

May 14, 2016

High Trails Outdoor Science School
Mr. Driz Cook
P.O. Box 2640
Big Bear City, CA 92314

Subject: Letter Report for San Bernardino Flying Squirrel (*Glaucomys sabrinus californicus*) Habitat Assessment for the High Trails Outdoor School Project in Angelus Oaks, San Bernardino County, California

Dear Mr. Cook:

FirstCarbon Solutions (FCS) is pleased to provide the following report which contains the findings of a habitat suitability assessment for the San Bernardino flying squirrel (*Glaucomys sabrinus californicus*) for the High Trails Outdoor Science School Project (Project), located at 'O' Radford Ranch Road, Angelus Oaks, California. The purpose of the habitat suitability assessment is to determine if the proposed development footprint and its associated 150-foot buffer contain sufficient suitable habitat to support San Bernardino flying squirrels. These efforts were completed to support project development and will provide sufficient analysis to address California Environmental Quality Act (CEQA) documentation and approval.

EXECUTIVE SUMMARY

The proposed project site is located north of California State Route 38, east of Seven Oaks in the central San Bernardino Mountains. The proposed project plans on developing 6.37% of a 40acre parcel for the High Trails Outdoor Science School. The proposed development will only take place in the Southeast quad of the parcel. The western half of the site is still naturally vegetated, but the understory vegetation community in the eastern half of the project site has been altered to reduce fire fuel loads. Close proximity to undeveloped National Forest land and low levels of nearby private land, so the occurrence of San Bernardino flying squirrels is possible, but unlikely.

San Bernardino flying squirrels were observed during the habitat suitability assessment. Moreover, due to the sites low elevation, distance to nearest sightings and the discontinuous canopy in the Southeast quad it is unlikely that development of the site will adversely affect potential San Bernardino flying squirrel populations.

SITE DESCRIPTION

The proposed project is approximately 40-acres and is located in the in the San Bernardino Mountains off of Radford Camp Road, 0.40 miles east of Seven Oaks within Township 01 North, Range 01 East, Section 08 of the United States Geological Survey (USFS) *Big Bear Lake* 7.5-minute quadrangle map (Exhibit 1; Exhibit 2). The survey area is located on private land within the San Bernardino National Forest (34.186014°, -116.907647°). The project site contains several small hills and generally increases moderately in slope from south to north. On-site elevation ranges from 5,520 feet above mean sea level (AMSL) in the northwest corner to 5,322 AMSL in the southwest corner. The property is undeveloped, supporting natural vegetation with two exceptions: 1) an expansion tank for a private water well located on a small concrete pad in the center of the site, 2) on-site fuels reduction primarily on the eastern side of the property bordering the San Bernardino National Forest. The parcel is traversed by the upper Santa Ana River in the southwest corner of the property, Converse creek in the western portion of the parcel, and Radford Camp Road which traverses north to south on the western half of the property. A dirt access road and gate are on the southeast corner of the property (Appendix A: Site Photographs). The project site is bound by undeveloped United States Forest Service (USFS) land with the exception of undeveloped private land to the northwest.

Soils on the project site are limited to Oak-glen rush families complex (2 to 15% slopes) and Wapi-Pacifico families (50 to 75% slopes; Exhibit 3; Bowman 1973). Soils from the Oak-glen complex are alluvial and well-drained. Soils from the Wapi-Pacifico complex are found on mountain slopes and are also somewhat excessively drained. Both soils are mostly made up of mixed coarse loam and sand.

The plant communities on the proposed project site are big sagebrush scrub, oak/coniferous forest, and white alder riparian forest. The proposed development footprint is primarily on big sagebrush scrub vegetation community. The majority of the remainder of the site is oak/coniferous scrub. The southwest corner is classified as white alder riparian forest.

SAN BERNARDINO FLYING SQUIRREL

Status

The International Union for Conservation of Nature (IUCN) listed the population as a species of concern in a 1998 status and conservation action plan for North American rodents, because of concerns that San Bernardino flying squirrel populations were in decline (Hafner 1998). Concerns were raised between 2000 and 2010 that in the San Bernardino Mountains current mitigation and conservation measures were not sufficient for protecting the subspecies (Center for Biological Diversity 2010). In 2010, the Center for Biological Diversity petitioned the Secretary of the Interior, through the United States Fish and Wildlife Service (USFWS) to list the San Bernardino flying squirrel as a threatened or endangered species under the Endangered Species Act (ESA; Center for Biological Diversity 2010). In 2016, after six years of review the USFWS determined that the San Bernardino flying squirrel did not warrant protection under then ESA citing that in occupied areas San Bernardino flying squirrels are abundant and that currently in

place conservation measures were sufficient. California Department of Fish and Wildlife (CDFW) currently (2017) assigned the following special status classifications to the San Bernardino flying squirrel: Rank Globally- Secure, Rank State- Critically Imperiled or Imperiled, CDFW- Species of Special Concern, USFS- Sensitive.

