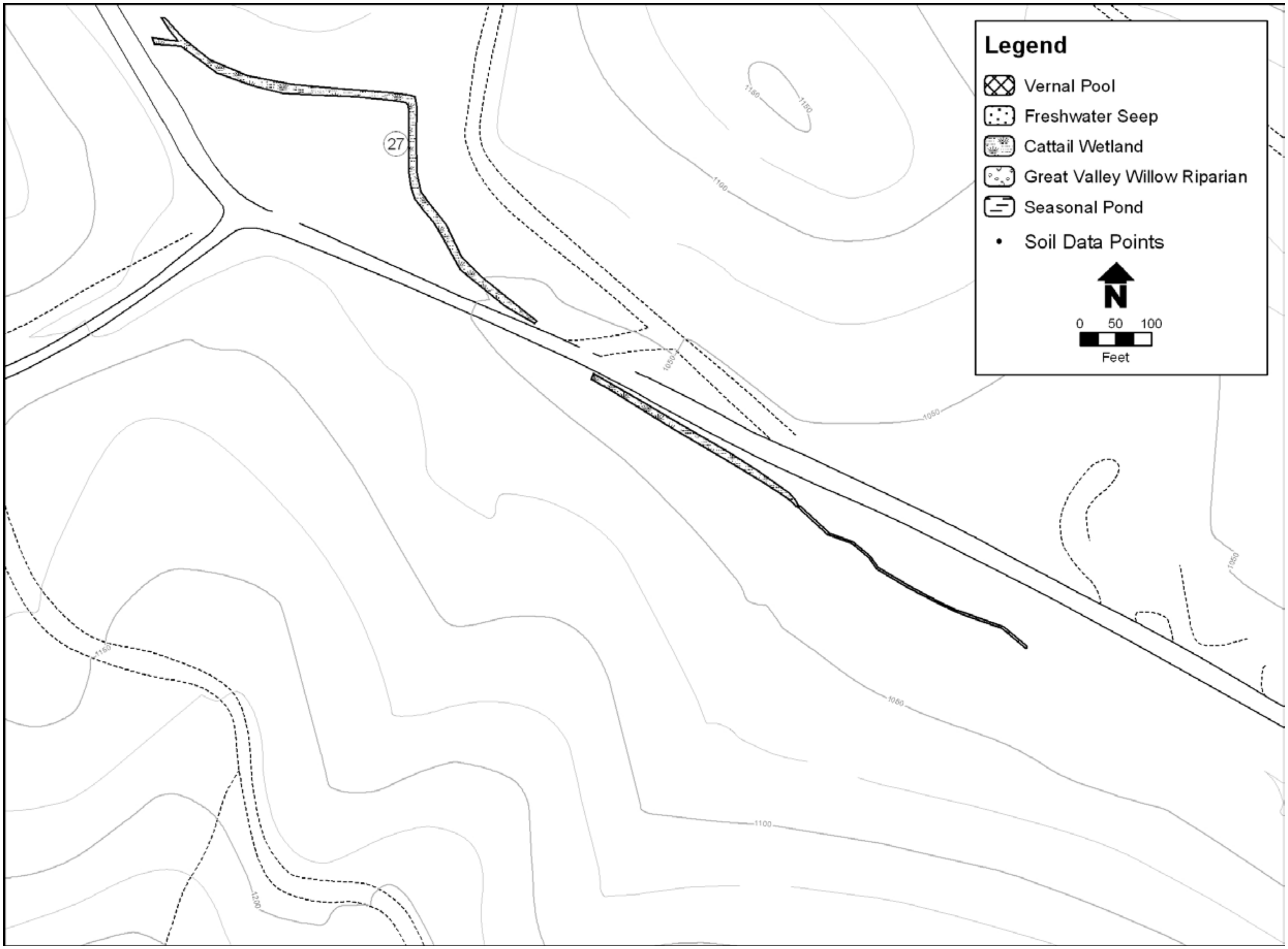
Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–18.—*Wetland Delineation (Wetland 26)*



