

Biological Assessment for USFWS

# Alamo Creek Detention Basin

City of Vacaville

FEMA-1628-DR-CA & FEMA-1646-DR-CA, HMGP #1628-31-14

*October 2009*



**FEMA**

**Federal Emergency Management Agency**  
**Department of Homeland Security**  
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*This document was prepared with the support of*

URS Group, Inc.

Contract No. HSFEHQ-06-D-0162

Task Order HSFEHQ-07-J-0004

15299521.00200



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°F	degrees Fahrenheit
ACDB	Alamo Creek Detention Basin
BA	Biological Assessment
BMP	Best Management Practice
CalEMA	California Emergency Management Agency
CDFG	California Department of Fish and Game
City	City of Vacaville
CNDDDB	California Natural Diversity Database
CRLF	California red-legged frog
DSOD	California Department of Water Resources Division of Safety of Dams
E	Endangered
ESA	Endangered Species Act
FDB	Florence Detention Basin
FEMA	Department of Homeland Security's Federal Emergency Management Agency
HMGP	Hazard Mitigation Grant Program
ID	identification
LCDB	Laguna Creek Detention Basin
m	meter(s)
NAVD88	North American Vertical Datum of 1988
NMFS	National Marine Fisheries Service
T	Threatened
URS	URS Group, Inc.
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VELB	valley elderberry longhorn beetle



## SECTION ONE INTRODUCTION

The Department of Homeland Security's Federal Emergency Management Agency (FEMA) proposes to provide Hazard Mitigation Grant Program (HMGP) Federal financial assistance (Federal action) to the City of Vacaville (City) in Solano County, California, through the California Emergency Management Agency (CalEMA), to implement the Alamo Creek Detention Basin (ACDB) Project (proposed project). The detention basin, which would be constructed on approximately 77 acres of City-owned property, would reduce the potential for damage from flooding on Alamo Creek. Severe storms from December 17, 2005, to January 3, 2006, and March 29, 2006, to April 16, 2006, caused the creek to overrun its channel, resulting in widespread flooding of roads, farms, houses, and businesses adjacent to the creek and within the City limits (Presidentially declared Severe Storms, Flooding, Mudslides, and Landslides Disaster of 2005–2006, FEMA-1628-DR-CA and FEMA-1646-DR-CA). HMGP funds are available under these declarations.

Alamo Creek drains an area of approximately 10 square miles in the vicinity of the City of Vacaville and is one of approximately six major drainage channels that flow through the City. The channel of Alamo Creek has been determined to have insufficient capacity to contain a 10-year flood event, and the creek is known to overflow its banks within the City boundary during storm events. In recent years, heavy rainfall has caused the creek to overflow onto City streets, businesses, public property, and private property. Damages in the City from the 10-year flood event on Alamo Creek that occurred in December 2002 totaled approximately \$3.4 million, and damages in the City from the 28-year flood event on Alamo Creek that occurred in December 2005 totaled approximately \$26.5 million. The proposed project would reduce the potential for damage from flooding on Alamo Creek.

This report contains the results of a Biological Assessment (BA) that FEMA has prepared. The BA was conducted to evaluate the potential effects of the proposed project on species that are listed or proposed for listing under the Endangered Species Act of 1973 (ESA) (16 U.S.C. §§ 1531–1544 [2007]) and that are under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS). The potential effects on federally listed species have been evaluated in accordance with Section 7 of the ESA (16 U.S.C. § 1536).

FEMA is consulting separately with the National Marine Fisheries Service (NMFS) regarding the potential adverse effects to species that are listed and proposed to be listed under the ESA and that are under NMFS jurisdiction.

The remainder of the BA is organized as follows:

- Section 2: Description of the project area and proposed project
- Section 3: Description of the study methods
- Section 4: Description of environmental setting and biotic resources in the region and project area

## **Alamo Creek Detention Basin: Biological Assessment for USFWS**

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- Section 5: Discussion of the species that are federally listed or proposed to be listed and that are relevant to the proposed project
- Section 6: Evaluation of the potential adverse effects to the species that are federally listed or proposed to be listed and that are relevant to the proposed project
- Section 7: Evaluation of potential cumulative effects
- Section 8: Conclusions on the potential effects that the proposed project would have on federally listed or proposed species
- Section 9: References cited in the report

**SECTION TWO PROJECT AREA, PRELIMINARY ENGINEERING AND  
ENVIRONMENTAL INVESTIGATION, AND PROPOSED PROJECT**

**2.1 PROJECT AREA**

The project vicinity is the area northwest of Vacaville, California, approximately 54 miles northeast of San Francisco and 34 miles southwest of Sacramento (Figure 1). The project area is northwest of the City (Figure 2) between Pleasants Valley Road (west) and Rogers Lane (east) and Vaca Valley Road (north). The southern boundary of the project area is along the northern bank of Alamo Creek. The project area consists of approximately 77 acres, which are owned by the City.

The project area is defined as the limit of proposed construction activities associated with implementation of the proposed project (e.g., access and construction staging areas). The project area includes all areas that may be permanently or temporarily disturbed by the proposed project.

**2.2 PRELIMINARY ENGINEERING AND ENVIRONMENTAL INVESTIGATION**

The preliminary engineering and environmental investigation consist of geotechnical investigations (Figure 3) and a geoarchaeological testing and site evaluation program. Geotechnical investigations were conducted in October and November 2008, and are necessary for the City to initiate its detailed project design and to begin its approval process with the California Department of Water Resources' Division of Safety of Dams (DSOD). A geoarchaeological testing and site evaluation was conducted between June 30 and July 2, 2009 and was necessary for FEMA to comply with Section 106 of the National Historic Preservation Act.

**2.2.1 Geotechnical Investigations**

As a part of the process of designing the ACDB and the process of obtaining approval from the DSOD for the ACDB, the City conducted geotechnical investigations, which involved ground-disturbing activities within the project area. Between October 13, 2008, and November 10, 2008, the City conducted test borings, dug test pits, and conducted cone penetration tests (Figure 3). Test borings were 4 to 8 inches in diameter, were performed by a truck-mounted or track-mounted drill rig, and were drilled to depths ranging from approximately 31 to 90 feet below ground surface. The City drilled 14 borings. On completion of the drilling, the borings were filled with cement grout. Test pits were excavated between October 28, 2008, and October 30, 2008, by a backhoe. The 21 test pits were excavated to depths that ranged from 7 to 16 feet below ground surface. On completion, the test pits were backfilled with the excavated soils and bucket-tamped and wheel-rolled with the backhoe. The City made six cone penetration test soundings on November 6, 2008, and November 7, 2008, with a track-mounted and truck-mounted cone rig. Biological monitors were present for most of the geotechnical investigations.

## **Alamo Creek Detention Basin: Biological Assessment for USFWS**

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If required by DSOD, the City would conduct additional geotechnical investigations involving ground-disturbing activities before beginning construction. The investigations could include activities such as the preparation of test borings, test pits, and cone penetrations within the project area. All future geotechnical investigations would be conducted with the following constraints:

- Ground-disturbing activities would occur during the dry season, specifically between June 15 and October 15; and
- Ground-disturbing activities would occur 100 feet or more from the drip line of all elderberry shrubs

If the City requires modifications to the above buffers, the City would notify FEMA prior to conducting the activity and FEMA would consult with the USFWS.

### **2.2.2 Geoarchaeological Testing and Site Evaluation Program**

As a part of the process of FEMA's compliance with Section 106 of the National Historic Preservation Act for the proposed project, geoarchaeological testing and site evaluation was conducted within the project area. Ground-disturbing activities associated with the geoarchaeological testing and site evaluation program were completed between June 30 and July 2, 2009 and involved the use of mechanical trenching techniques. The excavation depth averaged approximately 12.5 feet below ground surface.

The geoarchaeological testing and site evaluation program was performed within the following constraints:

- Ground-disturbing activities occurred during the dry season, specifically between June 15 and October 15; and
- Ground-disturbing activities occurred 100 feet or more from the drip line of all elderberry shrubs.

Any future geoarchaeological testing and site evaluations conducted by the City would be conducted within the constraints above. If the City requires modifications to these buffers, then the City would notify FEMA prior to conducting the activity and FEMA would consult with the USFWS.

## **2.3 PROPOSED PROJECT**

### **2.3.1 Construction of Alamo Creek Detention Basin**

The entire ACDB would be designed and constructed to meet the requirements of the DSOD. The geological conditions and characterization of the project area would be ongoing until the ACDB would be under construction, and DSOD does not complete its approval of the proposed project design until construction is under way. The ACDB design could be subject to change per DSOD requirements once construction has been initiated. Thus, most elements of the proposed

## Project Area, Preliminary Engineering and Environmental Investigation, and Proposed Project

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project described below could be subject to change as the proposed project design proceeds or once construction is initiated.

The proposed ACDB would be designed to reduce the existing flood hazard from Alamo Creek within the City boundaries during flood events. The inlet structure would be designed to passively allow flowing water in Alamo Creek to flow into the ACDB when water in the creek is less than the 10-year flood event elevation. The ACDB would be designed to store up to 575 acre-feet of water, with a surface area of approximately 104,000 square yards. At this capacity, the ACDB would provide storage for between a 10- and 25-year storm event. The ACDB would be designed to retain water for a period of 24 to 48 hours. Retained water would be passively released back into Alamo Creek through an outfall structure. The outfall structure would limit, but not stop, the gravity flow of floodwater back into Alamo Creek. Water in the ACDB would flow over an engineered spillway in the southern berm during flood events that exceed the capacity of the basin. The ACDB would be excavated and constructed with an earthen bottom, engineered earthen berms, an emergency spillway, a 300-foot-wide articulated concrete block inlet structure, a 42-inch-diameter reinforced-concrete pipe outlet, and a maintenance road. An excavation disposal area, two parking lots, an access road, perimeter fencing, and access gates would also be constructed adjacent to the ACDB on the 77-acre City-owned parcel as permanent features of the facility (Figure 4).

Construction of the ACDB would be initiated with mass grading of the project area. Mass grading would include the removal of trees and other vegetation located within the project area and the demolition of several structures located along the eastern side of the project area. Aside from trees and vegetation in the vicinity of the intake and outfall structures, which would be permanently removed, trees and other vegetation within the riparian zone would primarily be protected and not subject to removal. The basin footprint, intake footprint, outfall footprint, and foundation area for the berms would be excavated. The maximum depth of excavation would be approximately 17 feet below ground surface. The basin bottom would consist of native soil and would have a lowest depth of 227 feet above the North American Vertical Datum of 1988 (NAVD88). The berm nearest to Alamo Creek would be constructed outside of the 100-year floodplain. The berms would have a maximum crest elevation of 255 feet above NAVD88 and an approximate crest width of 20 feet. An approximately 12-foot-wide maintenance road would be constructed atop the crest. An emergency spillway would be constructed across the crest on the eastern side of the southern berm. The emergency spillway would have a reinforced-concrete bottom and would be 50 feet wide at its bottom, with an invert elevation of 250 feet above NAVD88. The berms would be constructed on an engineered fill foundation that would be built on undisturbed native soil. Soil excavated for the basin, intake structure, and outlet structure would be used to construct the berms. The berms would have a maximum side slope of 3 horizontal to 1 vertical (3:1).

The ACDB intake structure would consist of an inlet weir lined with articulated concrete block placed on undisturbed native soil. The block would be designed based on the flow characteristics of the inlet and the block manufacturer's recommendations. Riprap could be placed at the

## **Alamo Creek Detention Basin: Biological Assessment for USFWS**

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junction between the intake structure and Alamo Creek to prevent scour. As the intake structure would function passively, it would not extend into the natural stream channel. The inlet weir would have an invert elevation of 242 feet above NAVD88 and a bottom width of 300 feet.

The ACDB outfall structure would consist of a 42-inch-diameter reinforced-concrete culvert constructed on a reinforced-concrete bed. This structure would be designed to meter the detained water into Alamo Creek. Water would be conveyed through the outfall structure by gravity. The outfall structure would be constructed using open channel trenching methods. The creek bank would be lined with half-ton rock riprap at the terminus of the outfall structure to prevent scour, and the terminus of the culvert could include a flap gate.

To minimize off-site disposal and truck trips, some excess excavated soil would be stored at an on-site disposal area. This disposal site would have a height of approximately 265 feet above NAVD88, would be constructed on undisturbed native soil, and would have a maximum slope of 3:1. Any additional excess soil from excavation of the ACDB would be trucked to other locations in accordance with local, State, and Federal requirements.

On completion of mass grading activities, construction of the berms, construction of the disposal site, construction of the intake structure, and construction of the outfall structure, the project area would be finish-graded. This activity would include the completion of the maintenance road along the berms; the permanent parking areas; and the access road that would be used for maintenance-related access to the intake structure, one of the parking areas, the southern berm, and the maintenance road along the southern berm. Temporarily disturbed soils within the project area would be hydroseeded, a fence would be installed in upland areas around the perimeter of the property boundary, and access gates would be installed.

The area of temporary and permanent disturbance would be limited to the project area. As stated above, with the exception of areas where the outfall and intake structures would be installed, the riparian zone would not be disturbed. All equipment would be staged in the project area outside of the riparian and stream zones. Rogers Lane would be used to access the project area. The proposed project would not include improvements to Rogers Lane. The City would implement all standard and necessary Best Management Practices (BMPs) to protect water quality, wetlands, waters of the United States, and the Alamo Creek streambed, through its compliance process with Sections 401, 402, and 404 of the Clean Water Act of 1972 and Section 1600 *et seq.* of the California Fish and Game Code. Any construction-related BMPs required under local regulations or by local regulatory agencies (for example, BMPs to reduce construction-related air quality effects, noise effects, or traffic control) would be implemented, as applicable.

