Miocene Cierbo Formation sandstones at depths of 900 to 2,000 ft. In 1992, the Livermore oil field was operated by the American Exploration Corporation. Of the original ten wells, five were producing an average of seven barrels of oil per day; one well was plugged and abandoned; three wells have been shut in; and one well was used for salt-water injection. Reserves were thought to be approximately 132,000 barrels and production was declining (DOE 1992a). In 2002, the XL Operating Company operated the Livermore oil field. In February 2002, only three wells were producing. No oil or gas exploration is currently being conducted or proposed for the Livermore Valley or in the hills to the east (CADC 2002a).

While Alameda County has no active natural gas wells, the closes field is located southwest of the City of Livermore approximately 7 mi. Contra Costa and San Joaquin counties have 26 and 63 producing gas wells, respectively. The closest gas field is located east of SNL/CA approximately 15 mi near the City of Tracy (CADC 2002a).

4.4.3.3 Geological Hazards

Seismology

SNL/CA is located near the boundary between the North American and Pacific tectonic plates, and the area is characterized by the San Andreas Fault system, which trends southeast northwest. Three principal components of the San Andreas Fault system, the San Andreas, Hayward, and Calaveras faults, have produced the majority of significant historical earthquakes in the Bay Area. These three faults also accommodate the majority of slip along the Pacific and North American plate boundary and they would likely continue to generate moderate to large earthquakes more frequently than other faults in the region. The potential for local, damaging earthquakes was highlighted by the January 1980 Livermore earthquake sequence on the Greenville fault, which produced two earthquakes of magnitudes 5.5 and 5.6 on the Richter Scale. The earthquake caused structural and nonstructural damage to the SNL/CA facilities.

In most cases, Calaveras fault earthquakes in the Livermore Valley region have occurred on strike-slip faults, generally indicating north-south-oriented compression. The fault segment nearest SNL/CA may be capable of generating a magnitude 6 to 6.5 earthquake (DOE 1992a).

Slope Stability

SNL/CA consists of two different types of terrain separated by the north branch of the Las Positas fault. The area north of the fault (north of Arroyo Seco) consists of a relatively smooth land surface that gently slopes downward to the northwest. Because of the very low relief, the potential for slope instability on the northern portion of SNL/CA is remote. The terrain south of the Las Positas fault, however, contains greater relief and steeper slopes that increase the potential for slope instability. The potential for slope instability in the southern portion of SNL/CA is considered moderate.

4.4.3.4 Soils

Topically, surface soils and arroyo sediments cover the site. The soils beneath the site are formed primarily upon sediments deposited by local streams (Figure 4-5). Most of the deposits in the eastern part of the valley are relatively young, and thus soils are only moderately developed. These soils (generally loam) have minimal horizon, or development of layers, and can be several meters thick locally. Three soils cover most of SNL/CA: Rincon clay loam, Positas gravelly loam, and Livermore gravelly loam (SNL/CA 2002b).

Environmental Restoration Program

The Environmental Restoration Program activities began in 1984. By 1991, 23 solid waste management units were identified at SNL/CA. Of these locations, nine were identified for further investigation. The largest site, the Navy Landfill, is 2 acres in size. Investigation of these sites is regulated under the *Resource Conservation and Recovery Act* (RCRA). As of February 2002, ER activities at SNL/CA have progressed through a series of remedial and closure actions to the point where most sites have attained closure and active environmental monitoring is continuing on three sites: Fuel Oil Spill, Navy Landfill, and the Trudell Auto Repair Shop site. SNL/CA is working with the State on full closure requests and monitoring requirements.

4.5 WATER RESOURCES AND HYDROLOGY

4.5.1 Groundwater

4.5.1.1 Definition of Resource

Groundwater in the SNL/CA area occurs within saturated unconsolidated geologic material. The Livermore Valley has been divided into 12 groundwater subbasins based on the location of faults, topography, and other hydrogeological barriers that affect groundwater occurrence, movement, and quality. Figure 4-6 shows four drainage basins and numerous watershed boundaries.

4.5.1.2 Region of Influence

SNL/CA is situated primarily within the Spring and Mocho I subbasins. The water-bearing sediments in the Livermore Valley include late-Pleistocene to Holocene-age alluvial sediments, generally less than 200 ft thick, which overlie Plio-Pleistocene alluvial and lacustrine Livermore Formation sediments up to 4,000 ft thick. The Livermore Formation consists of beds of gravel, sand, silt, and clay of varying permeabilities. Sandy-gravelly layers alternate with fine-grained, relatively impermeable layers, and

groundwater can be both confined and semiconfined (DOE 1992a).

4.5.1.3 Affected Environment

Water-bearing units beneath SNL/CA are composed of shallow heterogeneous, unconsolidated alluvium and deep fluvial and lacustrine sediments. The permeable sediments are separated by low-permeability silt and clay layers, generally 15 to 60 ft thick. These silt and clay layers may constitute a regional confining layer. The confining layer slopes westward and varies in depth from about 60 ft to 400 ft. Shallow groundwater is located in a layer of sand, silt, and gravel at a depth of about 98 to 112 ft beneath the fuel oil spill site in the central developed portion of SNL/CA (SNL/CA 2002b). Shallow groundwater is continuous throughout the site and has a saturated thickness of about 6 to 8 ft. Beneath this layer of sand, silt, and gravel is about 12 to 18 ft of stiff clay that acts as an aquiclude (a formation that contains water but cannot transmit it rapidly enough to furnish a significant supply). Below this aquifer are two other water-bearing units that are probably local and not part of the underlying aquifer.