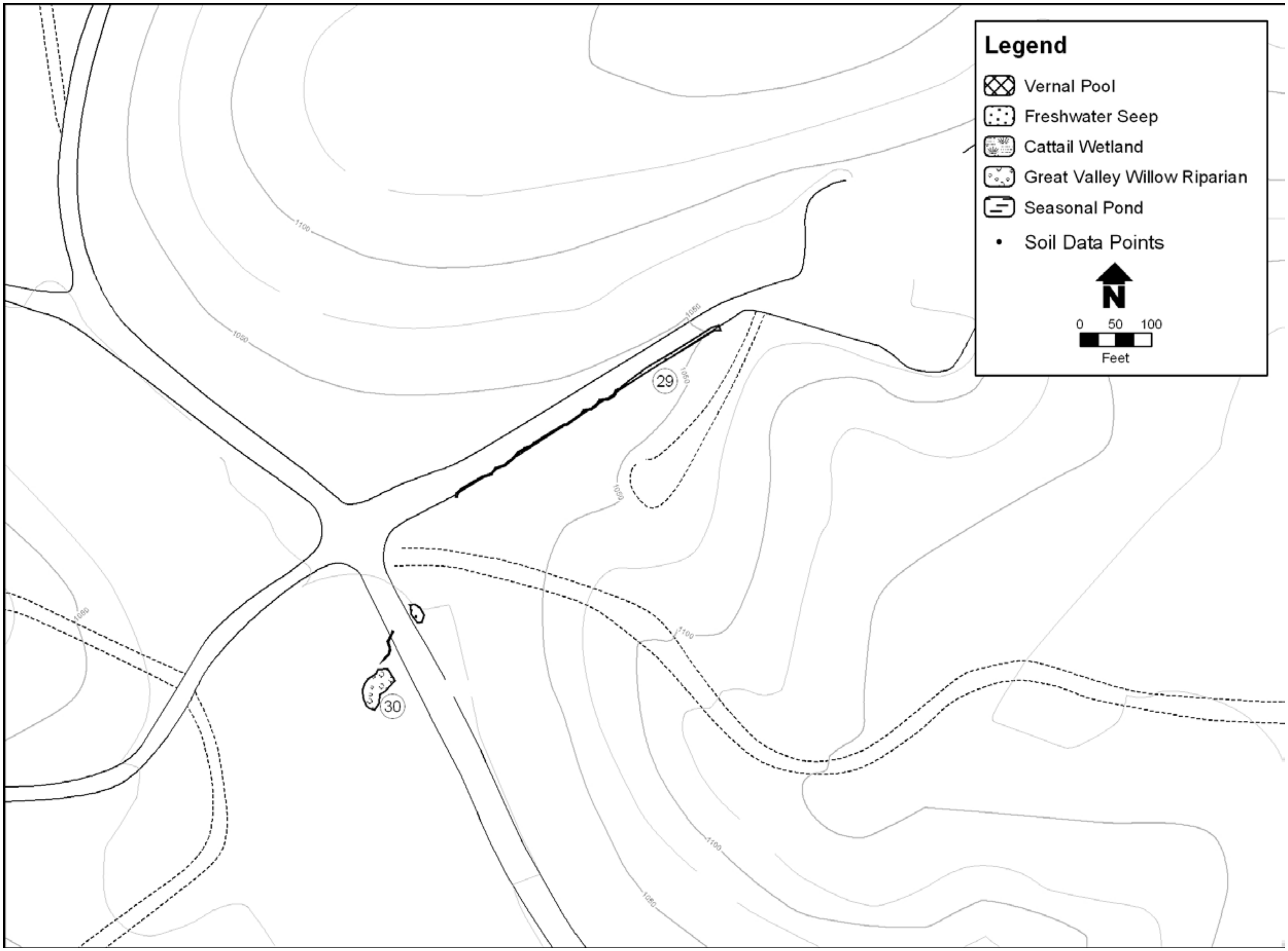
Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–19.—*Wetland Delineation (Wetlands 27 and 28)*



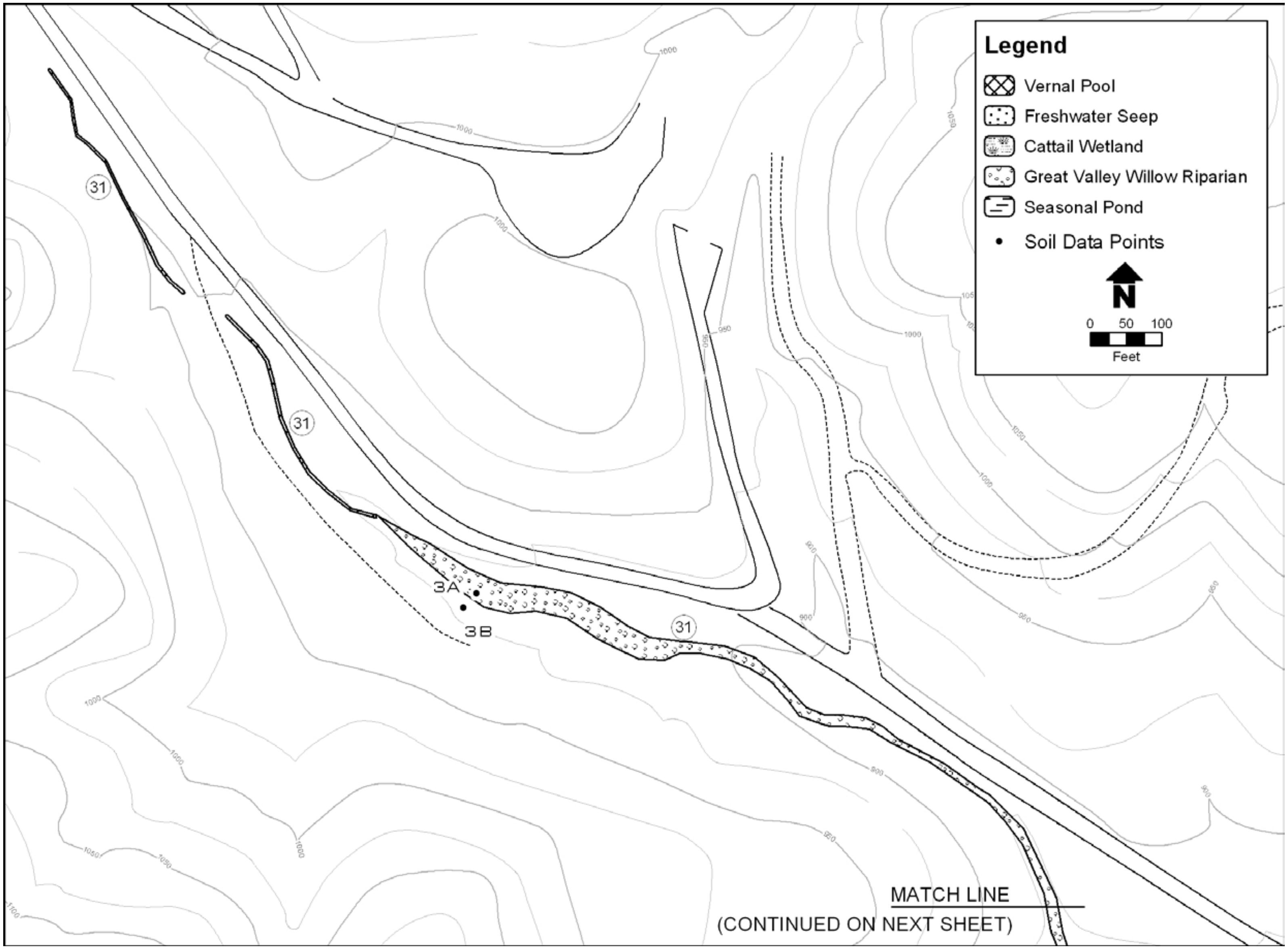
Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–20.—*Wetland Delineation (Wetland 27)*