Biology

Northern flying squirrels are one of two species of flying squirrels in North America. There are currently 25 recognized subspecies (Roskov et al. 2017). Extent populations in the U.S. are stable; but, northern flying squirrels do not occupy uniformly risky habitat and four subspecies of northern flying squirrel have been identified as species of concern (Hafner 1998). Habitat degradation and fragmentation, data deficiency and limited distributions are the primary reasons for population decline in these four subspecies (Hafner 1998). Additionally, interspecific competition with the co-occurring southern flying squirrel (*Glaucomys volans*) are causing populations of northern flying squirrel in Southeastern United States to decline.

The San Bernardino flying squirrel is the terminal southern subspecies of northern flying squirrel in the western United States. Historically, the San Bernardino flying squirrel occurred in three populations that are all isolated from northern flying squirrel populations in the southern Sierra Nevada mountain range. The three populations historically occurred in the San Bernardino, San Gabriel and San Jacinto mountains, although there are only museum specimens for populations in the San Bernardino and San Jacinto populations (Brylski 1998). Rhoads (1987) initially described the subspecies, but more recent studies of mitochondrial DNA have confirmed the subspecies classification (Arbogast 1999, Arbogast 2007).

Little is known about the life history characteristics of the San Bernardino flying squirrel. However, at the species level the northern flying squirrel has been studied extensively across much of its range. In forests of the Pacific Northwest, northern flying squirrels have been proposed as a keystone species, due to their importance to forest health and its importance in the diet of the federally threatened northern spotted owl (*Strix occidentalis caurina*; Smith 2007). Northern flying squirrels can occupy a broad range of habitats, but in general they prefer old growth or mature coniferous forests, with continuous closed canopy cover, and rich understory structural complexity (Smith et al. 2003). Northern flying squirrels have been proposed as a K-selected species due to their relatively long life-span (>7 years) relative to body size, small litter sizes (2-3), seasonal reproduction (spring), and delayed maturation (>1-year-old at 1st reproduction; Wells-Gosling and Heaney 1984). Reported home range sizes (core nesting area) are quite variable (0.2-9ha) and variation is likely related to local food availability. Also, males have more variable and sometimes larger home ranges. Males and juveniles have larger measured dispersal distances, where the largest measured dispersal of a male was 1.5km and the largest measured dispersal of a juvenile was 2.1km (Smith 2007, Wiegl 1999). Nesting sites are typically cavities in both live trees and snags as well as brooms created by parasitic infestations of trees (*Phoradendron spp*) that can be used as dreys (Smith 2007).

Density estimates for northern flying squirrels in the Pacific Northwest range from 0.5 squirrels/ha to 4 squirrels/ha. But, densities are not well studied in other parts of its range. A number of studies presented conflicting inference about the effects of timber harvest and forest age on the density of northern flying squirrels. However, a recent meta-analysis by Holloway and Smith (2011) demonstrated significantly higher densities of northern flying squirrels in old or mature forests. Additional studies have demonstrated positive relationships between northern flying squirrel density and the number of trees per hectare >50cm diameter at breast height (DBH), as well as high canopy cover and the number of large snags per hectare (Carey 1999, Smith 2007). Although, the association between the number of large snags per hectare and flying squirrel was positive, the results were inconclusive, possibly indicating that a minimum habitat requirement was met and the range of sampled values was not wide enough to demonstrate a statistically significant effect (Holloway and Smith 2011).

Northern flying squirrels are primarily mycophagous and their diet largely consists of hypogeous fungi supplemented by secondary foods such as berries, seeds, nuts and eggs (Maser et al. 1978, Wells-Gosling and Heaney 1984). Specifically, northern flying squirrels appear to favor *Rhizopogon* and *Gauteria* fungi truffles and patterns of habitat selection likely reflect suitable habitat for the growth of these fungi. For example, northern flying squirrels are associated with coarse woody debris, which provides microhabitat that support the growth of hypogeous fungi (Carey 1999, Lehmkuhl 2004).

A variety of avian and mammalian predators are known to consume northern flying squirrels, but significant predation is likely limited to the specialist predator northern spotted owl (Forsman et al. 2004), and generalist predators such as barred owls (*Strix varia*; Wiens et al. 2014), martens (*Martes americana*; Bull 2000), ermines (*Mustella erminea*; Wilson and Carey 1996), and long-tailed weasels (*Mustella frenata*; Wilson and Carey 1996). Northern flying squirrels are the most common prey identified in the diets of northern spotted owls in Washington and Oregon, but are much less prevalent in the southern portions of northern flying squirrels range (Forsman et al. 2004, Smith et al. 1999).