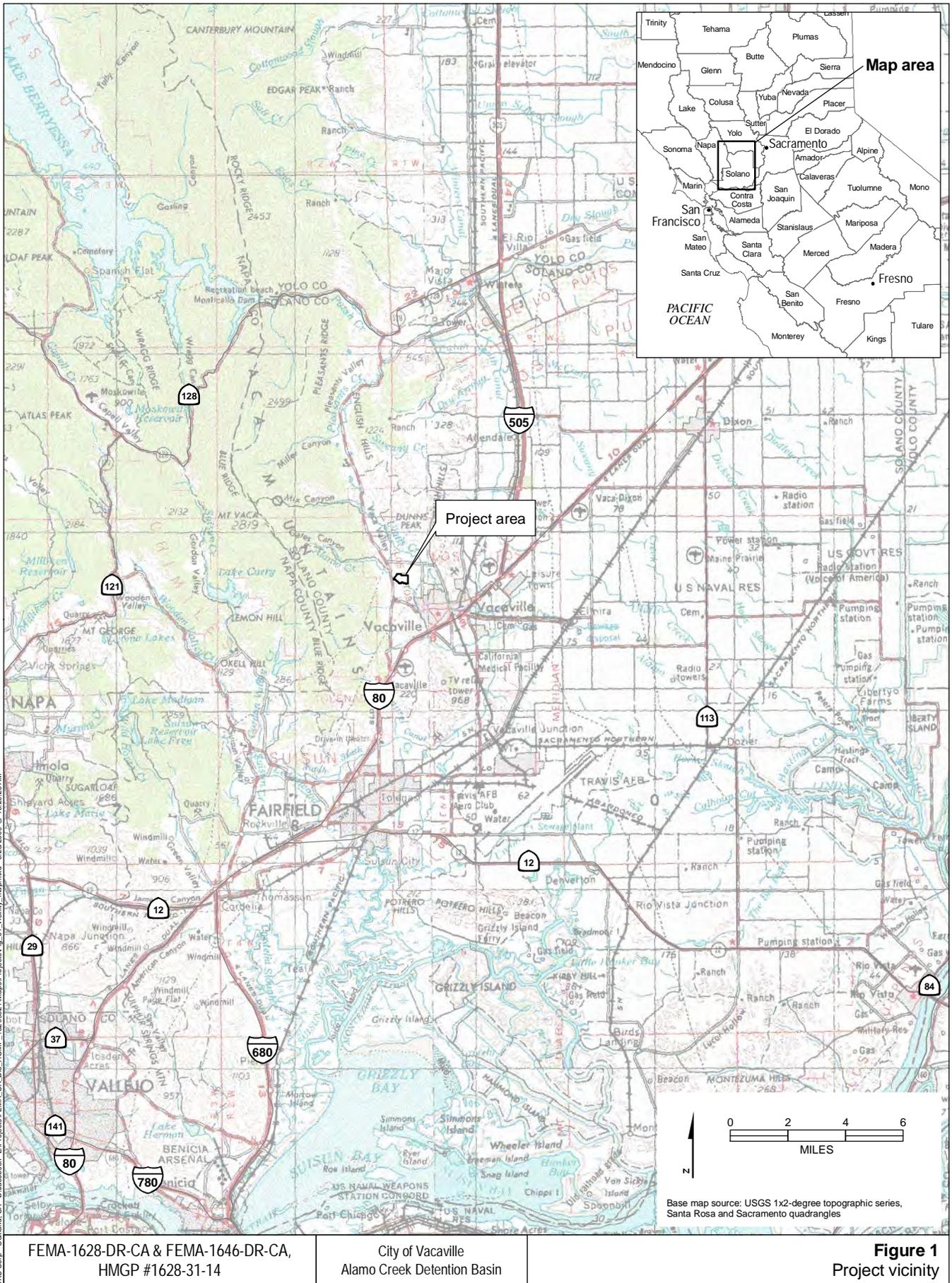
The proposed project would take approximately 450 working days to construct. Construction activities would result in at most 15 to 20 personnel on-site at any one time. An estimate of the maximum number of equipment pieces that could be used at the project area at any one time is provided below.

- Water trucks, rubber tired: 3
- Excavators, tracked: 3
- Backhoes, rubber tired: 2
- Bulldozers, tracked: 4
- Scrapers, rubber tired: 5
- Compactors, sheep's foot: 4
- Bottom dump trucks, rubber tired: 10
- Pickup trucks, rubber tired: 10

### 2.3.2 Operation and Maintenance of ACDB

Operation and maintenance of the ACDB would be minimal. The intake and outfall structures would operate passively and thus would not require any personnel to operate mechanical devices to allow water to enter or exit the ACDB. The basin is anticipated to operate less than once every 10 years (or less than a 10 percent chance of operation every rainy season). The bottom of the ACDB may be used for agricultural use. Debris removal and cleanup would occur after the winter and spring rainy season. Some debris removal may occur during the winter, but this activity would be infrequent and only occur as needed. Accumulated silt would be removed bi-annually using a backhoe or excavator. Weed abatement would occur throughout the summer. Weed abatement through mowing and/or use of an herbicide (Aquamaster) would be performed two to three times in the summer to restrict the accumulation of fire fuel and maintain water flow in the ACDB. If the ACDB bottom is used for agricultural purposes, weed abatement activities could occur less frequently.





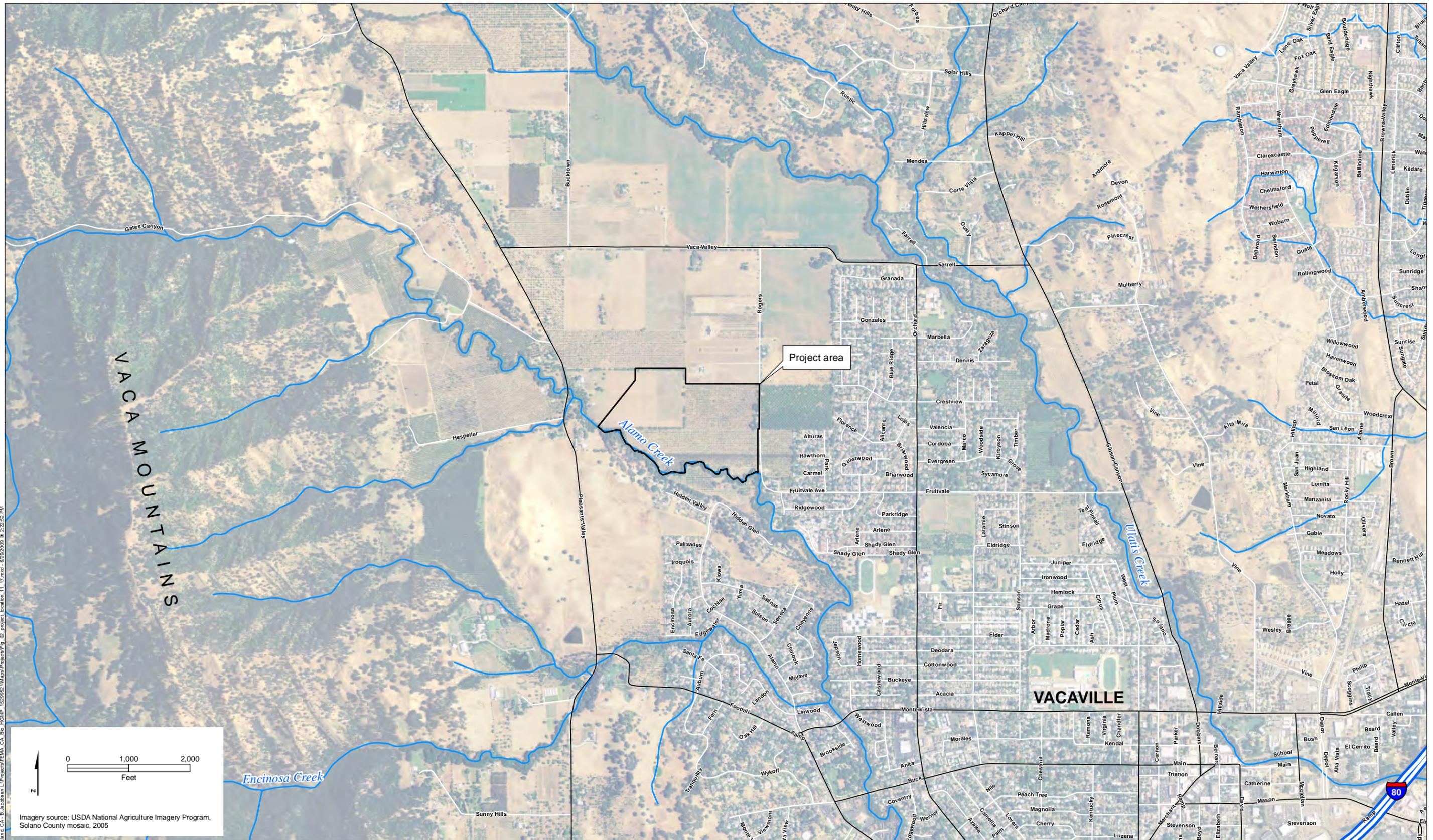
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City of Vacaville  
Alamo Creek Detention Basin

**Figure 1**  
Project vicinity





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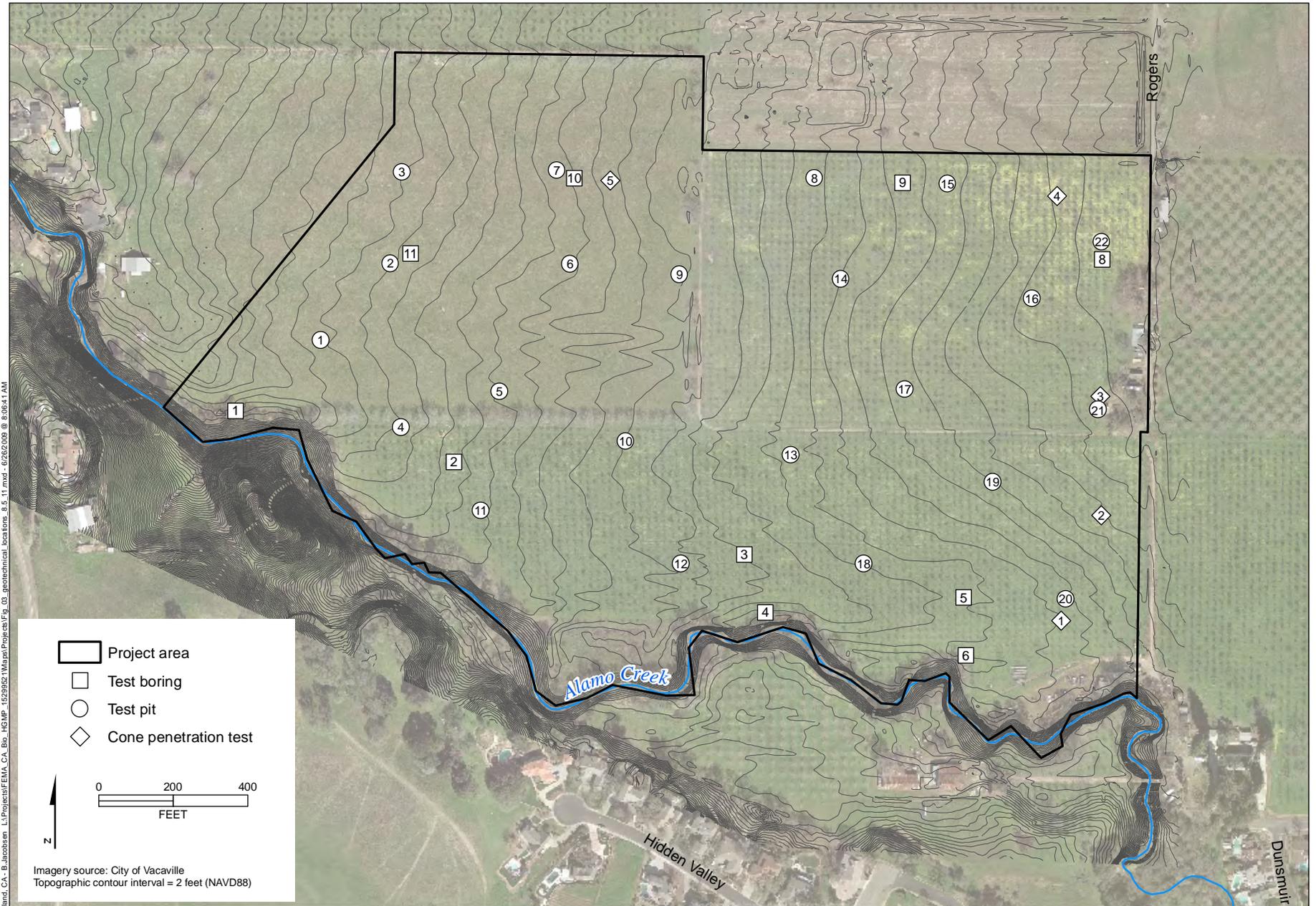
Imagery source: USDA National Agriculture Imagery Program,  
 Solano County mosaic, 2005

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City of Vacaville  
 Alamo Creek Detention Basin