The general direction of groundwater flow in the shallow aquifer is from the southeast to the northwest, with a hydraulic gradient of about 0.005 ft per foot, a hydraulic conductivity of 0.4 to 14.9 ft per day and a porosity of about 0.30. Given the maximum recorded groundwater flow velocity, 340 ft per year, it would take 12 years for groundwater to naturally flow from the SNL/CA fuel oil spill site to the nearest downgradient domestic groundwater well 3,400 ft away (SNL/CA 2002b).

Since 1996, SNL/CA has monitored as many as 30 wells. In June 1998, six wells were closed because the wells no longer were needed for their original purpose. In August 1999, 11 additional wells were closed. For 12 wells, the average depth to water ranged from 77.03 ft (monitoring well [MW]-406) to 107.79 ft (MW-11) from 1996 to 2000. The remaining well's (AS-4) average depth to water was 16.34 ft from 1996 to 2000 (SNL/CA 2002b). This large variation in groundwater measurements (as much as 120 feet) indicate that groundwater levels drop precipitously on the valley side of a fault zone that runs along the base of the hills east of the SNL/CA site. Figures 4-7 and 4-8 show the locations of the groundwater monitoring wells. Current depth of groundwater at SNL/CA varies from approximately 12 ft below ground surface at well AS-4 (located on the south side of the North Branch Los Positas fault [see Figure 4-4]) to 126 ft at well MW-11 on the northeast side of the site (north side of the fault zone).

Groundwater Quality

Groundwater near SNL/CA is generally suitable for use as a domestic, municipal, agricultural, and industrial supply; however, industrial and agricultural uses of some shallower groundwater may be limited by marginal quality. Furthermore, groundwater less than about 300 ft deep is usually unsuitable for domestic use without treatment.

Groundwater monitoring wells were sampled at SNL/CA for background water quality. Typical parameters used to judge ground water quality are total dissolved solids, hardness, and naturally occurring organics. Water quality data for the past five years (1996-2000) for wells screened in the upper aquifer system under SNL/CA are presented in the EID. Water quality data are managed in the Environmental Operations Database.

SNL/CA compares groundwater constituents to maximum contaminant levels (MCLs) for informational purposes in annual reports. The MCLs apply only to drinking water sources. None of the aquifers sampled are used as a source of drinking water.

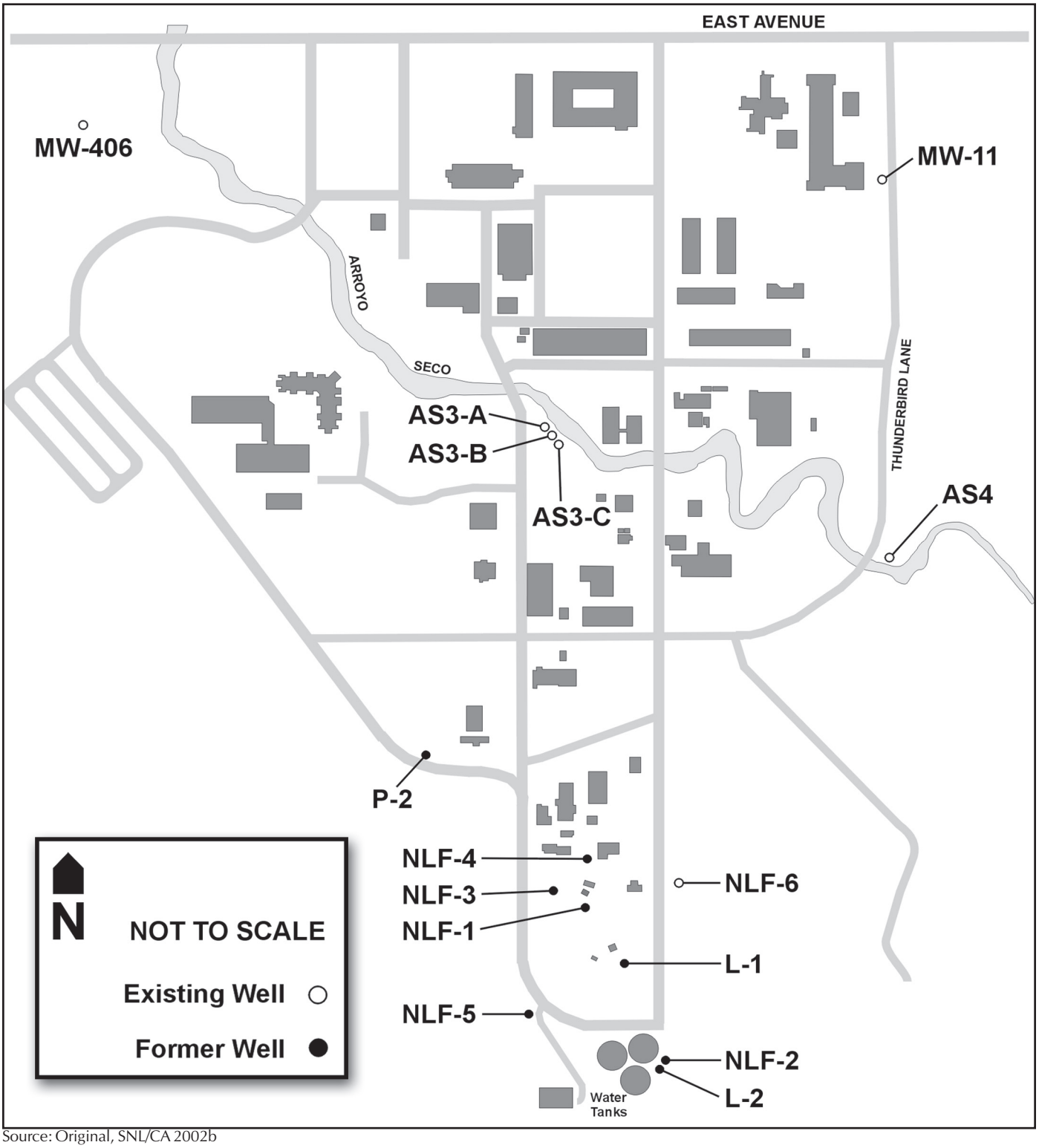
Recent reports (constituents of concern) include detection of carbon tetrachloride in well NLF-6, fuel and fuel constituents in wells at the former fuel tank location, and tetrachlorethlene and several metals in MW-406. SNL/CA continues to monitor according to DOE and State of California requirements.