Much of the suitable habitat for the subspecies San Bernardino flying squirrel, lies within the San Bernardino National Forest, with distribution potentially fragmented by fire and changes in vegetative cover along the Santa Ana River (Brylski 1998). The San Bernardino flying squirrel occupies high elevation (4,000' - 8,000') mixed coniferous forests characterized by white-fir (*Abies concolor*), Jeffrey pine (*Pinus jeffreyi*), and black oak (*Quercus kelloggii*; Butler et al. 1991). Successful trapping efforts targeting northern flying squirrels characterize habitat as mature to over-mature mixed conifer with relatively closed canopy, heavy duff, and close proximity to annual or ephemeral streams (Butler et al. 1991). Fecal pellet analysis of San Bernardino flying squirrels indicate primary consumption of hypogeous fungi (Genera: *Melanogaster*, *Hymenogaster*, *Gymnomyces*) with supplemental consumption of Jeffrey pine pollen, plant material and insect parts (Butler et al. 1991). There is no available demographic information on the San Bernardino fly squirrel, but Brylski (1998) suggests that population densities are substantially less than populations in the Pacific Northwest.

SURVEY METHODOLOGY

Prior to the site visit, FCS biologists performed a thorough review of existing technical and peer-reviewed literature regarding life history and habitat requirements for San Bernardino flying squirrels. The site was compared to available San Bernardino flying squirrel range maps and the site fell within habitat delineated by the California Wildlife Habitat Relationships (CWHR) range map for northern flying squirrel; however, no peer-reviewed occupancy information for this subspecies is available. Aerial imagery was reviewed to assess site canopy cover and proximity to annual and ephemeral water sources. Current and historical sightings were evaluated by searching the CNDDDB database, USFWS historical sightings, and publicly available citizen science data (inaturalist.com; Exhibit 5).

On May 13, 2017, Matt Weldy, a qualified biologist, performed a 6-hour onsite assessment of the proposed project site including a 150' buffer. There is not a reported protocol survey for San Bernardino flying squirrels. However, the qualified biologist is experienced working with northern flying squirrels and is familiar with the behavior and habitat for northern flying squirrels. The weather was warm, dry and sunny during the site visit.

The onsite visit was intended to evaluate the suitability of the project site for San Bernardino flying squirrel nesting and foraging habitat. The onsite visit was not intended to confirm occupancy or temporary use for nesting, dispersal or foraging behavior. The qualified biologist systematically surveyed the proposed project site as well a 150' buffer specifically searching for essential San Bernardino flying squirrel habitat features. Specific site features evaluated were dominant tree species present, canopy closure, duff layers, presence of large snags, presence of coarse woody debris >10cm, cavity nesting sites, and site proximity to annual or ephemeral water sources.

SURVEY RESULTS

Review of current and historical sightings identified two confirmed photographs of San Bernardino flying squirrels nearby. One photograph was taken on September 1st 2016, approximately 2.3 miles to the north northwest at an approximate elevation of 7,600 ft. The second photograph was taken on November 23rd 2015, approximately 2.0 miles to the south southwest at an approximate elevation of 5,800 ft. The project site elevation is within the reported range of suitable habitat and extent observations. However, the site is approximately 500 ft lower in elevation than the nearest confirmed photographs.

There were no observations of San Bernardino flying squirrel during the site visit. Multiple habitat features were observed that could provide low quality foraging habitat in the Southeastern quad of the project site and moderate quality foraging habitat in the North half of the project site. Habitat in the southeast portion of the project contained a number of mature trees >25cm DBH, multiple large snags, as well as, coarse woody debris >10cm, and a low number of tree cavities. However, the southeast portion of the site is characterized as big sagebrush scrub habitat and canopy cover was non-continuous.

In the northwest portion of the project site there were mature trees (>25cm DBH), multiple large snags, coarse woody debris (>10cm diameter), and a moderate number of tree cavities.

Relative canopy cover decreased from the northwest to the southeast corner of the project and canopy cover directly to the east of the project on San Bernardino national forest property was highly discontinuous. Canopy cover was nearly continuous from north to south in the seasonal Converse Creek bed.

DISCUSSION AND RECOMMENDATIONS

There is a low likelihood that the project site provides potential nesting habitat in the Northwest of the project footprint and low to moderate quality foraging habitat in the Southeast corner of the project habitat. The proposed project impacts are confined the Southeast quadrant of the project site, where habitat is low quality and likely only potential foraging habitat. Thus, development in the southeast corner of the project site is not likely to have substantial impact for San Bernardino flying squirrels. Furthermore, because the southeast corner of the project site has a discontinuous canopy cover and does not directly connect to adjacent continuous canopy forest the proposed development is unlikely to cause habitat fragmentation. With the current project footprint and the location of development, the proposed project affect is unlikely to adversely affect San Bernardino flying squirrels.

There is very little reported or published information specifically addressing the habitat needs and rigorous survey methods for the San Bernardino flying squirrel and a clearer determination of occupancy might require an additional specialized investigation such as a camera trapping protocol or a live-trapping protocol. However, given the results of this habitat assessment and the available technical and peer reviewed literature the following mitigation measures are recommended to minimize impact to San Bernardino flying squirrels.