**Figure 2**  
 Project area



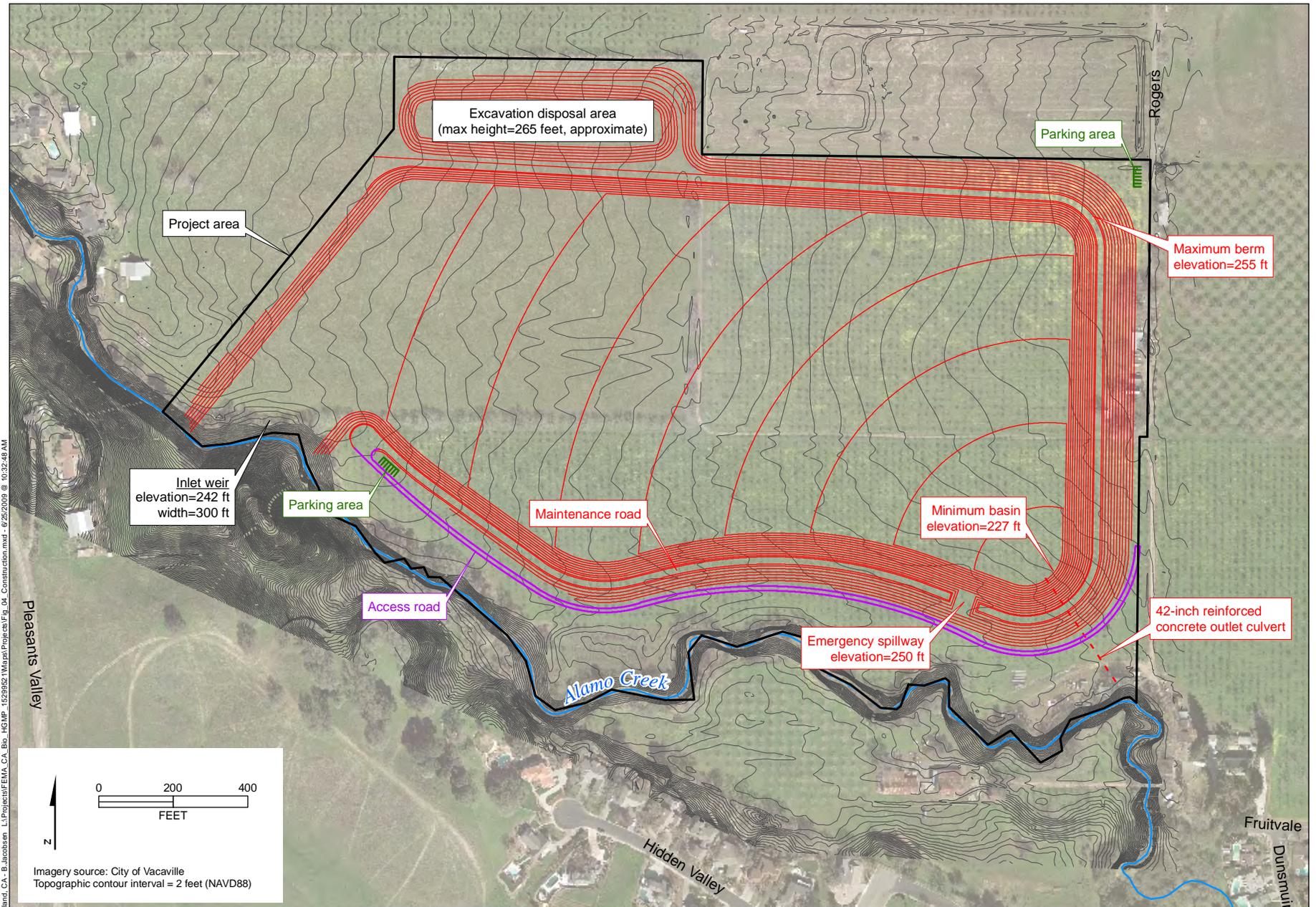


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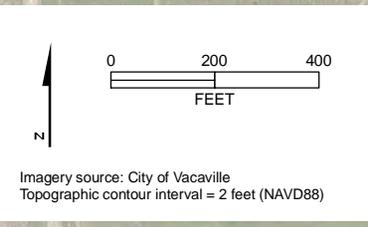
City of Vacaville  
 Alamo Creek Detention Basin

**Figure 3**  
 Geotechnical investigation locations





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City of Vacaville  
 Alamo Creek Detention Basin

**Figure 4**  
 Construction of the Alamo Creek Detention Basin



## SECTION THREE STUDY METHODS

This section presents the study methods that were used to evaluate the potential effects of the proposed project to federally listed species.

### 3.1 LITERATURE REVIEW

FEMA obtained a list of species that are listed as endangered, threatened, or proposed for listing as endangered or threatened under the ESA that may occur in the vicinity of the project area from the following sources:

- United States Fish and Wildlife Service (USFWS) (USFWS 2009)
- California Department of Fish and Game (CDFG) California Natural Diversity Database (CNDDB) (CDFG 2009)

For each of the record searches the following nine United States Geological Survey (USGS) 7.5-minute quadrangles were searched for known occurrences of federally listed or proposed species: Fairfield North (project area), Denverton, Fairfield South, Cordelia, Allendale, Elmira, Mt. Vaca, Capell Valley, and Mt. George. Documented occurrences of federally listed or proposed species are shown on Figure 5a (plants) and Figure 5b (wildlife), and designated and proposed critical habitat within a 10-mile radius of the project area is shown on Figure 6.

The wildlife and plant species identified by the sources as having potential to occur in the vicinity of the project area that are under the jurisdiction of USFWS under the ESA are listed in Table A-1 (Appendix A). A literature review was conducted to identify habitat requirements and distribution of these species. The literature review included a review of the Federal Register, designated and proposed critical habitat, draft and final recovery plans, and other published reports including the California Wildlife Habitat Relationship System (CDFG 2005).

### 3.2 PERSONNEL AND SURVEY DATES

FEMA's consultant, URS Group, Inc. (URS), conducted numerous surveys of the project area and vicinity in 2008, to ascertain the potential presence of the federally protected species included in Table A-1 (Appendix A). General habitat characteristics of the project area were evaluated during the surveys. Qualitative assessments of each habitat, along with focused species surveys for federally protected plant species, elderberry shrubs, and the California red-legged frog (CRLF) were used to determine whether each of the species identified in Table A-1 (Appendix A) are likely to occur in the project area. A summary of the habitat assessments and focused species surveys is provided below.

### **3.2.1 Reconnaissance-Level Survey**

A reconnaissance-level survey of the project area was conducted by URS during the February 11, 2008, kick-off meeting and site visit attended by the City, FEMA, CalEMA, and URS.

### **3.2.2 California Red-Legged Frog Site Assessment and Protocol-Level Field Surveys**

URS biologists conducted a CRLF site assessment of the project area and a 1-mile radius surrounding the project area on April 15 and 16, 2008. Habitats suitable for breeding, dispersal, and aestivation of the CRLF were determined to be present within the CRLF site assessment study area, as described in the CRLF site assessment report that was submitted to the USFWS on September 24, 2008 (FEMA 2008). As recommended by USFWS (M. Tovar, Biologist, U.S. Fish and Wildlife Service, oral and written communication, 2008), protocol-level field surveys for the CRLF were conducted in the vicinity of the project area by URS biologists in May through August 2008. A CRLF survey report describing the survey methodology and results was submitted to the USFWS on March 9, 2009 (FEMA 2009a). No CRLF were observed or heard in the project area or 1-mile radius surrounding the project area during the surveys. The site assessment and protocol-level field surveys were conducted in accordance with the *Revised Guidance on Site Assessments and Field Surveys for the California Red-Legged Frog*, issued by the USFWS on August 2005 (USFWS 2005a). FEMA has not received any comments from the USFWS on the CRLF survey results.

### **3.2.3 Federally Protected Plant Species Surveys**

URS biologists conducted botanical surveys in the project area on April 24 and 25, May 19 and 20, and June 11, 2008. During the botanical surveys, the biologists documented all identifiable plant species in the project area but focused on locating plant species listed under the Federal ESA or proposed to be listed under the Federal ESA (federally protected plant species). No federally protected plant species were observed within the project area during any of the surveys. A letter report, dated February 5, 2009, detailing the federally protected plant species surveys and results has been submitted to USFWS (FEMA 2009b). FEMA has not received any comments from the USFWS on the federally protected plant species survey results.

### **3.2.4 Elderberry Shrub Stem Count Surveys**

URS biologists conducted focused surveys for elderberry shrubs (*Sambucus* sp.) in the project area plus a 100-foot buffer surrounding the project area on June 10 and 11, July 3, and September 15 and 16, 2008. The surveys were conducted using the guidelines established in the *Conservation Guidelines for the Valley Elderberry Longhorn Beetle*, issued by the USFWS in July 1999 (USFWS 1999). A letter report, dated May 14, 2009, describing the elderberry shrub stem count surveys and results, has been submitted to the USFWS (FEMA 2009c). FEMA has not received any comments from the USFWS on the elderberry shrub stem count survey results.

### 3.3 SUMMARY OF AGENCY CONSULTATION TO DATE

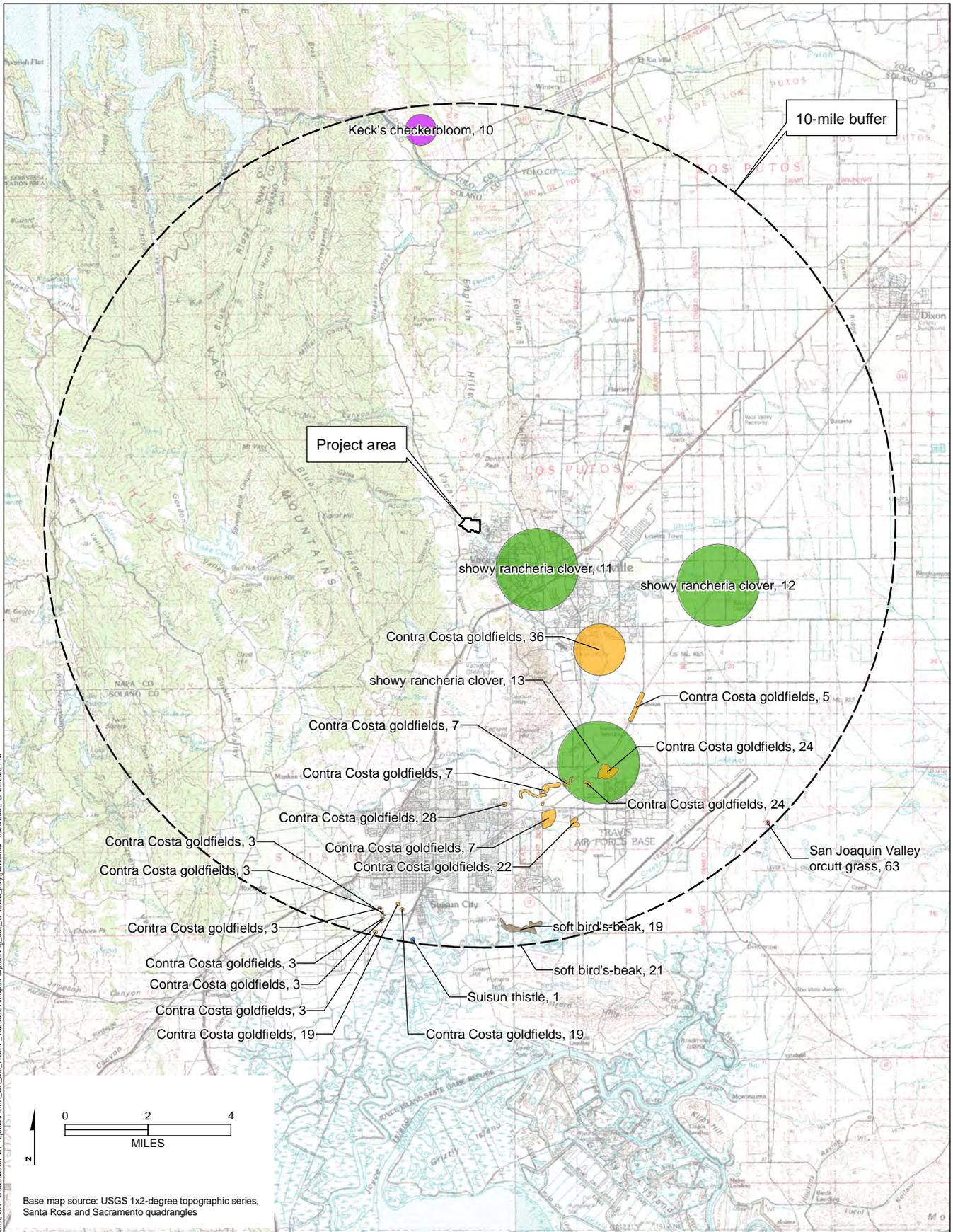
On behalf of FEMA, URS biologists Lorena Solórzano-Vincent and Melissa Newman have engaged in informal consultation with Michelle Tovar of the Sacramento Fish and Wildlife Office. A summary of the consultations with this agency is provided below.

- March and April 2008. Lorena Solórzano-Vincent discussed conducting the site assessment and protocol-level field surveys for the California red-legged frog (*Rana draytonii*, formerly *Rana aurora draytonii*) for the proposed project with Michelle Tovar.
- April 9 and 22, 2008. Lorena Solórzano-Vincent submitted request (verbally and by e-mail) to Michelle Tovar to initiate field surveys for California red-legged frog in the study area according to the USFWS (2005a) survey protocol.
- April 24, 2008. Lorena-Solórzano Vincent received an e-mail authorization to conduct protocol-level field surveys for California red-legged frog from Michelle Tovar of the Sacramento Fish and Wildlife Office.
- August 1, 2008. Lorena Solórzano-Vincent and Michelle Tovar discussed, by telephone, two archeological sites identified by URS archeologists within the project area and the need for a geoarchaeological testing and site evaluation program to be conducted prior to the start of construction activities for the ACDB, for FEMA to make conclusions regarding effects to historic properties. It was agreed that a letter requesting informal consultation would be prepared for the geoarchaeological investigations and submitted to the USFWS.
- September 17, 2008. Lorena Solórzano-Vincent and Melissa Newman spoke with Michelle Tovar regarding conservation measures that were included in the Pleasants Valley Encinosa Detention Basin Biological Opinion. Michelle Tovar provided a copy of the Biological Opinion for the Pleasants Valley Encinosa Detention Basin project by e-mail. Ms. Tovar discussed potential mitigation measures that could be included for the ACDB Project and confirmed FEMA was taking the appropriate steps for the ACDB Project in terms of surveys, BAs, and informal consultation for a geoarchaeological testing and site evaluation program.
- September 24, 2008. FEMA submitted the California Red-Legged Frog Site Assessment for the proposed project to the USFWS.
- October, November, and December 2008. Lorena Solórzano-Vincent and Melissa Newman attempted to contact Michelle Tovar requesting guidance on how to proceed on the unannounced geotechnical evaluations conducted by the City in October and November 2008.
- December 4, 2008. Lorena Solórzano-Vincent and Michelle Tovar discussed the appropriate steps to be taken regarding the geotechnical activities that were conducted for the proposed project. Ms. Tovar requested that FEMA include information on the geotechnical activities into the BA for the proposed project for review by the USFWS.