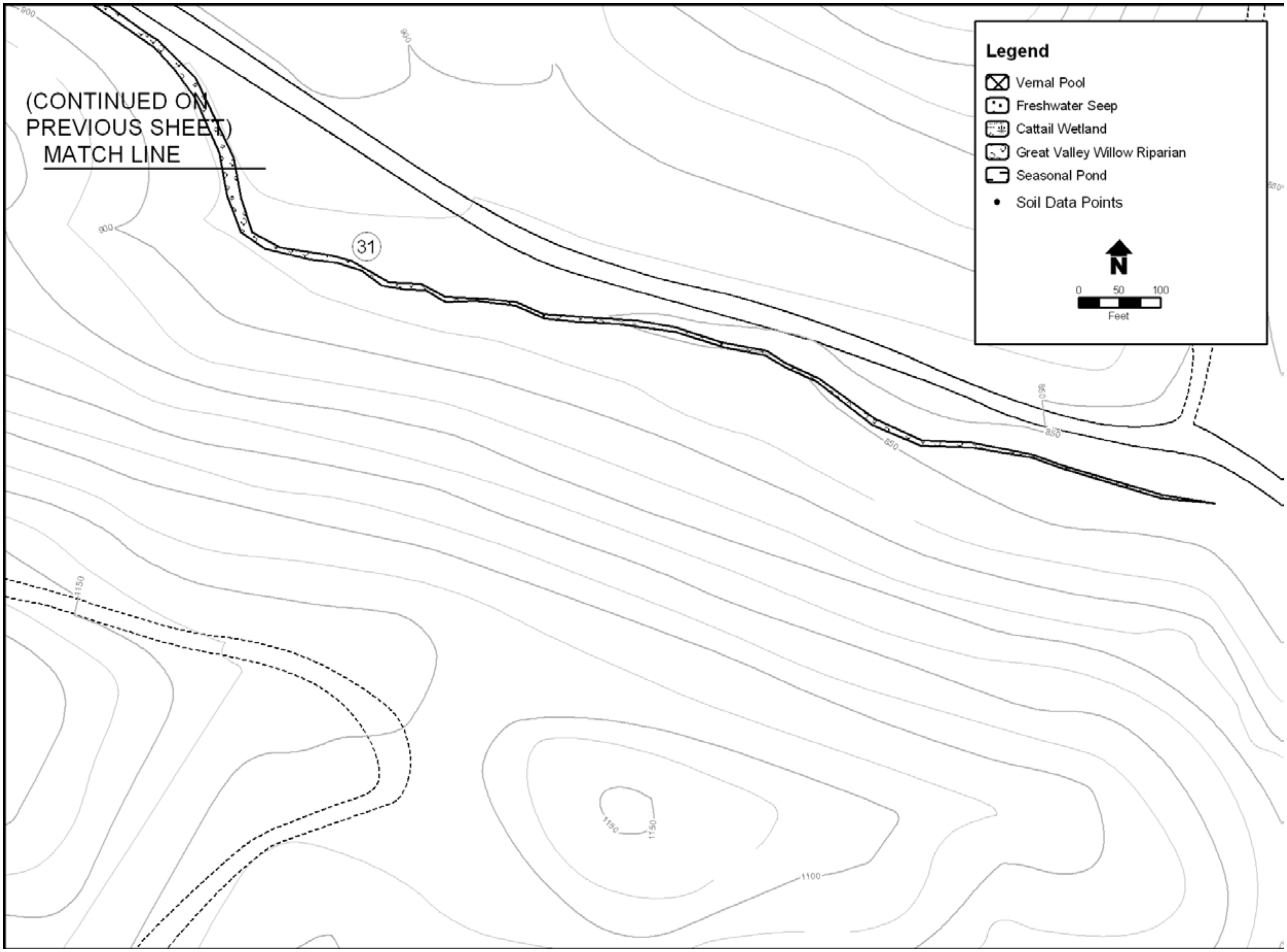
Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–21.—*Wetland Delineation (Wetlands 29 and 30)*