- 1) Minimize the removal of large coarse woody debris (>10cm diameter), which provide microhabitat for the growth of hypogeous fungi.
- 2) Limit removal of standing snags (>25cm DBH) and large trees (>25cm DBH), which provide both structural complexity and potential nesting habitat.
- 3) Prioritize the retention of large trees and snags with visible potential cavity nesting structures, which are associated with higher densities of northern flying squirrels.
- 4) Minimize the loss of continuous canopy closure, especially in the Converse Creek bed, which provides protection from predators while foraging and may play an important role in maintaining habitat connectivity.

CERTIFICATION

First Carbon Solutions (FCS) appreciates the opportunity to assist you on this project. If we can be of any further assistance, or if you have any questions concerning this letter report, please contact me at (714) 508-4100 extension 1203 or via email at kboydstun@fcs-intl.com.

Sincerely,



Kim Boydstun, Senior Biologist
FirstCarbon Solutions
650 E. Hospitality Lane, Suite 125
San Bernardino, CA 92408

Enc: Tables 1 and 2
Exhibit 1 through 7
Appendix A

REFERENCES

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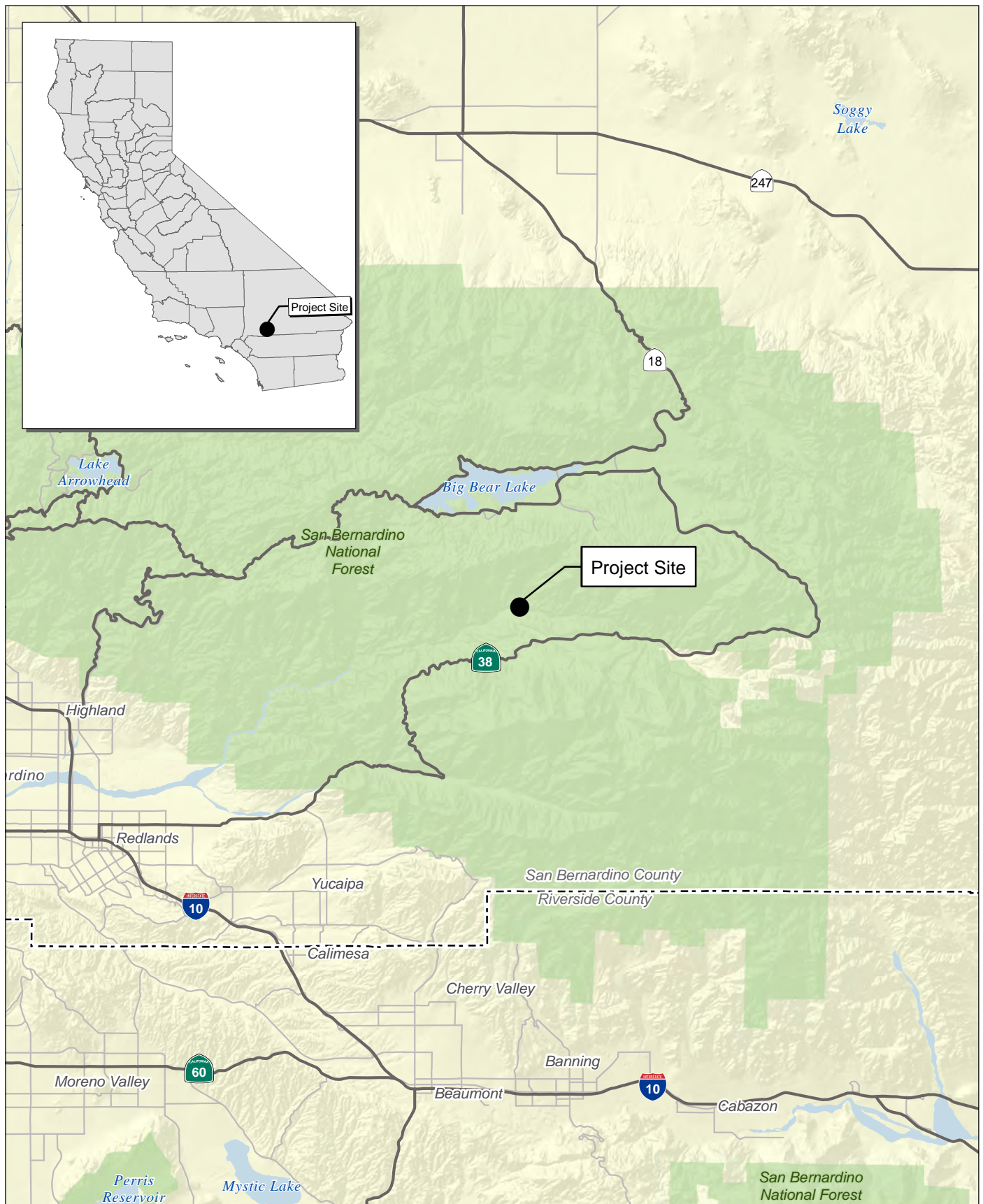
TABLES

Table 1. Presentation of wildlife species observed by the qualified biologist on May 12th 2017 during the onsite habitat suitability visit