Locations of Potential or Known Groundwater Contamination

SNL/CA has been conducting quarterly groundwater monitoring since 1986 in response to several environmental remediation projects onsite. These projects—Navy landfill closure, the Trudell Auto Repair Shop closure, and the fuel oil spill site closure—are described in further detail in Chapter 13 of the EID.

Groundwater monitoring wells were sampled at SNL/CA for background water quality. Typical parameters used to judge groundwater quality are total dissolved solids, hardness, and naturally occurring organics. Water quality data for the past five years (1996-2000) for wells screened in the upper aquifer system under SNL/CA are presented in the EID. Water quality data are managed in the Environmental Operations Database.

Groundwater levels range from about 555 to 650 ft MSL near Arroyo Seco to about 661 to 696 ft MSL at the Navy landfill site. Groundwater elevation data are available in the SNL/CA *Groundwater Investigation Quarterly Reports* (1996-2000). Groundwater beneath the eastern Livermore Valley has generally been rising because there has been a decrease in the volume being pumped for agricultural uses. As a result of abnormally low rainfall from 1987 through 1991, groundwater levels stopped rising and declined in many monitoring wells at SNL/CA. In response to normal rainfall in recent years, water levels are once again rising.



Source: Original, SNL/CA 2002b

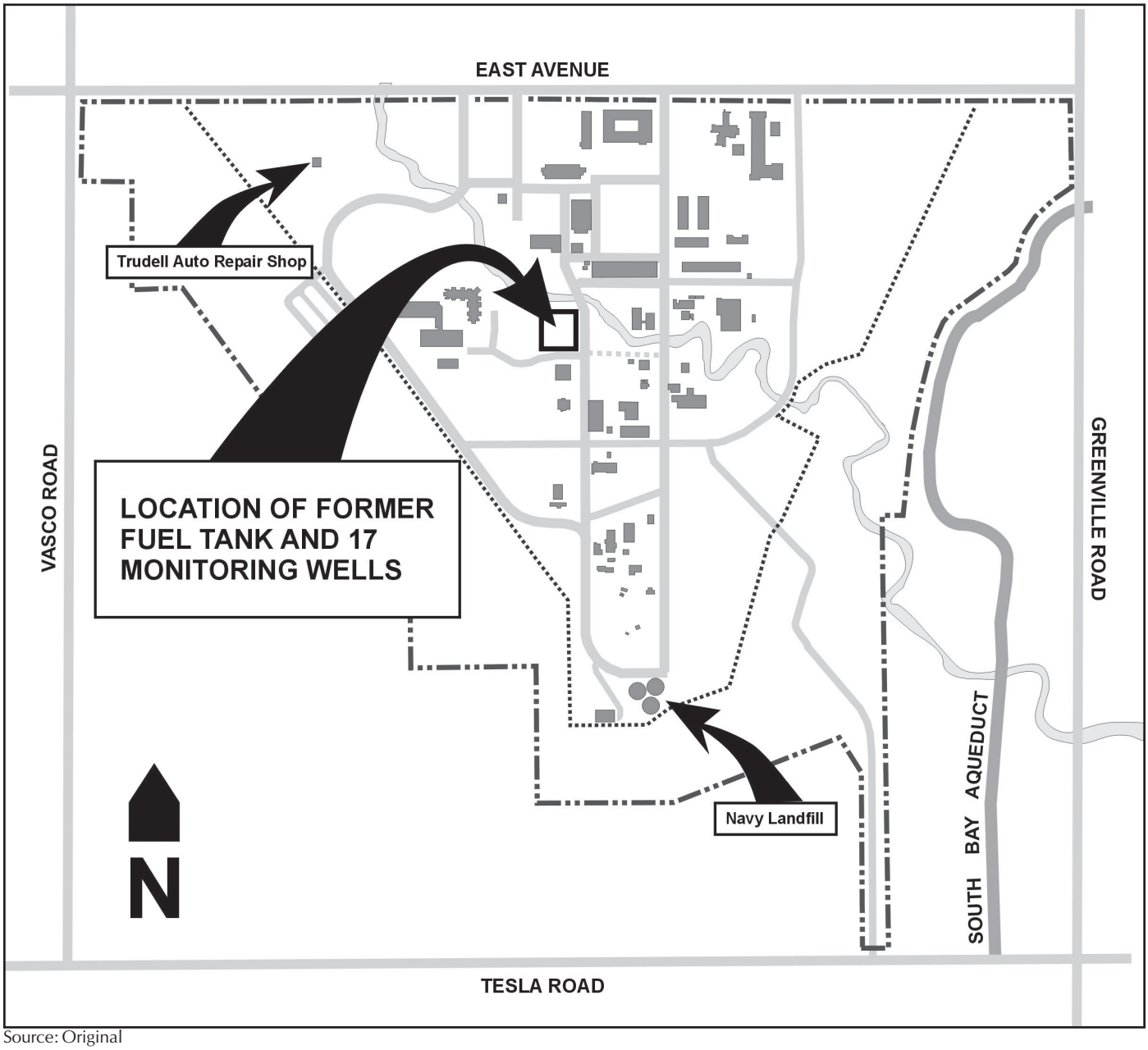
Figure 4-7. Existing and Former Groundwater Monitoring Well Locations excluding Fuel Oil Spill Wells