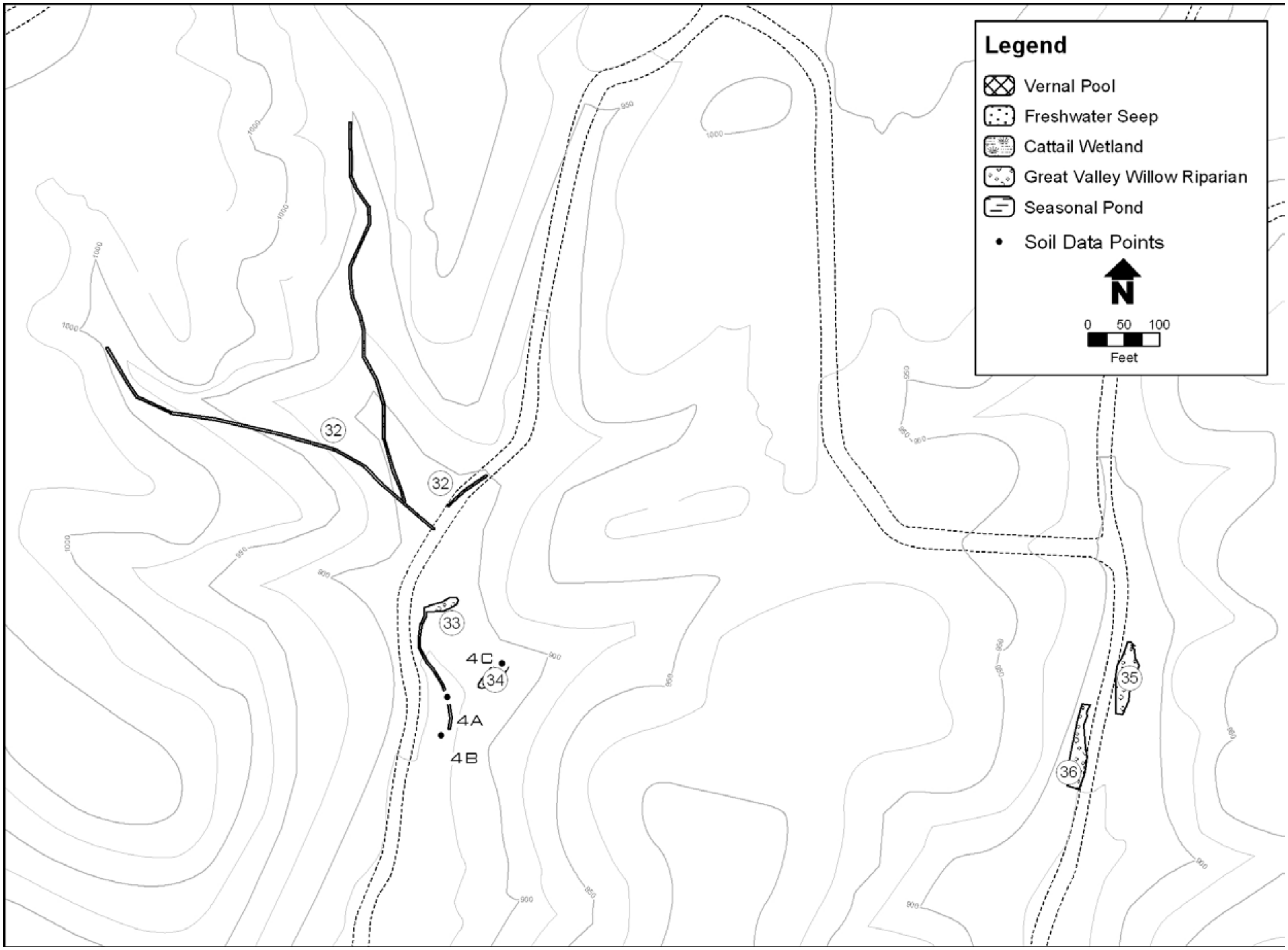
Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–22.—*Wetland Delineation (Wetland 31)*



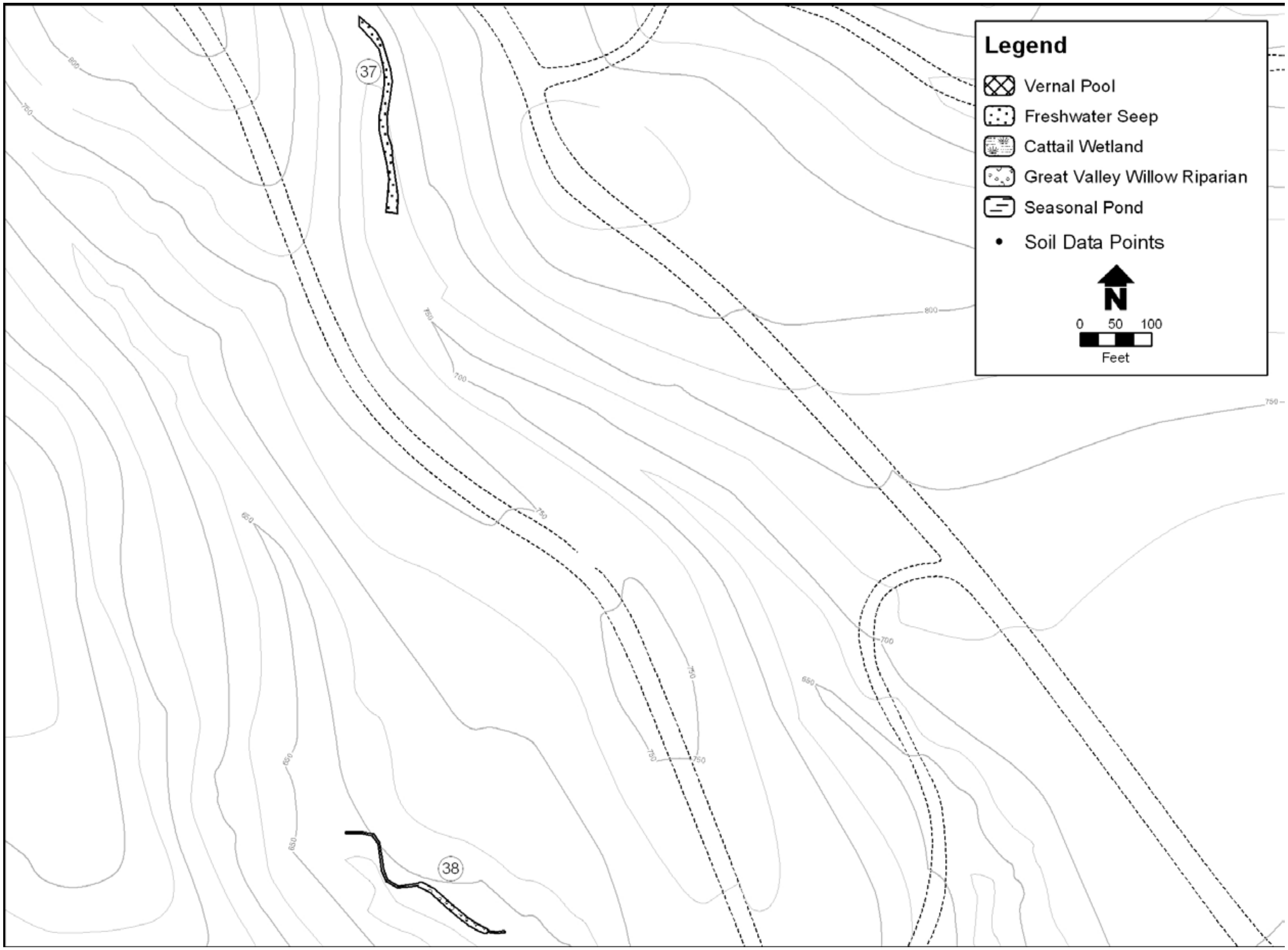
Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–23.—*Wetland Delineation (Wetland 31) (continued)*