## **Alamo Creek Detention Basin: Biological Assessment for USFWS**

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- February 5, 2009. FEMA submitted the Federally Protected Plant Species Survey Letter Report for the proposed project to the USFWS.
- March 9, 2009. FEMA submitted the California Red-Legged Frog Survey Report for the proposed project to the USFWS.
- May 14, 2009. FEMA submitted the Elderberry Shrub Stem Count Survey Letter Report for the proposed project to the USFWS.



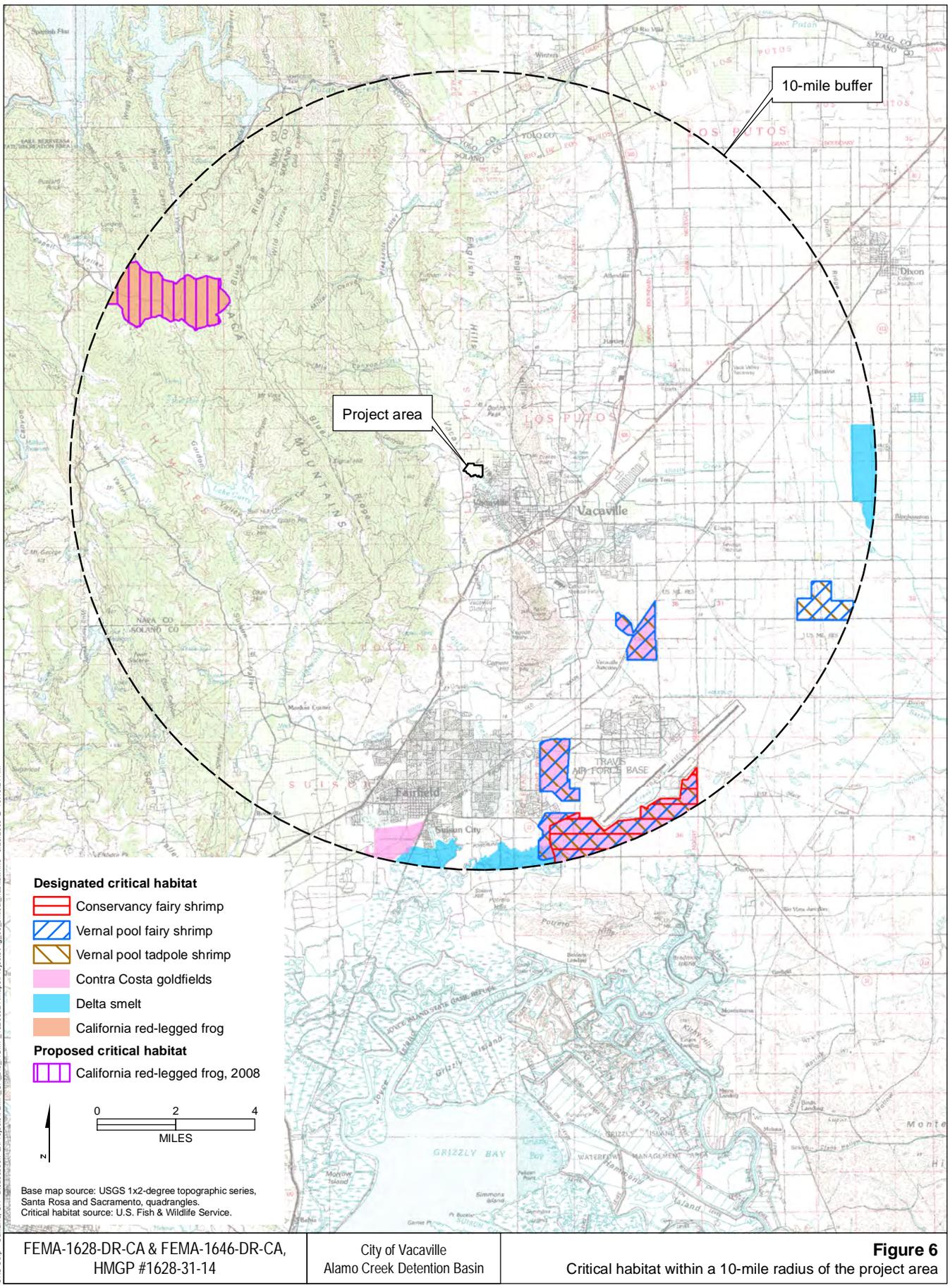
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 City of Vacaville, Alamo Creek Detention Basin  
 CNDB occurrences within a 10-mile radius of the project area: plants  
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**FEMA-1628-DR-CA & FEMA-1646-DR-CA, HMGP #1628-31-14** | 
 City of Vacaville, Alamo Creek Detention Basin | 
 CNDB occurrences within a 10-mile radius of the project area: plants | 
**Figure 5a**









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HMGP #1628-31-14

City of Vacaville  
Alamo Creek Detention Basin

**Figure 6**  
Critical habitat within a 10-mile radius of the project area



### SECTION FOUR ENVIRONMENTAL SETTING AND BIOTIC RESOURCES

This section describes the environmental setting in which the proposed project would occur and includes a regional description and a description of the waterways, vegetative communities, and general wildlife in the project area.

#### 4.1 CLIMATE AND TOPOGRAPHY

The project area is located in Vaca Valley which is bounded by Vaca Mountain to the west and the English Hills to the east. The English Hills represent the transition from the inner North Coast range habitats into the Sacramento Valley habitats. The Sacramento Valley to the east and north has hot, dry summers, and cool winters; the area to the south and west, nearer to the Northern Coast ranges has cool humid summers, and moderate winters (Miles and Goudey 1998). Due to its location between the transition of these ranges, the project area is subject to hot, dry summers, and mild winters, although it still experiences marine influences blowing up from the Carquinez Strait which can modify summer and winter temperatures. The average maximum temperature in Vacaville is 75.5°F, with an average range of 55.3°F in January and 95.1°F in July and average minimum temperature in Vacaville is 46.1°F, with an average range of 36.7°F in January and 56.1°F in July (Western Regional Climate Center 2009 [115 years between 1893 and 2008]). The average annual rainfall in Vacaville is 24.6 inches, mostly falling from November to April.

The topography within the project area consists of broader alluvial plains. This topography is typical of the Sacramento and San Joaquin Valleys. Elevations in the project area range between 220 and 258 ft above mean sea level.

#### 4.2 HABITATS IN THE PROJECT AREA

Five habitats were observed in the project area. The habitat types are shown on Figure 7 and described below. Photographs of the project area are provided in Appendix B.

- Alamo Creek, which parallels the southern boundary of the project area
- Riparian woodland corridor, dominated by valley oak (*Quercus lobata*) and red willow (*Salix laevigata*), surrounding Alamo Creek along the southern side of the project area
- Abandoned fruit (*Prunus* sp.) orchard with non-native annual grasses north of the riparian area covering the majority of the project area
- Active agricultural field planted in wild oats (*Avena fatua*) in the northwestern corner of the project area
- Developed areas—a homestead at the northeastern edge of the project area, a junk pile, a cleared area, and several farm roads that bisect the project area—dominated by ruderal vegetation and ornamental landscaping

### 4.2.1 Alamo Creek

Alamo Creek is an intermittent drainage that flows west to east through the southern portion of the project area. The creek flows from the Vaca Mountains, approximately 1.5 miles (straight-line distance) northwest of the project area, into Ulatis Creek, approximately 11 miles (straight-line distance) southeast of the project area. Ulatis Creek drains into Cache Slough of the Sacramento-San Joaquin Delta.

Within the project area, Alamo Creek varies in width, depth, composition, and flow rate, and exhibits sinuosity. The creek itself is a slow to medium moving stream with a sandy (mostly)/gravelly bottom. The wetted width of the stream varies from 2 to 15 feet and the stream depth varies from 2 to 6 feet. Intermittent pools and scattered logs and woody debris are located along the stream length. Emergent and overhanging vegetation were present within the stream and along the creek bank. Vegetation along the creek bank is characterized by riparian woodland (described below) dominated by valley oak and red willow. The majority of the creek bank is incised to deeply incised.

### 4.2.2 Riparian Woodland

The riparian corridor extends approximately 35 to 50 feet on either side of Alamo Creek (approximately 5 acres of the project area) (Figure 7). The canopy is dense and dominated by valley oaks. Other prominent species in the canopy include California walnut (*Juglans californica*), red willow, interior live oak (*Quercus wislizenii*), and big leaf maple (*Acer macrophyllum*). The understory is dominated by Himalayan blackberry (*Rubus discolor*), poison oak (*Toxicodendron diversilobum*), arroyo willow (*Salix lasiolepis*), and blue elderberry (*Sambucus mexicana*). The fringes of the riparian area, where more light penetrates, have a diversity of species including Indian hemp (*Apocynum cannabinum*), smilo grass (*Piptamtherum millaceum*), and mugwort (*Artemesia douglasiana*).

### 4.2.3 Orchard

The majority of the project area is characterized as an abandoned orchard (approximately 45 acres of the project area) (Figure 7). The orchard consists of plum trees (*Prunus cerasifera* and *Prunus domestica*) with several scattered apricot trees (*Prunus armeniaca*). The northern border is lined with grafted walnut trees (*Juglans regia* on *J. californica* stock). The understory is highly disturbed and dominated by non-native herbs and grasses including wild oat, Mediterranean barley (*Hordeum marnium*), Italian ryegrass (*Lolium multiflorum*), ripgut broom (*Bromus diandrus*), burclover (*Medicago polymorpha*), prickly lettuce (*Lactuca serriola*), and bristly ox-tongue (*Picris echiodes*). The northern orchard (north of the access road dividing the site) is densely covered with field mustard (*Brassica rapa*), in addition to the weedy grasses and herbs listed above.

### 4.2.4 Wild Oat Agriculture Field

The northwest corner of the property consists of an actively used agricultural field (approximately 23 acres of the project area) (Figure 7). The field has been disked and planted with wild oat. Bindweed (*Convolvulus arvensis*) was beneath the wild oat along with scattered black mustard (*Brassica nigra*) and wild radish (*Raphanus sativus*).

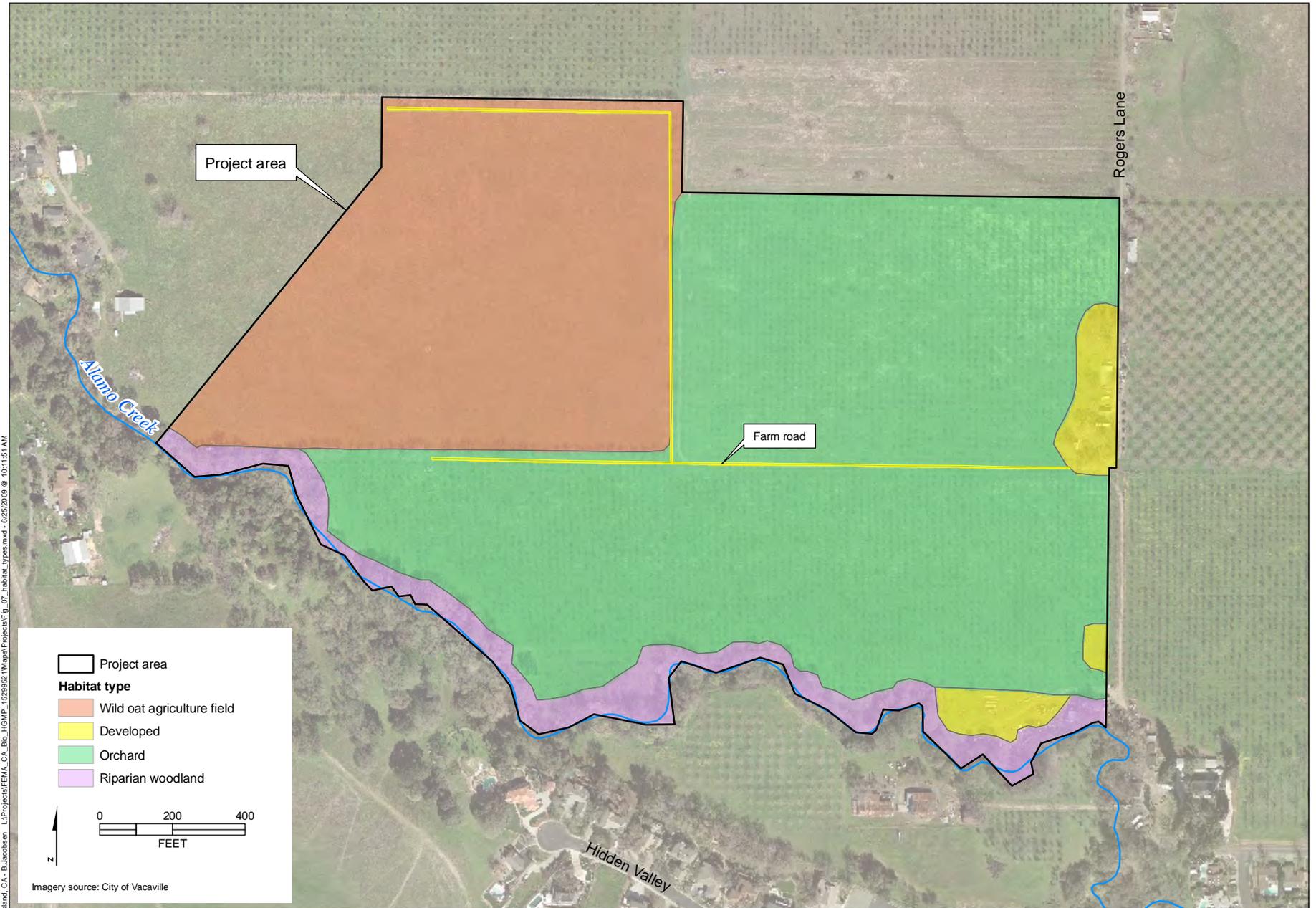
### 4.2.5 Developed

Approximately 3 acres of the project area are developed habitat (Figure 7). A homestead at the northeastern part of the project area contains houses, trailers, and cars and covers approximately 1 acre of the project area. Adjacent to the homestead is ornamental landscaping, including lawns and fruit trees. The farm roads bisecting the project area, a junk pile, and a cleared area contain bare ground and weedy, non-native grasses (wild oat, Mediterranean barley, Italian ryegrass, and ripgut broom).