A network of monitoring wells is used to collect samples for environmental monitoring.

Total petroleum hydrocarbons (TPH)-Diesel continues to be a parameter of concern for SNL/CA because of the fuel oil spill site remediation. However, this site has been remediated, and the TPH-Diesel concentrations there continue to decrease.

Groundwater Quantity

The Livermore Valley groundwater basin is recharged from natural stream percolation; artificial stream percolation; aquifer storage; and recovery well, rainfall, applied water and subsurface groundwater inflow from adjacent



Source: Original

Figure 4-8. Fuel Oil Spill Groundwater Monitoring Well Locations

The former fuel tank is located south of Arroyo Seco. The Trudell Auto Repair Shop and Navy Landfill sites are located to the northeast and south, respectively.

groundwater basins. Stream recharge (natural and artificial) may contribute up to 65 percent by volume of recharge to the basin. At SNL/CA, Arroyo Seco provides recharge to the groundwater basin. The majority of the basin recharge would occur in the undeveloped uplands east and southeast of SNL/CA.

In general, most groundwater in the basin flows toward the west central portions of the valley. Groundwater generally moves east to west within the Livermore Valley; groundwater near the center of the valley moves toward the Amador subbasin and terminates in a large groundwater depression near gravel mining areas west of the city of Livermore. This depression is created by extraction of groundwater for drinking water use and dewatering for gravel mining. Pumping groundwater for agricultural uses has historically accounted for the major withdrawal of groundwater from the Livermore Valley basin. As the valley has become increasingly urbanized, the amount of pumping for municipal use and gravel quarrying has exceeded agricultural withdrawals. Municipal use accounts for approximately 52 percent. Numerous in-use domestic supply wells and public water supply wells are located near SNL/CA. The total volume of agricultural water use has decreased from 1,420 acre-ft in 1990 to 203 acre-ft in 1999 (SNL/CA 2002b).

4.5.2 Surface Water

4.5.2.1 Definition of Resource

The surface water system on SNL/CA is a reflection of the dry climate of the area. There are no perennial streams or other natural surface water bodies at SNL/CA. The Arroyo Seco, an ephemeral and intermittent stream, diagonally traverses the site, entering along the southeast border and leaving the site along the northwest corner. The arroyo flows only in very wet years and for short periods of time after significant storm events. Along the eastern part of the Arroyo, however, an area designated as a wetland is wet well into June and sometimes July. This wetland may supply a small contribution to groundwater recharge, as do other streams in the general area.

4.5.2.2 Region of Influence

The ROI for surface water is Arroyo Seco and the watershed downstream from SNL/CA. Surface water flowing in Arroyo Seco and subject to SNL/CA influences can affect LLNL and the City of Livermore.

Surface Drainages

The major surface drainage of SNL/CA is Arroyo Seco (Figure 4-8). The arroyo flows only in very wet years and for short periods of time after significant storm events. Along the eastern part of the Arroyo, however, an area designated as a wetland is wet well into June and sometimes July. Several locations in the Arroyo are wet year-round because of irrigation runoff from landscaped areas. Storm drains from the developed portions of the site discharge roof and parking lot runoff into the creek channel at various locations. For the most part these flows are of short duration—creating some in-channel flow that fills pools and may run down the channel for some distance—and are generally rapidly absorbed by the alluvial material (GMA 2001a).