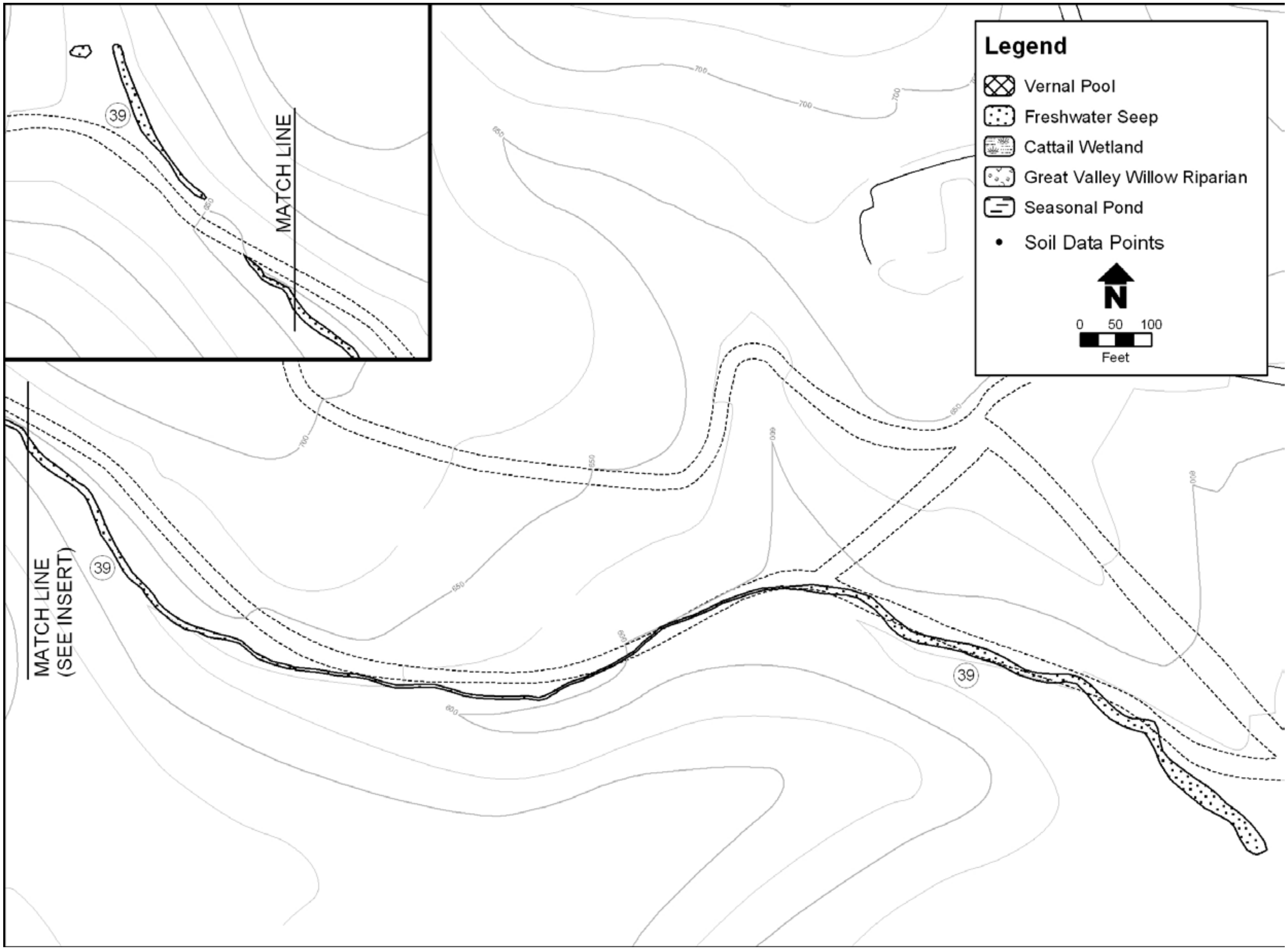
Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–24.—*Wetland Delineation (Wetlands 32, 33, 34, 35, and 36)*