## 4.3 WILDLIFE OBSERVED IN THE PROJECT AREA

During surveys, black-tailed deer (*Odocoileus hemionus*), jackrabbits (*Lepus californicus*), red-winged blackbirds (*Agelaius phoeniceus*), turkey vultures (*Cathartes aura*), and pheasants (*Phasianus colchicus*) were observed multiple times in the orchard and/or the wild oat agriculture field habitats. Pacific tree frogs (*Pseudacris regilla*), bullfrogs (*Lithobates catesbeiana*, formerly *Rana catesbeiana*), Louisiana red crayfish (*Procambarus clarkii*), a mallard duck (*Anas platyrhynchos*), skunk (*Mephitis mephitis*), three-spine stickleback (*Gasterosteus aculeatus*), mosquitofish (*Gambusia affinis*), California roach (*Hesperoleucus symmetricus*), and beaver dams were observed in the creek or bank of Alamo Creek. Red-tailed hawks (*Buteo jamaicensis*) and a barn owl (*Tyto alba*) were also seen in the riparian habitat area.





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City of Vacaville  
Alamo Creek Detention Basin

**Figure 7**  
Habitat types in the project area



### SECTION FIVE      FEDERALLY LISTED SPECIES WITH SUITABLE HABITATS IN THE PROJECT AREA

As a result of the field and background review, FEMA determined that the project area may provide habitats suitable to support two federally listed wildlife species and three plant species regulated by USFWS under the Federal ESA:

- California red-legged frog (Threatened)
- Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (Threatened)
- Tiburon paintbrush (*Castilleja affinis* ssp. *neglecta*) (Endangered)
- Contra Costa goldfields (*Lasthenia conjugens*) (Endangered)
- Showy Indian clover (*Trifolium amoenum*) (Endangered)

The remaining species were determined to have no potential to occur or are not likely to occur in the project area, and thereby would not be affected by the proposed project. This determination was based on the absence of suitable habitat in the project area and/or the fact that the project area is outside the documented species range. Additionally, the project area is outside designated or proposed critical habitat for these remaining species. Since the proposed project would have no effect on these species and/or their critical habitat, these species are not discussed further in this document.

#### 5.1 CALIFORNIA RED-LEGGED FROG

##### 5.1.1 Life History

The California red-legged frog (CRLF) was listed as a threatened species under the Federal ESA on May 23, 1996 (USFWS 1996). The species is distributed throughout at least 28 counties in California but occurs primarily between Santa Barbara and just north of San Francisco (Jennings and Hayes 1994; USFWS 2002; Schaffer et al. 2004). The largest areas of currently occupied habitat are in Monterey, San Luis Obispo, and Santa Barbara counties (USFWS 2004). The CRLF uses a variety of aquatic, riparian, and upland habitats up to an elevation of 4,921 feet (Jennings and Hayes 1994; Bulger et al. 2003; Stebbins 2003).

The CRLF typically inhabits permanent and semipermanent water sources such as streams, lakes, marshes, natural and artificial ponds, and ephemeral drainages in valley bottoms and foothills. CRLFs typically breed between November and April in standing or slow-moving water that is at generally over 2 feet deep (Hayes and Jennings 1988), although CRLF tadpoles have been observed in shallower (10- to 20-inch) sections of streams not overrun by riparian vegetation (Reis 1999). Streams suitable for CRLF breeding typically contain shrubby riparian or emergent vegetation, such as cattails (*Typha* sp.), tules (*Scirpus* sp.), and overhanging willows (*Salix* spp.) (Hayes and Jennings 1988). Egg masses containing 2,000 to 5,000 eggs are attached to

vegetation below the surface of the water and hatch in 6 to 14 days (Storer 1925; Jennings and Hayes 1994). The fully aquatic CRLF larvae require approximately 11 to 20 weeks for development through metamorphosis, and metamorphosed frogs require appropriate upland refugia for aestivation during dry periods. Refuge for the CRLF includes small mammal burrows, downed logs or vegetation, and dense vegetation/litter layer (USFWS 2002).

Non-migrating CRLFs typically stay within 200 feet of aquatic habitat 90 percent of the time and have been found to be closely associated with dense cover (e.g., California blackberry [*Rubus ursinus*], poison oak, and coyote bush [*Bacharis pillularis*]) (Bulger et al. 2003). Adult frogs are mainly active at night and may be active year-round in areas with permanent water. Juvenile frogs are active diurnally and nocturnally. Feeding occurs along the shoreline and the surface of the water (USFWS 2002). Migrating CRLFs are known to disperse to streams up to 2 miles from their breeding sites. These migrations are typically made during wet-weather periods and at night (USFWS 2002).

Continuing loss of fresh water habitat and the introduction of non-native predatory fish species and bullfrogs (*Lithobates catesbeianus*, formerly *Rana catesbeiana*) are attributed to the continuing population decline of the CRLF (USFWS 2002).

### 5.1.2 Critical Habitat

On July 20, 2007, the USFWS announced its decision to review eight decisions made under the Endangered Species Act “after questions were raised about the integrity of the scientific information used and whether the decisions were consistent with appropriate legal standards” (USFWS 2007a). On November 23, 2007, USFWS announced that it would take action to revise seven of the decisions, including the 2006 final critical habitat designation for the CRLF, which consisted of a subset of the proposed critical habitat units under consideration and that “may have affected the extent of the critical habitat designation” for this species (USFWS 2007a, 2007b, 2007c).

On September 16, 2008, USFWS issued a revised proposal for designating critical habitat boundaries for the CRLF (USFWS 2008a). The area that USFWS proposed as designated critical habitat for the CRLF is three times larger than the 2006 designation for the species. The final critical habitat rule is due to the *Federal Register* by August 29, 2009.

The project area lies outside of all currently designated critical habitat for the CRLF (USFWS 2006a) and all proposed revised designated critical habitat for the CRLF (USFWS 2008a). The closest critical habitat unit, NAP-1 (USFWS 2006a, 2008a), is approximately 7.5 miles northwest of the project area. The project area does not overlap any previously proposed critical habitat units (USFWS 2005b) and is not within a CRLF Recovery Plan Core Area (USFWS 2002).

### 5.1.3 Previously Documented Occurrences

Solano County is considered to be within the CRLF's current range (USFWS 2002). A CNDDDB records search of the nine USGS 7.5-minute quadrangles surrounding and including the project area (Fairfield North [project area], Denverton, Fairfield South, Cordelia, Allendale, Elmira, Mt. Vaca, Capell Valley, and Mt. George) returned 17 previously documented occurrences of the CRLF (CDFG 2009). The search returned no occurrences of CRLF within 1 mile of the project area and only one record of the CRLF from within a 10-mile radius of the project area. This occurrence is from the Vaca Mountains, approximately 8.5 miles northwest of the project area, where in April 1983, one CRLF adult was observed in Wragg Creek, on the northern side of Highway 128. Habitat at that site consisted of a mix of oak woodland and non-native grassland (CDFG 2009).

### 5.1.4 Suitable Habitats in the Project Area and Vicinity

Habitats suitable for breeding, dispersal, and aestivation of the CRLF are present throughout most of the project area. Alamo Creek has the pooling and emergent and overhanging vegetation required for CRLF breeding and larval development. The dense riparian vegetation along the banks of the channel within riparian woodland habitat provides suitable habitat for the CRLF to aestivate and disperse. The orchard provides suitable dispersal habitat for the CRLF. The agricultural field and developed habitats provide less suitable dispersal habitat for the CRLF.

Habitats suitable to support the CRLF breeding cycle are also present in the 1-mile radius buffer surrounding the project area. Aquatic habitats in the 1-mile radius buffer surrounding the project area include Alamo Creek, Ulatis Creek, Encinosa Creek, and tributaries of all three creeks. These streams support great valley mixed/valley oak riparian forest, where development has not replaced the natural vegetation. The 1-mile radius area also contains four ponds and Goepfert Reservoir. Upland habitats include non-native grasslands, oak woodlands, and developed areas (e.g., residential, agricultural). Please refer to the CRLF Site Assessment Report for a detailed analysis of the suitability of the habitats in the project area and the 1-mile radius buffer surrounding the project area for the California red-legged frog (FEMA 2008).

### 5.1.5 Survey Results

No CRLFs were observed in the project area or the 1-mile radius surrounding the project area during the site assessment (April 2008) and protocol-level field surveys (May through August 2008) conducted for the proposed project in 2008. These surveys were conducted in accordance with the *Revised Guidance on Site Assessments and Field Surveys for the California Red-Legged Frog*, issued by the USFWS on August 2005 (USFWS 2005a). These surveys are briefly discussed in Section 3.2.2 of this BA. For a detailed discussion of the methodology and findings of these surveys please refer to the CRLF Site Assessment Report (FEMA 2008) and the CRLF Field Survey Report (FEMA 2009a) prepared for the proposed project.

### **5.2 VALLEY ELDERBERRY LONGHORN BEETLE**

#### **5.2.1 Life History**

The VELB was listed as a threatened species under the Federal ESA on August 8, 1980. However, on October 2, 2006, the USFWS released a *5 Year Review: Summary and Evaluation Report* which recommended delisting the VELB from the ESA. This recommendation was based on USFWS data collected that indicates the species has recovered to a point where listing is no longer warranted (USFWS 2006b).

VELBs have only been found in association with their host plants, elderberry shrubs. Elderberry shrubs are often found within or close to riparian habitats along Central Valley rivers and their tributaries. Due to the widespread reduction of riparian habitat throughout the State, supporting habitat for this species has been drastically reduced from historical levels (Biosystems Analysis, Inc. 1994).

The VELB depends on the elderberry shrub, throughout its entire life cycle. Beetles remain hidden within the stems and trunks of elderberry shrubs as larvae and pupae for 1 to 2 years. VELBs spend most of the life in the larvae stage within the elderberry shrub. Adults emerge from the shrubs between mid-March through June, about the same time the elderberry shrub produces flowers (Barr 1991; USFWS 1984; USFWS 2006b).

Elderberry shrubs often occur in clumps that consist of several stems attached to a main trunk. Stems and trunks must be equal to or greater than 1 inch in diameter to provide suitable habitat for beetles. Generally, the VELB occurs in low densities and is difficult to observe. Therefore, USFWS requires mitigation for impacts to any elderberry shrubs located within the range of the beetle (USFWS 1999).

#### **5.2.2 Critical Habitat**

Critical habitat for the valley elderberry longhorn beetle was designated in 1980 (USFWS 1980). The USFWS designated two critical habitat areas along the American River in the Sacramento area. The project area does not overlap designated critical habitat for the VELB. The nearest critical habitat units are in Sacramento County more than 30 miles from the project area (USFWS 1980). According to the Recovery Plan for the species (USFWS 1984), an area along Putah Creek in Solano County and an area west of the Nimbus Dam along the American River Parkway in Sacramento County are considered essential habitat for the VELB.

#### **5.2.3 Previously Documented Occurrences**

Eight previously documented occurrences of the VELB occur within 10 miles of the project area (CDFG 2009). The closest previously documented occurrence of this species is located approximately 6 miles south of the project area, and was last seen in 2002. At this location, one

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## Federally Listed Species with Suitable Habitats in the Project Area

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elderberry shrub with a basal diameter between 14 to 16 inches and VELB emergence exit holes was observed on the southern bank of a creek bed.

### 5.2.4 Suitable Habitats in the Project Area and Vicinity and Survey Results

The elderberry shrub, the host plant for the VELB, was identified in the project area and in the 100-foot buffer surrounding the project area during protocol-level surveys in 2008 conducted for the proposed project. The 100-foot buffer is based on guidance in the “*Conservation Guidelines for the Valley Elderberry Longhorn Beetle*” (USFWS 1999). These surveys are briefly discussed in Section 3.2 of this BA.

During the 2008 surveys, URS biologists identified 91 blue elderberry shrubs with stems of at least 1 inch in diameter at ground level (with a total of 141 stems) in the project area and the 100-foot buffer surrounding the project area (Figure 8, index sheet and sheets 1 through 4 and Figure 9, index sheet and sheets 1 through 4). Of the 91 shrubs, 63 shrubs were in the project area, and 28 shrubs were in the 100-foot buffer.

The majority of elderberry shrubs (83 shrubs) were in the riparian habitat associated with Alamo Creek. Of these 83 shrubs in the riparian habitat, 55 shrubs were within the project area, and 28 shrubs were within the buffer.

Eight elderberry shrubs (see Figure 9, Sheet 2, stems N64 to N74) did not occur within the riparian habitat; they were located approximately 225 feet north of the riparian corridor mapped within the project area.

Of the 63 elderberry shrubs with stems of at least 1 inch in diameter at ground level in the project area, 34 shrubs had exit holes anywhere on the shrub, 56 shrubs did not have exit holes, and 4 shrubs had exit holes that could not be fully assessed for the presence of exit holes because they were mixed in or covered by other vegetation.

For more detailed information regarding the survey methodology and findings please refer to the Elderberry Shrub Stem Count Survey Report prepared for the proposed project (FEMA 2009c).

## 5.3 TIBURON PAINTBRUSH

### 5.3.1 Life History

Tiburon paintbrush is listed as endangered under the Federal ESA. This species is a semi-woody perennial hemiparasitic herb of the snapdragon family (Scrophulariaceae) with branched stems that grow 1 to 2 feet tall. It has conspicuous floral bracts which are yellowish and sometimes red-tipped. The unbranched hairs and the lack of glands below the inflorescence (entire cluster of flowers and associated structures) distinguish this species from other *Castilleja* species. (USFWS 1998).

Tiburon paintbrush flowers from April to June at elevations from 60 to 400 meters. This species is found in serpentinite valley and foothill grassland (CNPS 2008).

### **5.3.2 Critical Habitat**

No critical habitat has been designated for this species.

### **5.3.3 Previously Documented Occurrences**

Only one documented occurrence of this species was identified in the CNDDDB search of the nine USGS 7.5-minute quadrangles surrounding and including the project area (CDFG 2009). This occurrence is approximately 18 miles southwest of the project area (CDFG 2009, occurrence number 5).