The peak discharge of the Arroyo Seco for a 2-year flood is estimated to be 100 cubic ft per second (cfs). The peak discharge of a 100-year flood is estimated to be 2000 cfs. A more detailed hydraulic analysis of the Arroyo can be found in the *Arroyo Seco Improvement Project Progress Report* (GMA 2001b). The SNL/CA storm water conveyance system transports surface runoff to the Arroyo Seco or to a ditch along East Avenue (Figure 4-9). The channel along East Avenue is predominantly dirt, and runoff eventually infiltrates into the ground or evaporates. During heavy storms, the water in the channel flows west and eventually discharges to the Arroyo Seco via an underground-corrugated pipe.

The arroyo and the East Avenue channel are monitored during the wet season as part of the SNL/CA storm water program. Monitoring includes determining the arroyo water quality as it enters the site, at various points within the site, and as it leaves the site.

No regulatory limits have been set for pollutants in storm water runoff. No pollutants were detected at levels that would be a cause for concern during previous fire years. Storm water quality data for the past five years (1996-2000) are presented in the EID.

Floodplains and Wetlands

All of SNL/CA drains to the Arroyo Seco. During the rainy season, from October to April, the arroyo is a potential source of flooding onsite. It has a drainage length of approximately 12 mi and a watershed area of approximately 8,960 acres upstream of SNL/CA. The channel is narrow and shallow as it enters the site from the east and reaches a depth of 20 ft further downstream as it leaves the site to the northwest. Storm water from the site is collected and channeled to the arroyo through gutters, culverts, and open ditches. Open ditches and storm drains at the site are designed for a 10-year storm and may experience local flooding during the rainy season.

Upstream, in the upper two-thirds of the wetland, there is a functional floodplain. In the lower one-third, the effects of channel incision become apparent as both banks are elevated 6 to 10 ft above the channel and there is no functional floodplain. Floodplain maps indicate that along most of the channel on SNL/CA property, the entire 100-year discharge is contained within the existing channel. Between A Street and Thunderbird Lane, however, FEMA mapping indicates that flood flows would spill out of the channel; this likelihood appears to be associated primarily with the culverts at a manmade land bridge,

What is a Floodplain?

A floodplain is defined as the valley floor adjacent to a streambed or arroyo channel that may be inundated during high water. Flood insurance studies were performed for the Federal Emergency Management Agency (FEMA) to determine flood hazards in the Alameda County area and to identify the approximate limits of the 100-year floodplain.

What is a Wetland?

The *Clean Water Act* defines wetlands as areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, and bogs.

which was in place when the FEMA study was conducted. In 1998, during a period of heavy flow, the discharge did spill out of the channel at this location (GMA 2001a).

The wetland area of SNL/CA is approximately 1,370 ft of the Arroyo Seco channel starting several hundred ft east of Thunderbird Lane and extending east to the property boundary. The wetland is approximately 8 ft wide except near the property boundary where it averages 20 to 30 ft wide; it occupies 0.44 acres (SAIC 1998a). The wetland area is a seasonal marsh. Vegetation is discussed in Section 4.6.3.3.

In 1998, SNL/CA proposed a project to restore a portion of the arroyo embankment and streambed at the east buffer zone fence crossing and at the east buffer zone trash rack and to remove the manmade land bridge within the main SNL/CA site area. All three project sites are designated flood zones, and the fence crossing and trash rack are within the wetland. The *Floodplain/Wetlands Assessment for Proposed Embankment and Streambed Restoration Project in the Arroyo Seco* (SNL/CA 1999a) assessed project impacts. Based on the assessment and to mitigate disturbance to the wetland area caused by maintenance activities performed there, the wetland area was replanted in December 1999. Plugs of native wetland plants were collected from the Arroyo Seco and replanted in the disturbed areas. Additionally, the bank of the arroyo was reseeded with a mixture of native grasses. The growth of the plantings was monitored, successful, and reported to the California Department of Fish and Game (CDFG). SNL/CA is required by CDFG to monitor the replanted wetland for three years.

Surface Water Quality—Storm Water Runoff

SNL/CA has a Storm Water Pollution Prevention Plan (SWPPP), as required by the State Water Quality Control Board's General Industrial Activities Storm Water Permit (General Permit). The SWPPP discusses the site's storm water drainage system, the rationale for choosing discharge observation locations, and the rationale for choosing storm water sampling locations; it identifies best management practices to reduce pollutant contact with storm water.

Pollutants may be picked up by storm water runoff. If a storm event lasts long enough there may be sufficient runoff to transport the pollutant to the Arroyo Seco before the runoff evaporates or infiltrates into the ground. The amount of runoff is a function of the permeability of the ground surface or cover material. Approximately 12 percent of the site's 410-acre drainage to the Arroyo is impervious (buildings, roads, parking lots, etc.) (SNL/CA 2002b).

The current SNL/CA storm water runoff-monitoring program includes visually inspecting 22 locations and sampling nine locations, shown in Figure 4-10. No pollutants were detected at levels that would be a cause of concern during 1995 to 1999 (SNL 1996a, 1997a, 1998a, 1999a, 2000a).

Authorized Nonstorm Water Discharges

The General Permit allows specific nonstorm water discharge that does not exceed quantities of pollutants. Best management practices have been developed to prevent or reduce the contact of nonstorm water discharges with materials of concern or equipment and to minimize the flow volume of the nonstorm water discharges. Authorized nonstorm water discharges onsite include air conditioning condensate, fire auxiliary building system and hydrant testing, safety wash testing, landscape irrigation, and emergency deionized water release. These discharges are not sampled but are inspected quarterly as part of the quarterly nonstorm water discharge visual observations of the site.