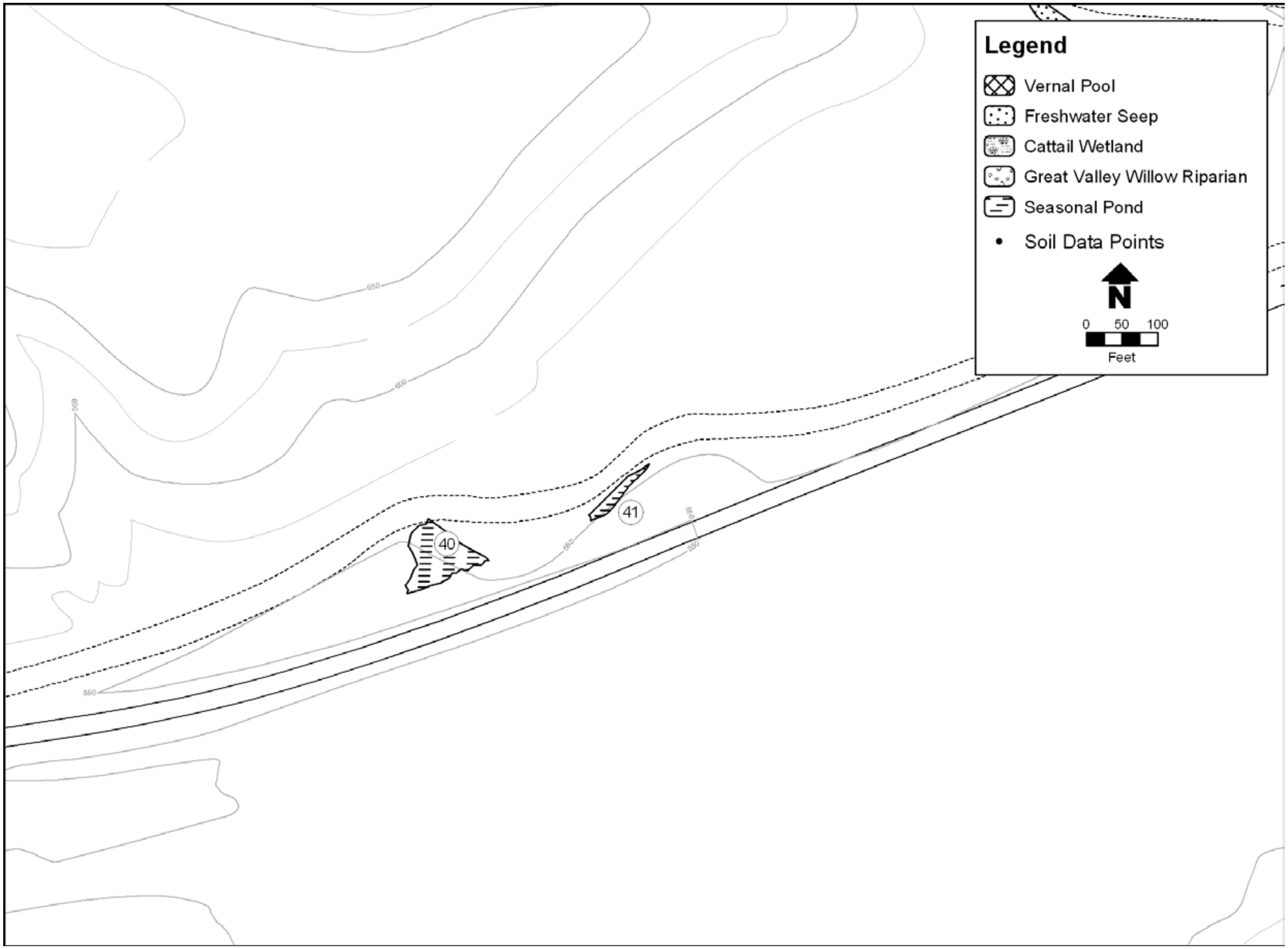
Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–25.—*Wetland Delineation (Wetlands 37 and 38)*