### **5.3.4 Suitable Habitats in the Project Area and Vicinity**

Tiburon paintbrush has the potential to occur in valley and foothill grassland habitat in the project area.

### **5.3.5 Survey Results**

Tiburon paintbrush was not observed in the project area during botanical surveys conducted on April 24–25, May 19–20, and June 11, 2008 (FEMA 2009b).

## **5.4 CONTRA COSTA GOLDFIELD**

### **5.4.1 Life History**

Contra Costa goldfields are listed as endangered under the Federal ESA. This species is a showy spring annual herb in the aster family (Asteraceae) that grows 4 to 12 inches tall and is usually branched. The flowers are bright yellow with phyllaries that are one-quarter to one-half fused. Identifying characteristics include the partially fused phyllaries and the lack of a pappus, which distinguishes this species from the similar Fremont's goldfields and Burke's goldfields (USFWS 2005c).

Contra Costa goldfields flower from March to June at elevations up to 470 meters. This species is found in cismontane woodland, alkaline playas, valley and foothill grassland, and mesic vernal pools (CNPS 2008).

### **5.4.2 Critical Habitat**

The project area does not overlap designated critical habitat for Contra Costa goldfields. The nearest designated critical habitat unit (4-A) is 5 miles southeast of the project area (USFWS 2006c).

### **5.4.3 Previously Documented Occurrences**

A total of 13 documented occurrences of Contra Costa goldfields were identified within the CNDDDB search of the nine USGS 7.5-minute quadrangles surrounding and including the project area (CDFG 2009). The closest documented occurrence of this species is approximately 4.39 miles southeast of the project area (CDFG 2009, occurrence number 36). All of the populations located in Solano County are clustered near the City of Fairfield or at Travis Air Force Base (USFWS 1997; CDFG 2009).

### **5.4.4 Suitable Habitats in the Project Area and Vicinity**

Typical habitat for Contra Costa goldfields consists of vernal pools, swales, moist flats, and depressions in open, grassy areas of woodland and valley grassland communities. (CDFG 2009; USFWS 2005c). While no vernal pools are located within the project area, woodland and valley and foothill grassland habitats occur throughout the project area, and is potential suitable habitat for this species (CNPS 2008).

### **5.4.5 Survey Results**

Contra Costa Goldfields were not observed in the project area during botanical surveys conducted on April 24–25, May 19–20, and June 11, 2008 (FEMA 2009b).

## **5.5 SHOWY INDIAN CLOVER**

### **5.5.1 Life History**

Showy Indian clover is listed as endangered under the Federal ESA. It is an annual herb in the pea family (Fabaceae) that grows from 10 to 69 centimeters. This species has flowers which are purple with white tips that grow in dense round or ovoid heads that are approximately 2.5 centimeters in diameter. The flowers are not subtended by the circular toothed bract present in many other clovers (USFWS 2008b).

Showy Indian clover flowers from April to June at elevations from 5 to 415 meters. This species is found in valley and foothill grasslands and coastal bluff scrub (CNPS 2008). Sometimes this species is observed in serpentine soils and can be found in open sunny sites and in swales. It has also been observed along the roadside and on eroding cliff faces (CDFG 2009).

### **5.5.2 Critical Habitat**

No critical habitat has been designated for this species.

### **5.5.3 Previously Documented Occurrences**

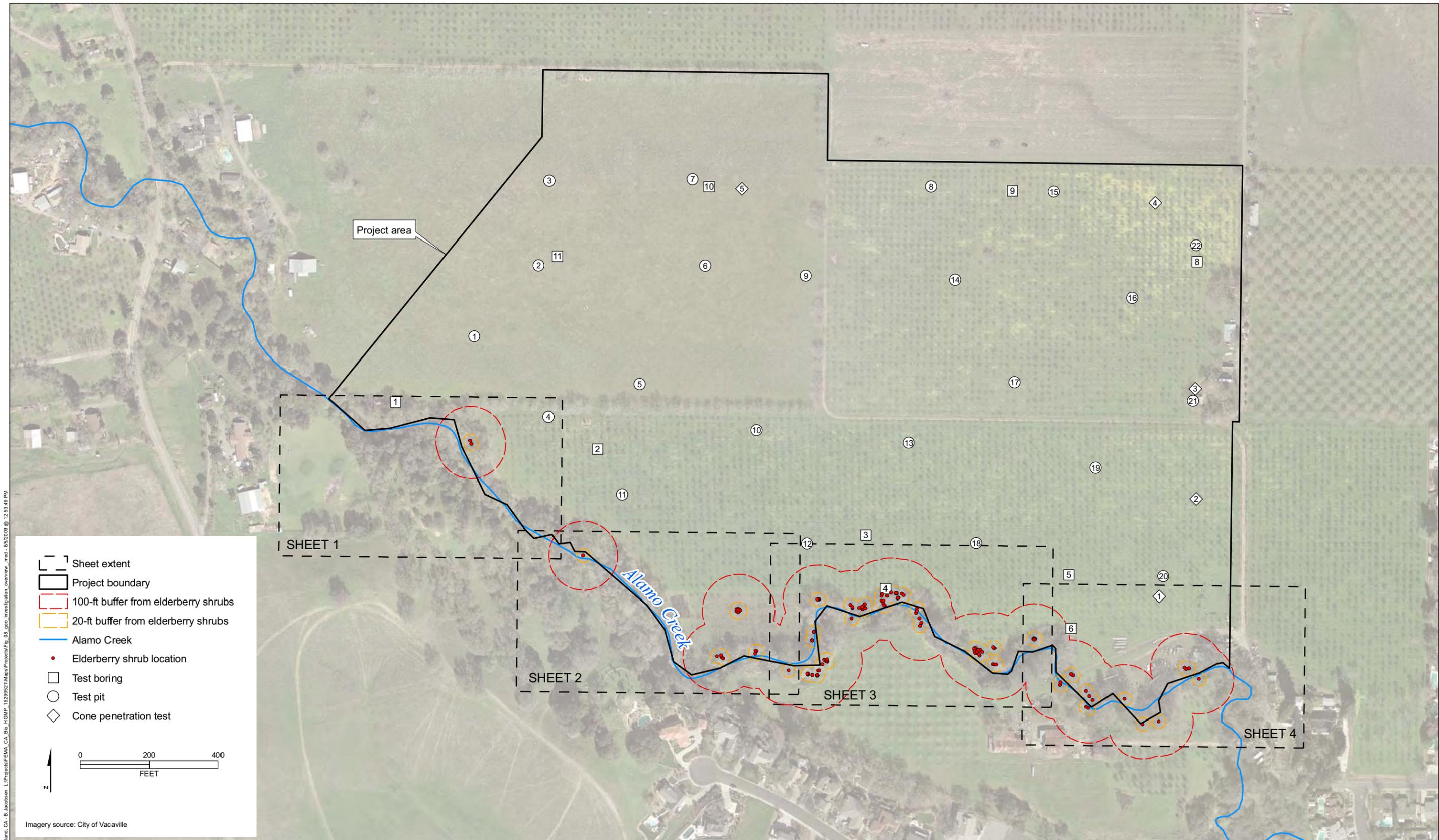
A total of four documented occurrences of showy Indian clover were identified within the CNDDDB search of the nine USGS 7.5-minute quadrangles surrounding and including the project area (CDFG 2009). The closest documented occurrence of this species is approximately 1.99 miles southeast of the project area (CDFG 2009, occurrence number 11).

### **5.5.4 Suitable Habitats in the Project Area and Vicinity**

Showy Indian clover has the potential to occur in valley and foothill grassland habitat in the project area.

### **5.5.5 Survey Results**

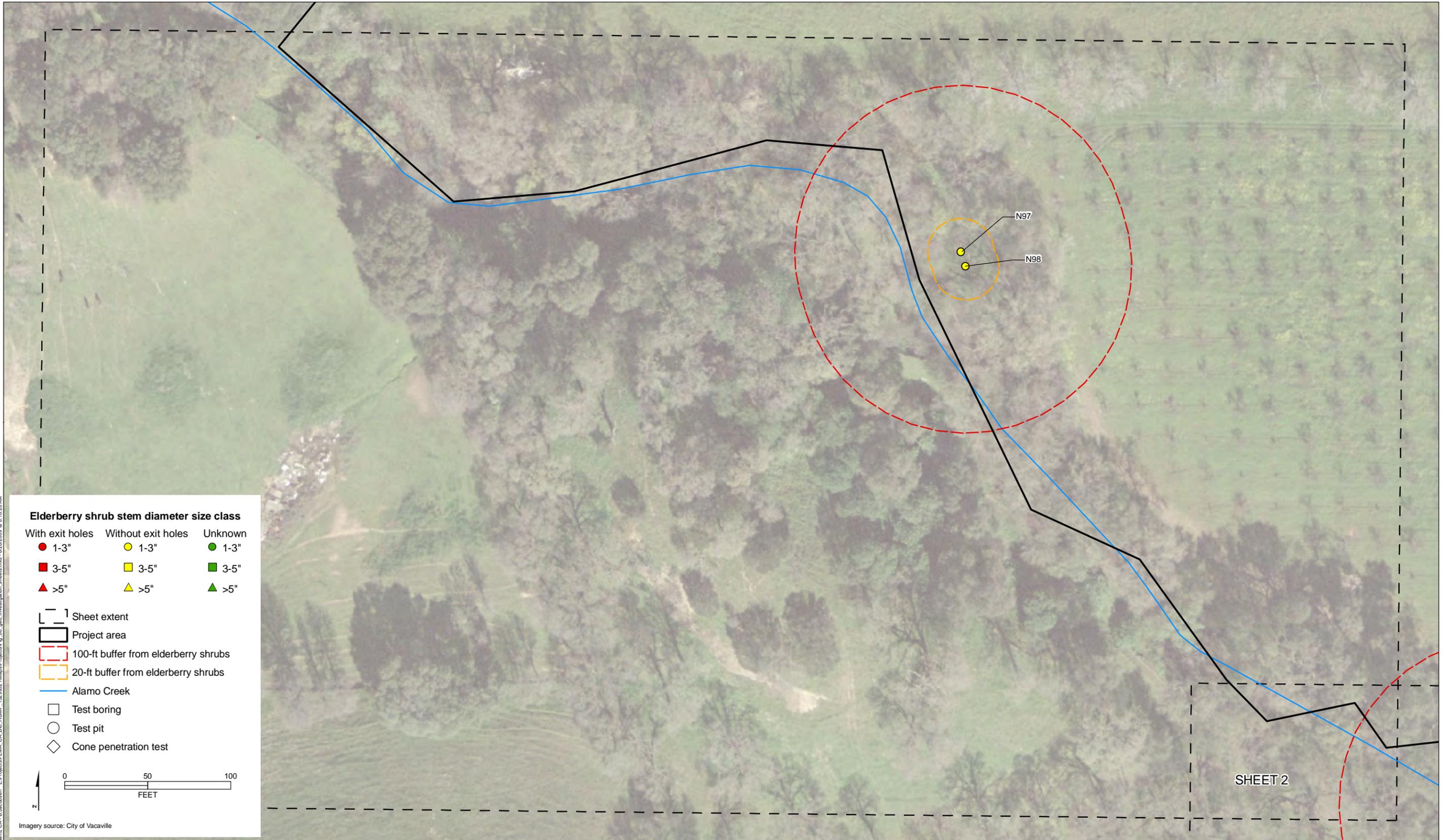
Showy Indian clover was not observed in the project area during botanical surveys conducted on April 24–25, May 19–20, and June 11, 2008 (FEMA 2009b).



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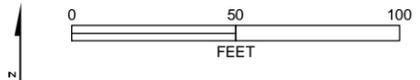
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**Elderberry shrub stem diameter size class**

With exit holes	Without exit holes	Unknown
● 1-3"	● 1-3"	● 1-3"
■ 3-5"	■ 3-5"	■ 3-5"
▲ >5"	▲ >5"	▲ >5"

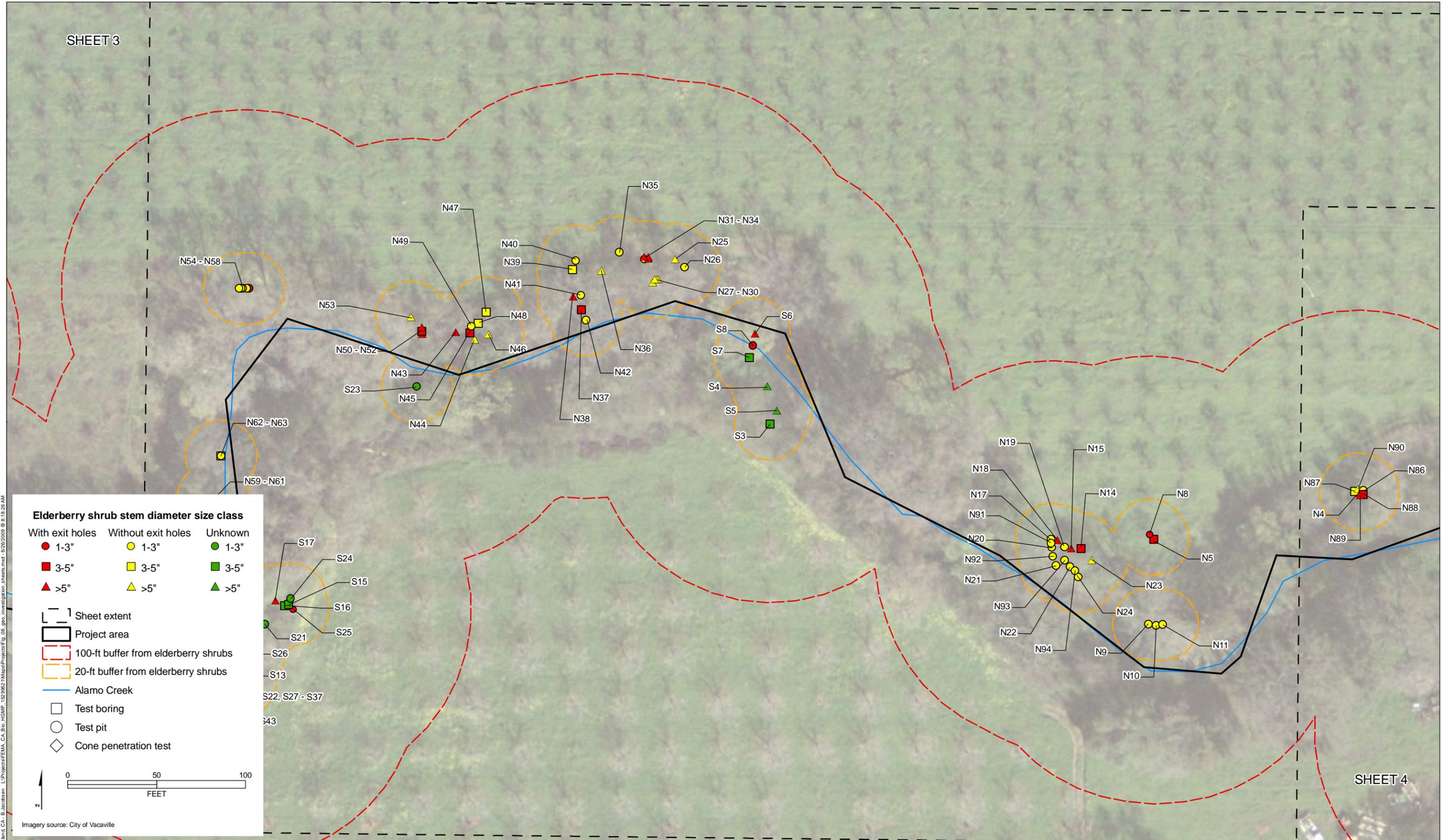
- [-] Sheet extent
- [ ] Project area
- [ ] 100-ft buffer from elderberry shrubs
- [ ] 20-ft buffer from elderberry shrubs
- [ ] Alamo Creek
- [ ] Test boring
- [ ] Test pit
- [ ] Cone penetration test