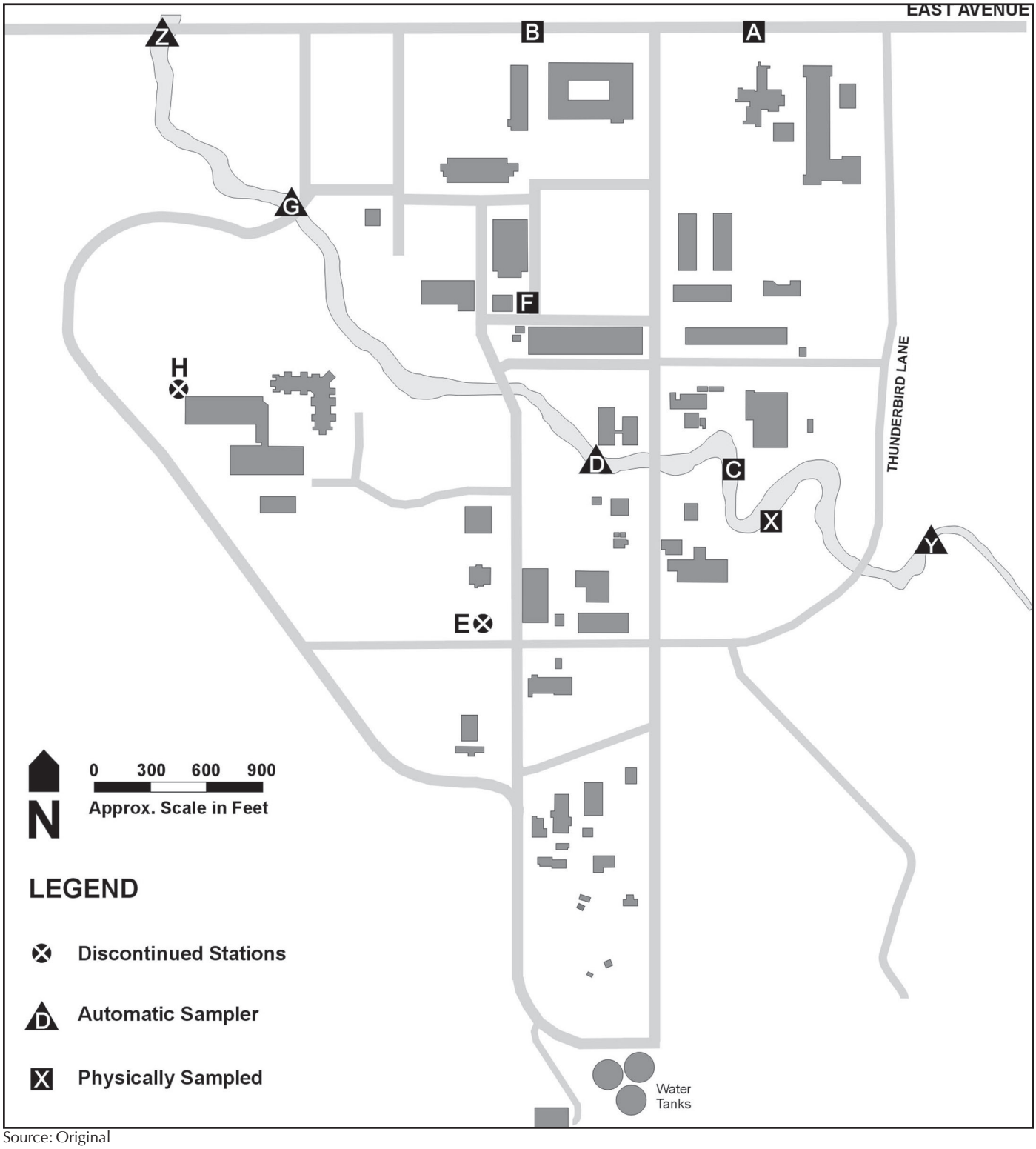
Sanitary Sewer Discharges

The DOE Sandia Site Office (SSO) and SNL/CA maintain a wastewater discharge permit issued by the City of Livermore. This permit regulates SNL/CA sanitary and industrial effluent, which is discharged to the city's sewer system, and enforces the requirements of the Federal *Clean Water Act* (CWA). The permit is renewed annually. It contains discharge limits for the site sanitary sewer outfall and for processes subject to U.S. Environmental Protection Agency (EPA) pretreatment standards. The permit also contains liquid effluent monitoring and reporting requirements.

The sanitary sewer effluent from SNL/CA must comply with the site outfall discharge limits for regulated physical parameters, radionuclides, and EPA priority organic pollutants. Two SNL/CA operations are subject to the EPA's pretreatment standards for point sources: one metal finishing and one semiconductor manufacturing operation. Another metal finishing operation is a closed loop process and does not discharge to the sanitary sewer; no sampling of this process is required.