Common Name	Scientific Name
Mammals	
Bobcat	<i>Lynx rufus</i>
Chipmunk	<i>Tamias ssp.</i>
Mule Deer	<i>Odocoileus hemionus</i>
Dusky-footed Woodrat	<i>Neotoma fuscipes</i>
Reptiles	
Great Basin Fence Lizard	<i>Sceloporus occidentalis longipes</i>
San Diegan Tiger Whiptail	<i>Aspidoscelis tigris stejnegeri</i>
Western Fence lizard	<i>Sceloporus occidentalis</i>
Birds	
Mountain Quail	<i>Oreortyx pictus</i>
California Quail	<i>Callipepla californica</i>
Red-tailed Hawk	<i>Buteo jamaicensis</i>
Acorn Woodpecker	<i>Melanerpes formicivorus</i>
Red-breasted Sapsucker	<i>Sphyrapicus ruber</i>
Northern Flicker	<i>Colaptes auratus</i>
Western Wood-Pewee	<i>Contopus sordidulus</i>
Steller's Jay	<i>Cyanocitta stelleri</i>
Mountain Chickadee	<i>Poecile gambeli</i>
Oak Titmouse	<i>Baeolophus inornatus</i>
Purple Finch	<i>Haemorhous purpureus</i>
Red Crossbill	<i>Loxia curvirostra</i>
Wilson's Warbler	<i>Cardellina pusilla</i>
Spotted Towhee	<i>Pipilo maculatus</i>
Chipping Sparrow	<i>Spizella passerina</i>
Song Sparrow	<i>Melospiza melodia</i>
Dark-eyed Junco	<i>Junco hyemalis</i>
Western Tanager	<i>Piranga ludoviciana</i>

Table 2. Presentation of plant species observed by the qualified biologist on May 12th 2017 during the onsite habitat suitability visit.

Plant Species Observed	Scientific Name
Trees	
White alder	<i>Alnus rhombifolia</i>
Western juniper	<i>Juniperus occidentalis</i>
Black oak	<i>Quercus kelloggii</i>
Interior live oak	<i>Quercus wislizeni</i>
Jeffrey pine	<i>Pinus jeffreyi</i>
Coulter pine	<i>Pinus coulteri</i>
Shrubs	
Big leaf sagebrush	<i>Artemisia tridentata</i>
Poison oak	<i>Toxicodendron diversilobum</i>
Prickly pear ssp.	<i>Opuntia ssp.</i>
Cholla sp.	<i>Cylindropuntia ssp.</i>
Rabbitbrush ssp.	<i>Chrysothamnus ssp.</i>
Mountain whitethorn	<i>Ceanothus cordulatus</i>
Greenleaf manzanita	<i>Arctostaphylos patula</i>
Mistletoe	<i>Phoradendron villosum</i>
Forbs	
Indian paintbrush	<i>Castilleja affinis</i>
Common mullein	<i>Verbascum thapsus</i>
Stinging nettle	<i>Urtica dioica</i>
Western columbine	<i>Aquilegia formosa</i>
Rubus ssp	<i>Rubus ssp.</i>
Chia sage	<i>Salvia columbariae</i>
Penstemon ssp	<i>Penstemon ssp.</i>
Grasses	
Bermudagrass	<i>Cynodon dactylon</i>
Bromegrass	<i>Bromus diandrus</i>



Source: Census 2000 Data, The CaSIL, FCS GIS 2016.

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Exhibit 1 Regional Location Map