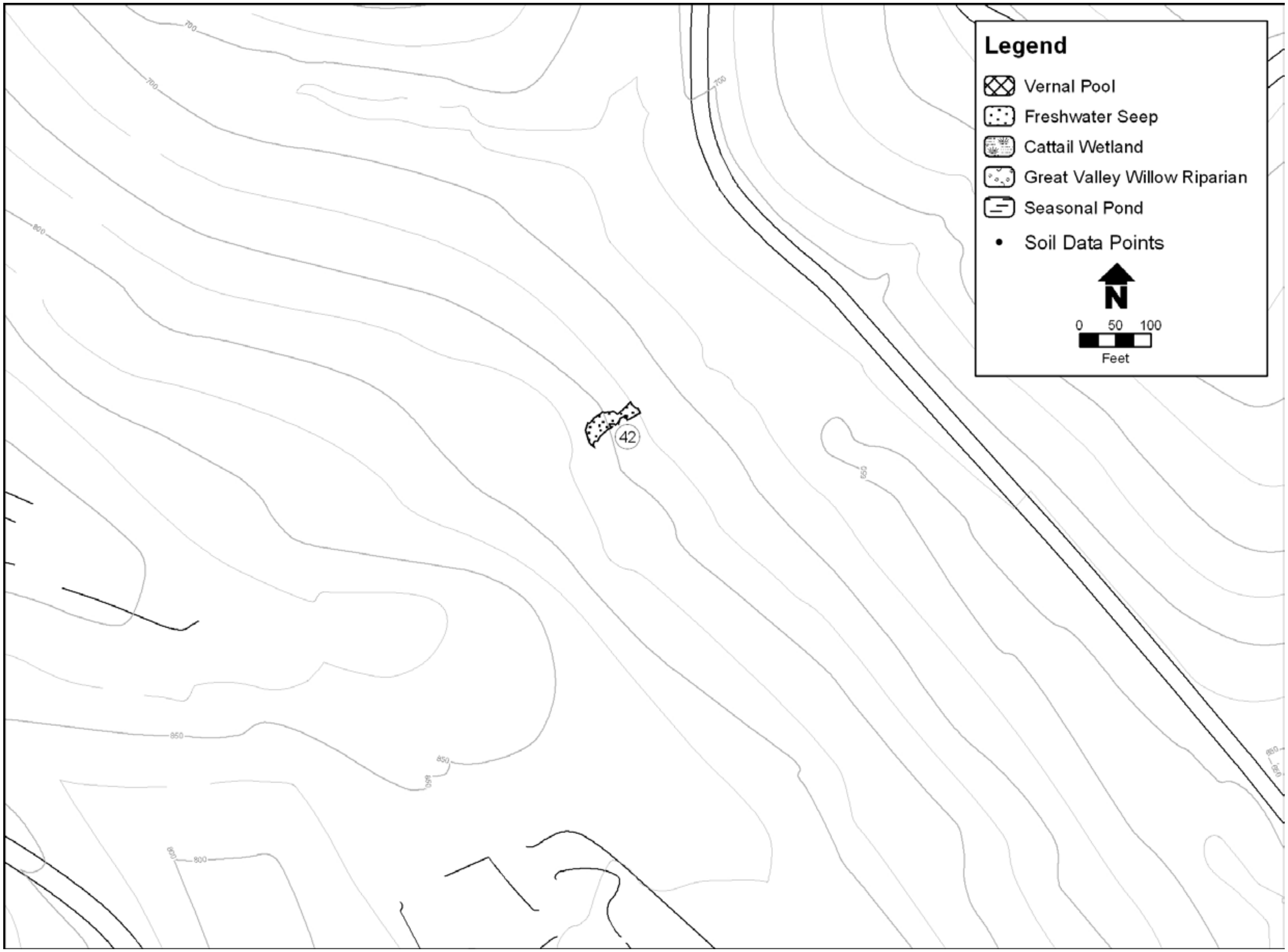
Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–26.—*Wetland Delineation (Wetland 39)*



Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–27.—*Wetland Delineation (Wetlands 40 and 41)*