Imagery source: City of Vacaville



SHEET 3

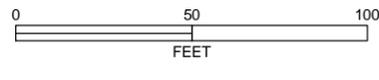


**Elderberry shrub stem diameter size class**

With exit holes	Without exit holes	Unknown
● 1-3"	○ 1-3"	● 1-3"
■ 3-5"	□ 3-5"	■ 3-5"
▲ >5"	△ >5"	▲ >5"

[---]	Sheet extent
[---]	Project area
[---]	100-ft buffer from elderberry shrubs
[---]	20-ft buffer from elderberry shrubs
[---]	Alamo Creek
[□]	Test boring
[○]	Test pit
[◇]	Cone penetration test



Imagery source: City of Vacaville

FEMA-1628-DR-CA & FEMA-1646-DR-CA,  
HMGP #1628-31-14

City of Vacaville  
Alamo Creek Detention Basin

SHEET 4

**Figure 8 - Sheet 2**  
Elderberry shrubs near the fall 2008 geotechnical investigations

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SHEET 2

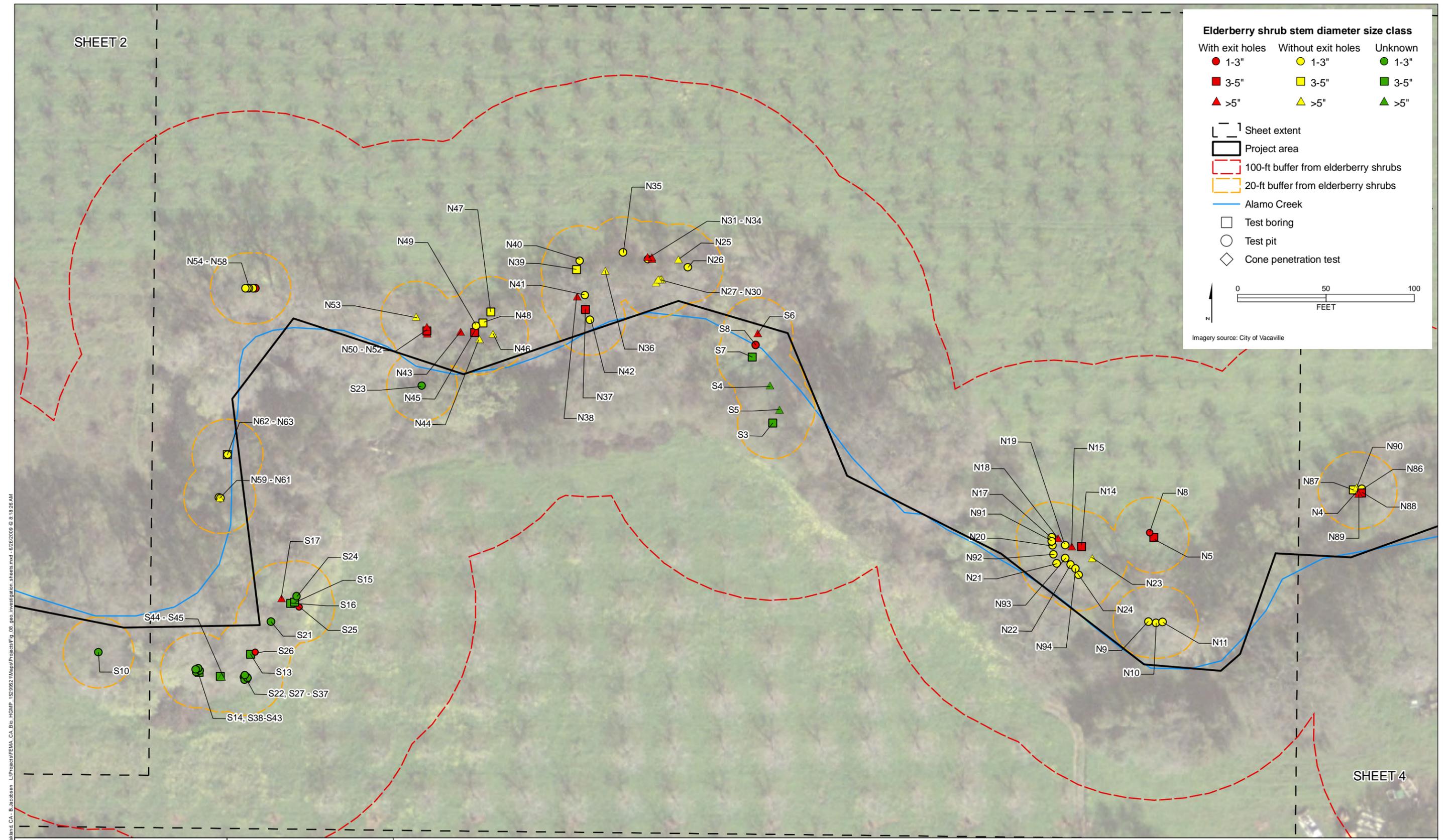
**Elderberry shrub stem diameter size class**

With exit holes	Without exit holes	Unknown
● 1-3"	● 1-3"	● 1-3"
■ 3-5"	■ 3-5"	■ 3-5"
▲ >5"	▲ >5"	▲ >5"

[---] Sheet extent  
 [---] Project area  
 [---] 100-ft buffer from elderberry shrubs  
 [---] 20-ft buffer from elderberry shrubs  
 [---] Alamo Creek  
 □ Test boring  
 ○ Test pit  
 ◇ Cone penetration test

0 50 100  
FEET

Imagery source: City of Vacaville

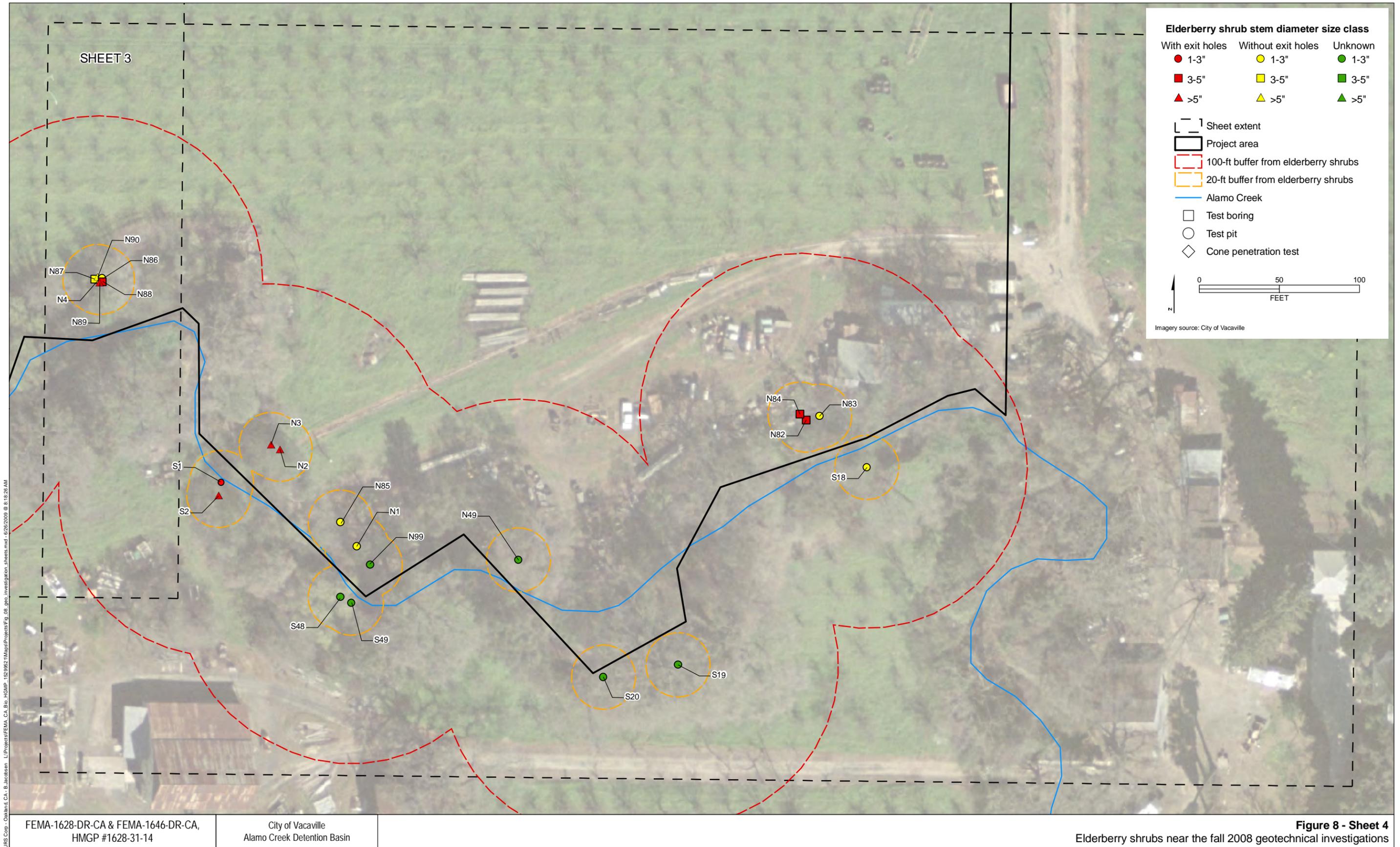


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SHEET 4

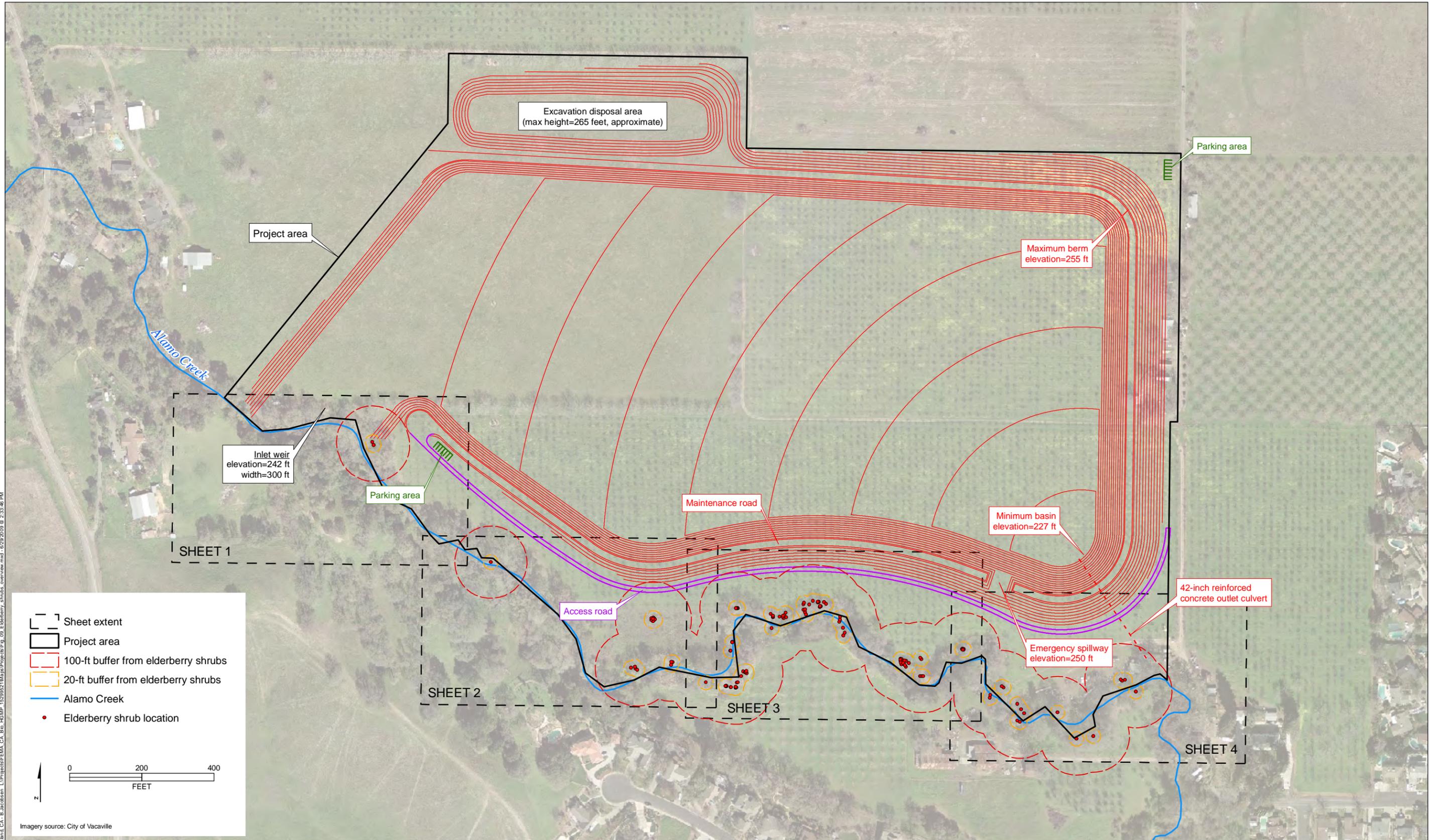
**Figure 8 - Sheet 3**  
Elderberry shrubs near the fall 2008 geotechnical investigations