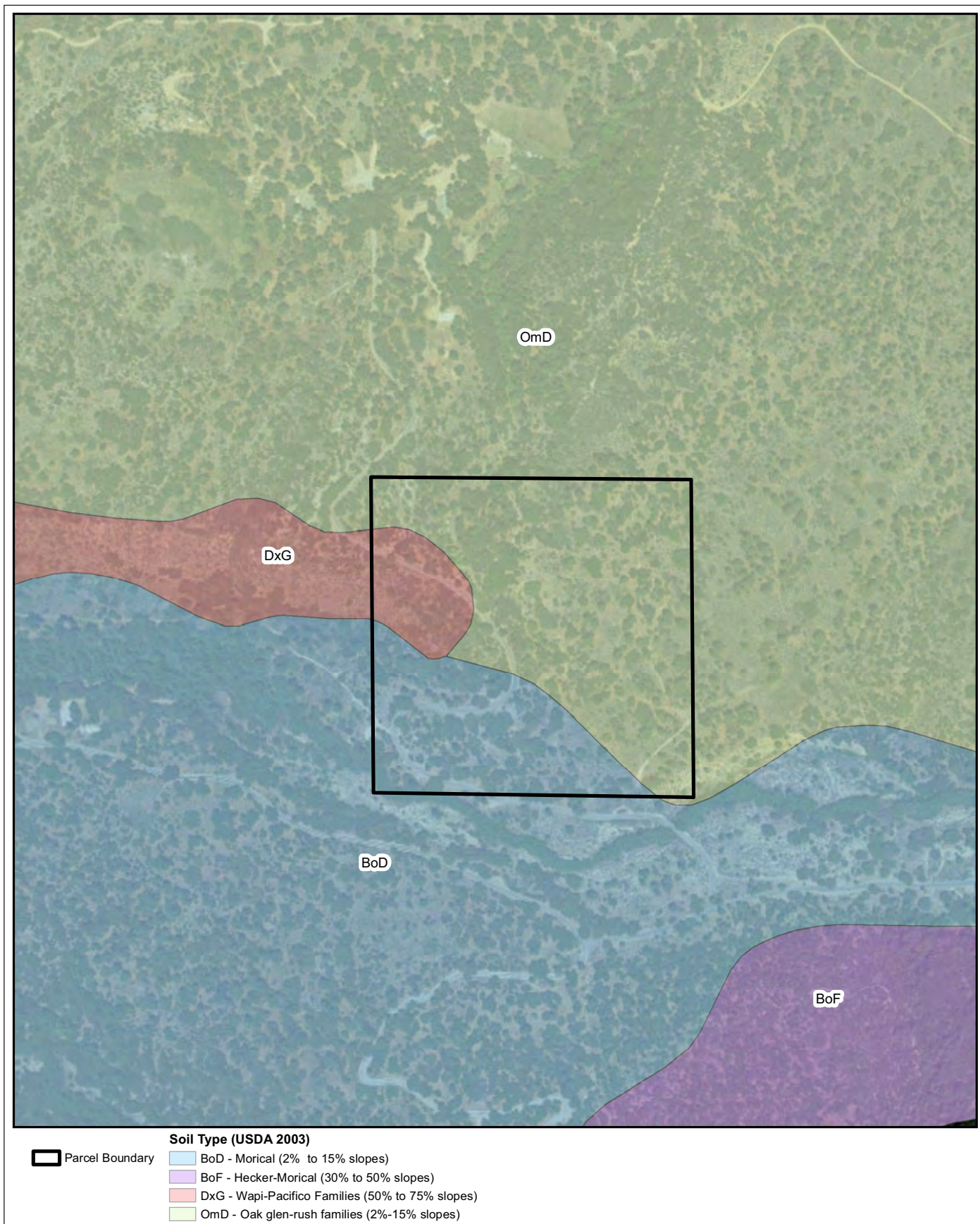
Source: Bing Imagery, 2015



Exhibit 2

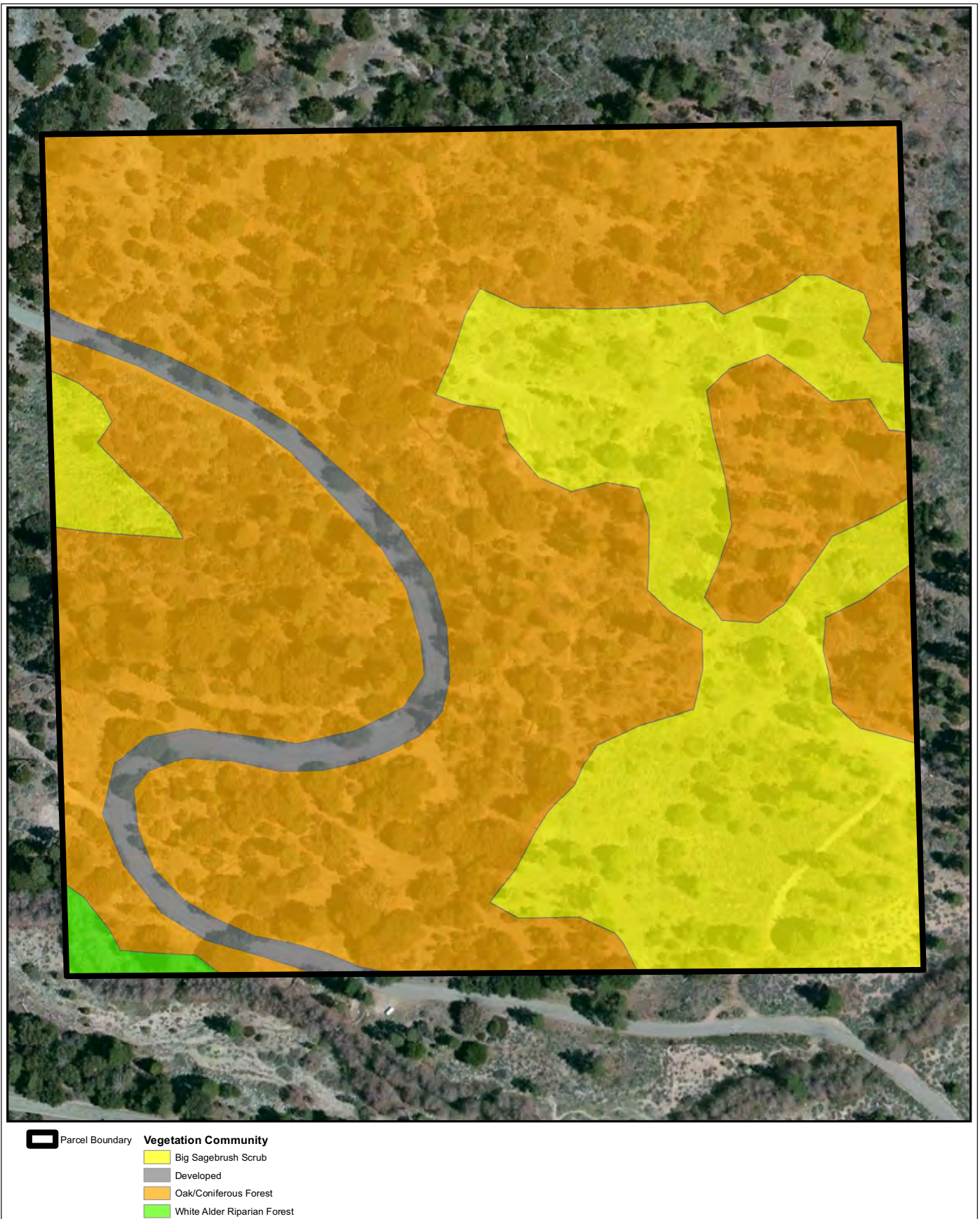
Local Vicinity Map

Aerial Base



Source: Borchers Environmental Management, 2016