Sanitary fixtures, serving office and work space for over 1,000 employees (including contractors), generate most of the wastewater discharged from SNL/CA. Laboratory and research processes produce only small and intermittent flows. These nonsanitary flows are generated by many independent sources, such as small-scale research and development (R&D) laboratories, throughout the site. SNL/CA's Wastewater Management Program tracks and documents potential sources of pollutants for both regulated and unregulated constituents.

SNL/CA policy prohibits the discharge of regulated chemical wastes to the sanitary drains. This policy is backed up by the Waste Management Program onsite and by ongoing site-wide education. The Wastewater Management Program participates in laboratory planning activities so that



Source: Original

Figure 4-10. Storm Water Sampling Locations

Surface water flows are primarily during winter storms.

proper wastewater disposal practices are implemented when the processes go online.

The site operates a wastewater management control system whereby potentially contaminated laboratory wastewater is routed to retention tanks for analysis and proper disposal. The Liquid Effluent Control System (LECS) provides a fail-safe mechanism for preventing any release of regulated materials from reaching a site outfall. Six LECS units currently serve the site's most active laboratories and research processes. Each LECS unit consists of one or more 2,000- to 5,000-gallon (gal) tanks. The con-

tents of the tanks are sampled and analyzed for metals and relative acidity (pH) before being discharged to the site's sanitary sewer system. Figure 4-11 shows the LECS and the site sanitary sewer system.

SNL/CA maintains a wastewater monitoring station in the site's northwestern security buffer area. The sewer discharges to the LLNL sewer system across East Avenue. SNL/CA maintains a flow meter, a pH meter, and two

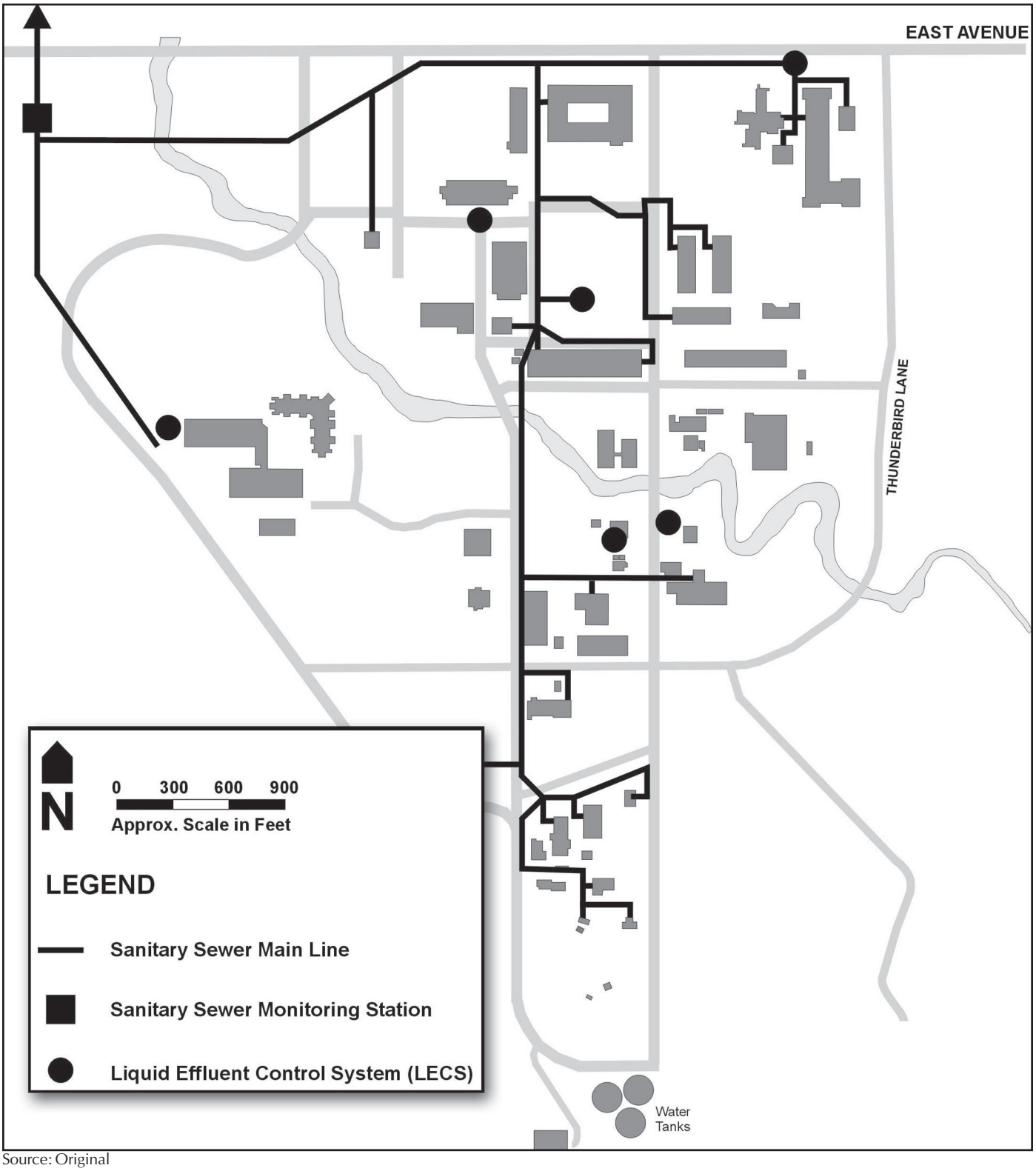


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Figure 4-11. Site Sanitary Sewer System and the Liquid Effluent Control System Locations

Sandia National Laboratories, California manages six Liquid Effluent Control Systems.

automatic samplers to comply with monitoring requirements. The liquid effluent from the SNL/CA sanitary sewer outfall is monitored for regulated physical parameters, metals, and EPA priority organic pollutants. The wastewater must comply with the site outfall discharge limits. Some slight exceedances have occurred, but these have had no impact on the receiving wastewater treatment plant (SNL 1996a, 1997a, 1998a, 1999a, 2000a).