URS Corp., Oakland, CA; B. Jacobsen L:\Projects\FEMA\_CA\_Bio\_HCMP\_1523992\Maps\Projects\Fig\_08\_geo\_investigation\_2insets.mxd - 6/26/2009 @ 8:18:26 AM

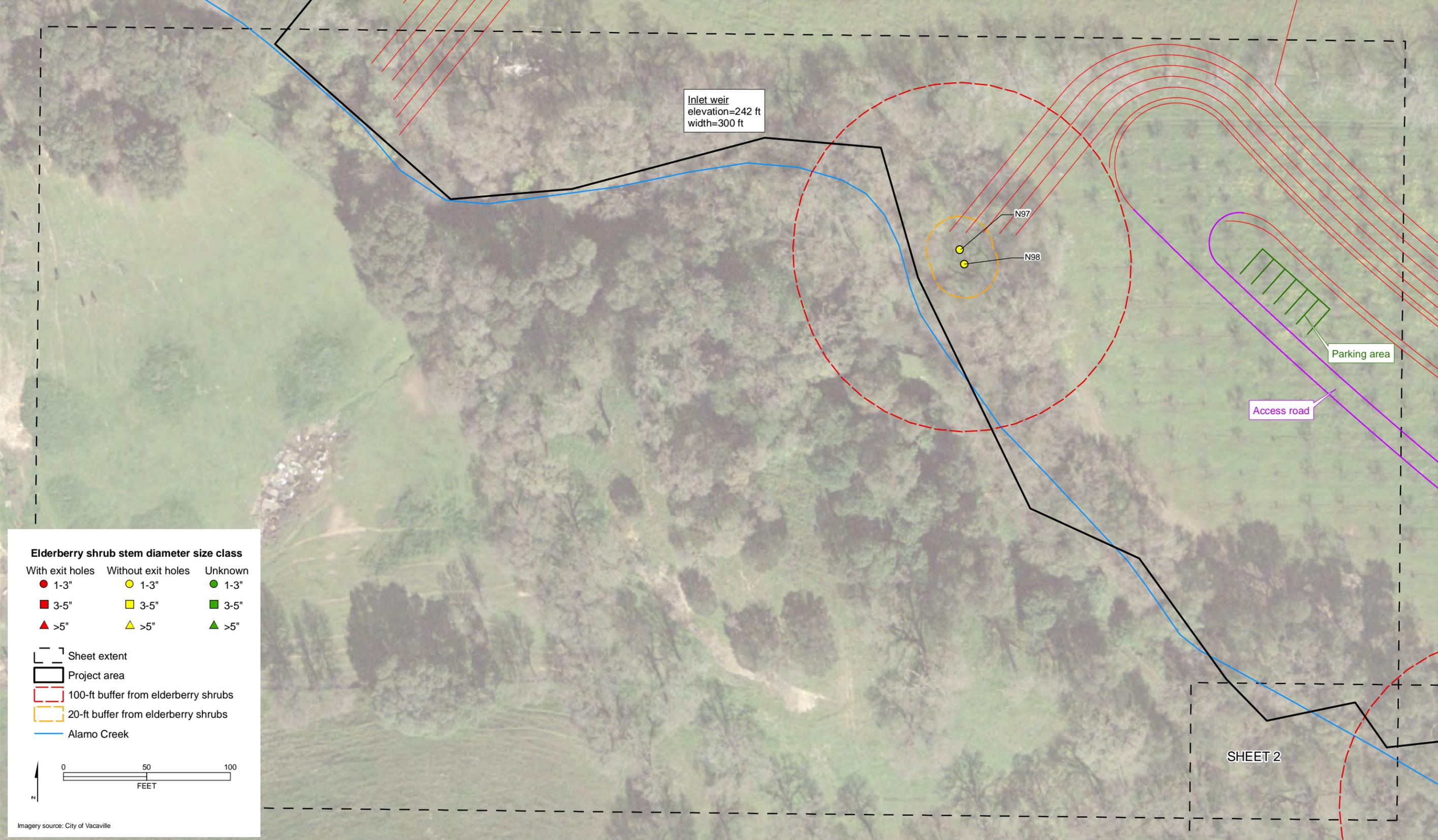




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**Elderberry shrub stem diameter size class**

With exit holes	Without exit holes	Unknown
● 1-3"	● 1-3"	● 1-3"
■ 3-5"	■ 3-5"	■ 3-5"
▲ >5"	▲ >5"	▲ >5"

[---] Sheet extent  
 [---] Project area  
 [---] 100-ft buffer from elderberry shrubs  
 [---] 20-ft buffer from elderberry shrubs  
 [---] Alamo Creek

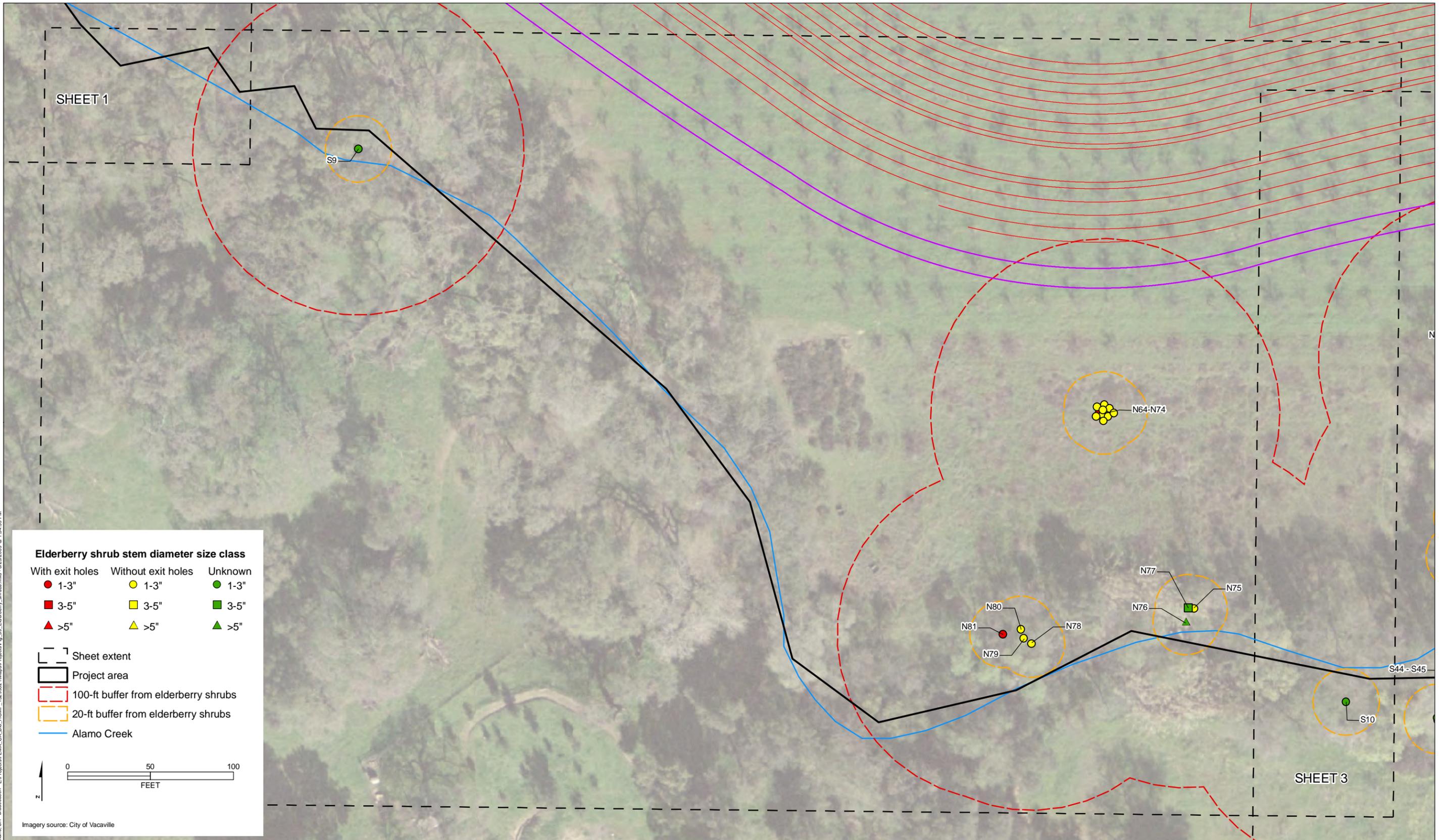
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Imagery source: City of Vacaville

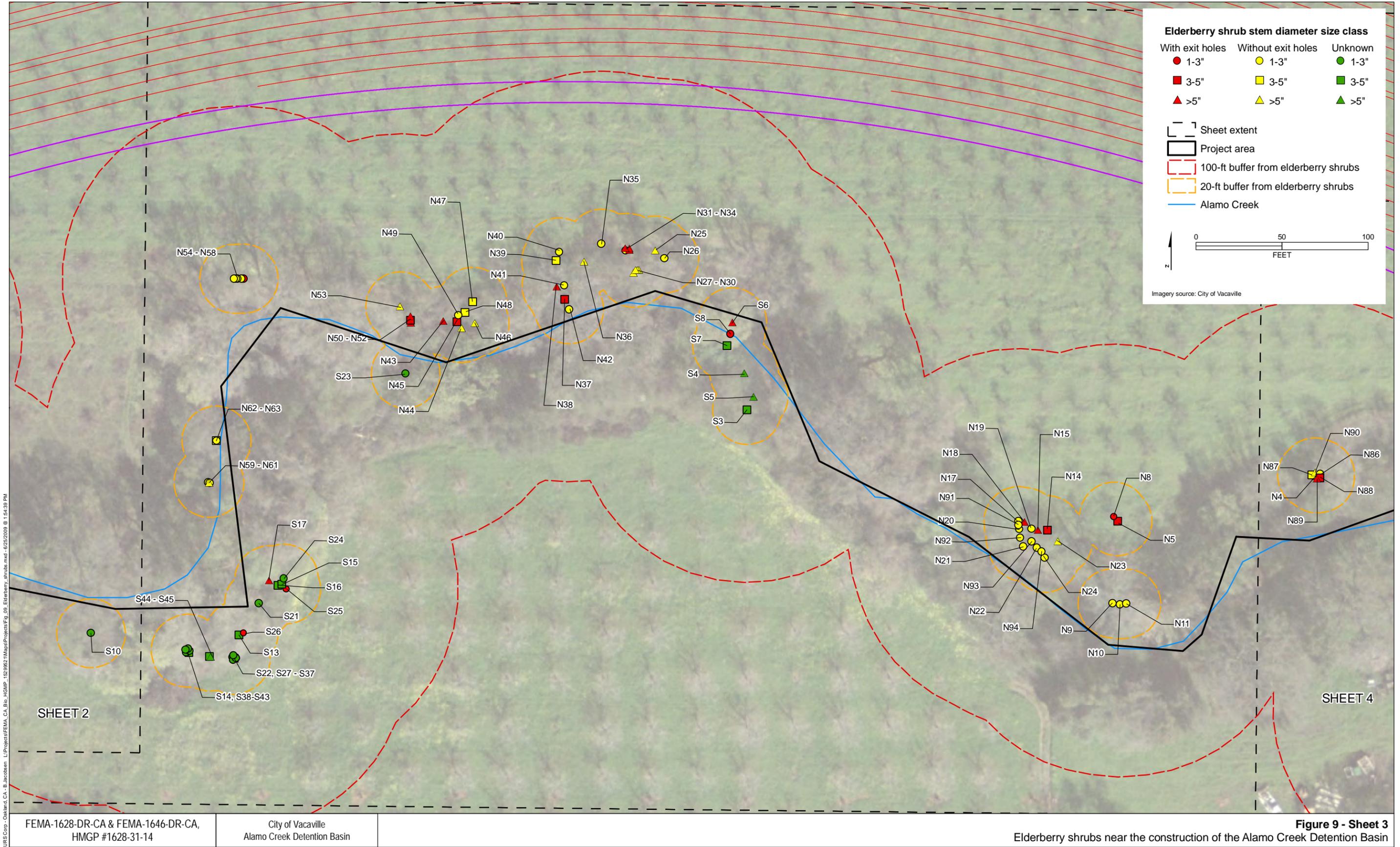
SHEET 2



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**Elderberry shrub stem diameter size class**

With exit holes	Without exit holes	Unknown
● 1-3"	● 1-3"	● 1-3"
■ 3-5"	■ 3-5"	■ 3-5"
▲ >5"	▲ >5"	▲ >5"

[ ] Sheet extent  
 [ ] Project area  
 [ ] 100-ft buffer from elderberry shrubs  
 [ ] 20-ft buffer from elderberry shrubs  
 — Alamo Creek

0 50 100  
 FEET

Imagery source: City of Vacaville

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**Elderberry shrub stem diameter size class**

With exit holes	Without exit holes	Unknown
● 1-3"	● 1-3"	● 1-3"
■ 3-5"	■ 3-5"	■ 3-5"
▲ >5"	▲ >5"	▲ >5"

[---] Sheet extent  
 [---] Project area  
 [---] 100-ft buffer from elderberry shrubs  
 [---] 20-ft buffer from elderberry shrubs  
 [---] Alamo Creek

0 50 100  
 FEET

Imagery source: City of Vacaville

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