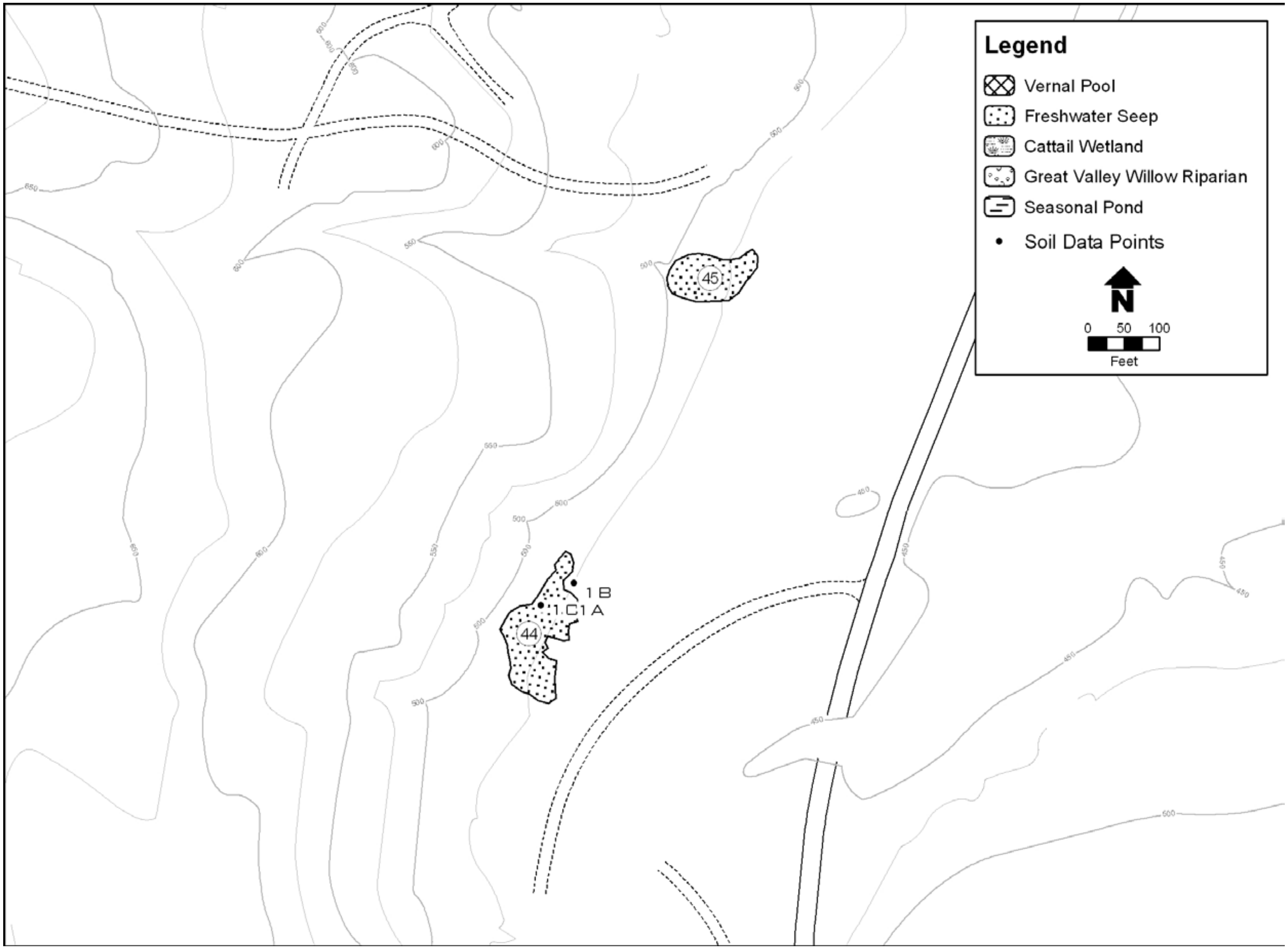


Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–28.—*Wetland Delineation (Wetland 42)*

Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–29.—*Wetland Delineation (Wetland 43)*

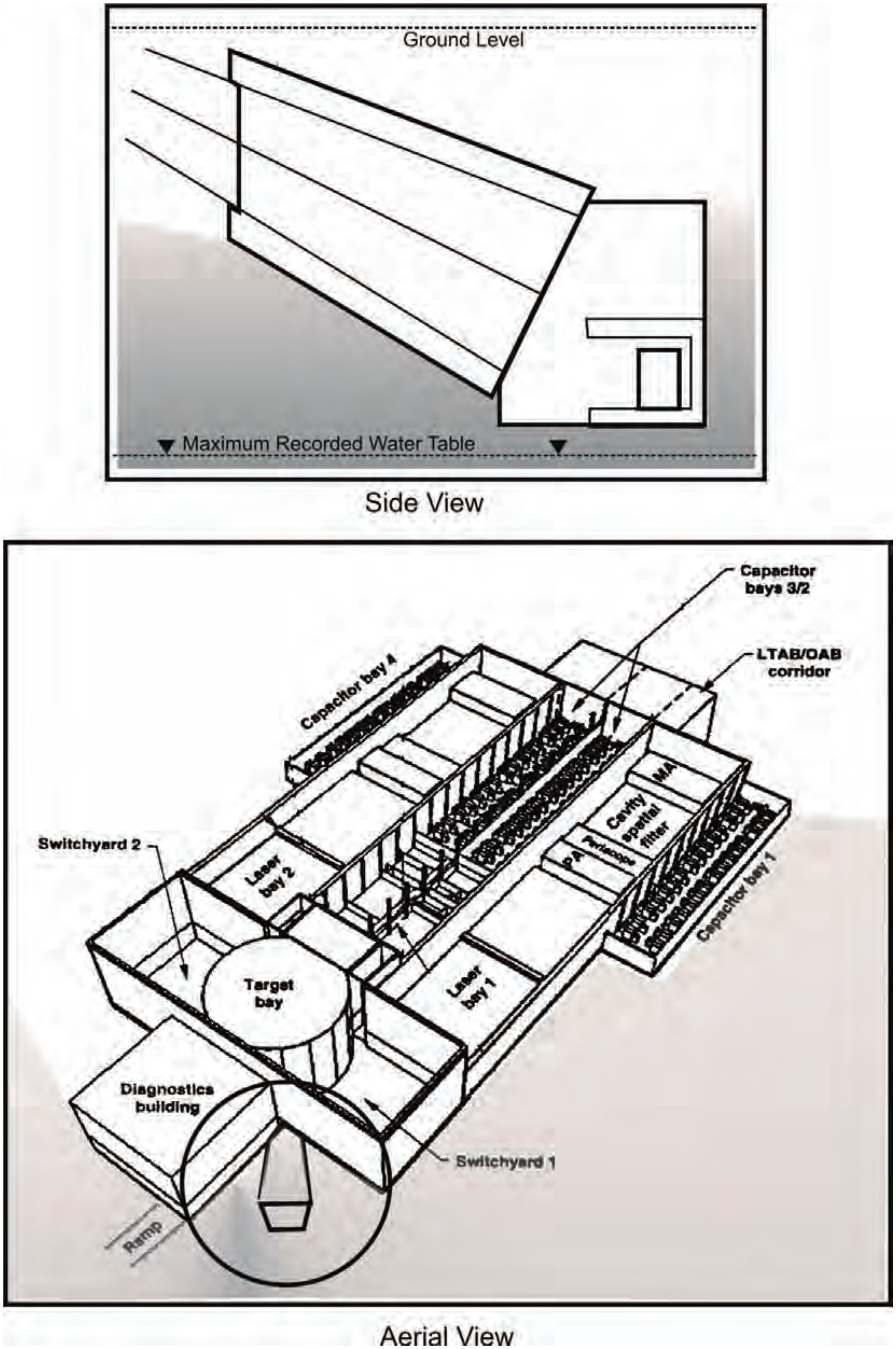


Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–30.—*Wetland Delineation (Wetlands 44 and 45)*

Source: Jones and Stokes 2002c.

FIGURE F.3.2.2–31.—*Wetland Delineation (Wetland 46)*



Source: Original.

FIGURE M.3.2.4–1.—*Location of the Neutron Spectrometer at the National Ignition Facility and Cross Section of the Neutron Spectrometer*