Potable Water Use

SNL/CA purchases potable water from the adjacent LLNL. LLNL is supplied by the San Francisco Water District through the Hetch Hetchy Aqueduct. When needed, water is also supplied by the Alameda County Flood Control and Water Conservation District, Zone 7. The San Francisco Water District and Zone 7 are responsible for monitoring the quality of the incoming water. SNL/CA neither treats nor samples the drinking water. LLNL maintains the drinking water distribution system for both sites. Maintenance includes water quality screening analyses. In 2000, SNL/CA used approximately 53 million gallons (M gal).

4.6 BIOLOGICAL RESOURCES

4.6.1 Definition of Resource

Biological resources at SNL/CA considered in this section are terrestrial resources, aquatic resources, wetlands, and protected and sensitive species.

4.6.2 Region of Influence

For biological resources, the affected environment consists of the plant and animal species within the boundaries of SNL/CA. Where appropriate, mention may be made of the proximity of protected or sensitive species that are not present at the site, but have been reported in the surrounding area.

4.6.3 Affected Environment

4.6.3.1 Terrestrial Resources

Vegetation

SNL/CA is located on 410 acres, with approximately 130 acres currently developed for use as research facilities, offices, support facilities, roadways, and parking areas (SNL/CA 2002c). Undeveloped areas on the east, south, and west sides of the facility provide a security buffer zone and areas for future development. The following three terrestrial habitat areas have been identified in the undeveloped areas: grassland, coyote brush scrub, and riparian woodland (SNL/CA 2002b). The location of these habitats is presented in Figure 4-12.

Grasslands

Grasslands comprise 226 acres at SNL/CA and represent the predominant habitat in the open, undeveloped areas. Although both native and nonnative species are present, nonnative species are dominant. Common nonnative grasses include ripgut brome (*Bromus diandrus*), soft chess (*B. hordeaceus*), wild oats (*Avena* sp.), and Mediterranean barley (*Hordeum marinum*). Common nonnative herbs include red maids (*Calandrinia ciliata*), bur clover (*Medicago polymorpha*), and cheeseweed (*Malva* sp.). Scattered patches or individual native wildflowers can be observed in the grassland habitat including Brodianea (*Brodinea* sp.), California poppy (*Escholzia californica*), blue dicks (*Dishelostemma capitatum*), and farewell to spring (*Clarkia purpurea*) (SNL/CA 2002b, SAIC 2001a).

Recent botanical surveys have confirmed the presence of mature valley oaks (*Quercus lobata*) in the grassland habitat, with many valley oak saplings identified on the east side of the site (SAIC 2001a). The locations of these sites are indicated in Figure 4-12 (SNL/CA 2002b). The presence of valley oak saplings at SNL/CA was considered noteworthy by the survey team. Several saplings that may be northern California black walnut (*Juglans californica hindsii*) were observed, but positive identification may not be possible for another several years (SAIC 2001a, SNL/CA 2002b).

Eleven invasive exotic plant species have been identified at SNL/CA: bindweed (*Convolvulus arvensis*), bull thistle (*Cirsium vulgare)*, Italian thistle (*Carduus pycnocephala*), mayweed (*Anthemis cotula*), Mediterranean mustard (*Hirschfeldia incana*), medusa head (*Taeniatherum caput-medusae*), milk thistle (*Silybum marianum*), pampas grass (*Cortaderia* sp.), pepperweed (*Lepidium latifolium*), purple star thistle (*Centaurea clacitrapa*), and yellow star thistle (*Centaurea solstitialis*) (SNL/CA 2002b, SAIC 2001a).

Coyote Brush Scrub

Two small areas of coyote brush scrub occur onsite. One is in the southwest corner of SNL/CA and the second is near the Arroyo Seco on the eastern property boundary. The total coyote brush scrub habitat is approximately 1.5 acres in size. It is located in steep and generally inaccessible areas where disturbance from site activities would be unlikely (SNL/CA 2002b).

Riparian Woodland

At SNL/CA, willow riparian woodland of approximately 2.4 acres is present along the eastern portion of the Arroyo Seco. This habitat has increased from just a few isolated patches in 1975 to a more dense and uniform cover along the arroyo (SNL/CA 2002b). A recent survey determined that dominant species include Goodding's black willow (*Salix gooddingii*), arroyo willow (*Salix lasiolepis*), red willow (*Salix laevigata*), and narrow-leaved willow (*Salix exigua*). Other common plant species include Fremont cottonwood *(Populus fremontii*), western sycamore (*Plantanus racemosa*), and valley oak. A few immature trees were tentatively identified as northern California black