Source: Borchers Environmental Management, 2016

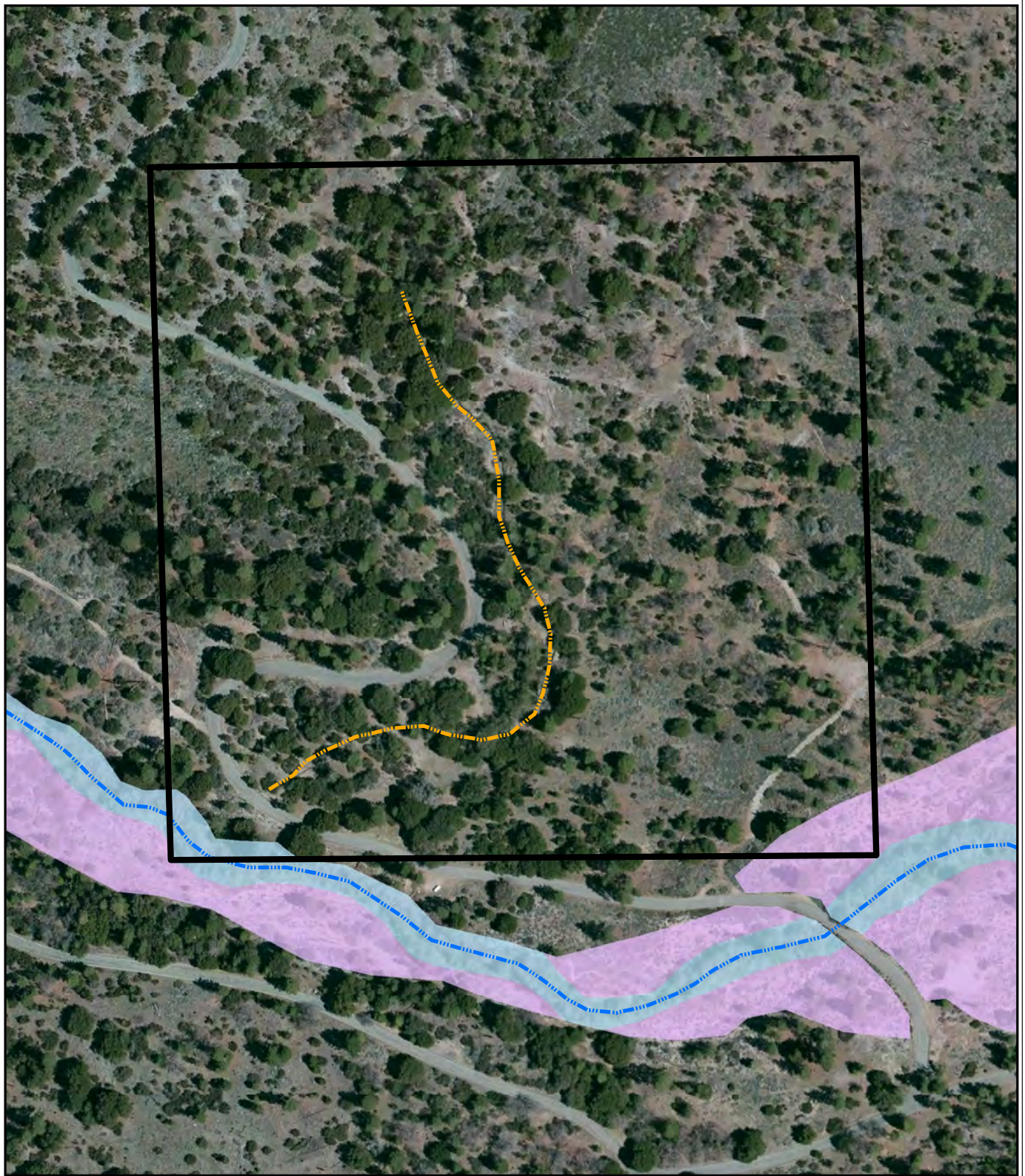
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Exhibit 4 Vegetation Communities

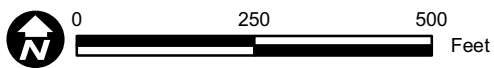




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|---|--------------------------------|
| Parcel Boundary | Jurisdictional Features |
| Jurisdictional Perennial Stream (Santa Ana River) | CDFW/RWQCB/ACOE Wetland Waters |
| Non-jurisdictional Swale | CDFW Streambed/RWQCB Waters |

Source: Borchers Environmental Management, 2016

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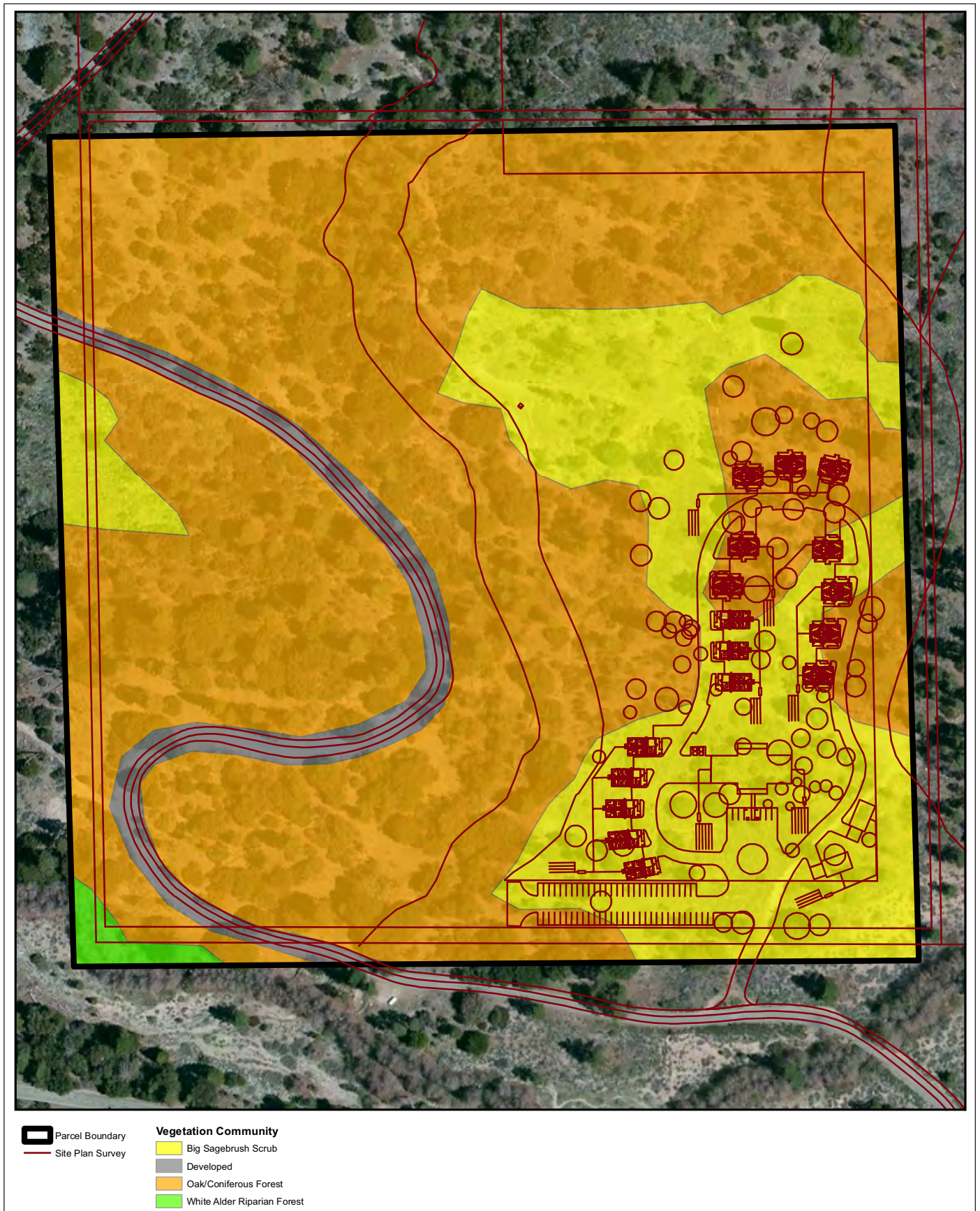


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Exhibit 6

Jurisdictional Resources - Wetland/Waters

HIGH TRAILS OUTDOOR SCIENCE SCHOOL • HIGH TRAILS OUTDOOR SCIENCE SCHOOL
BIOLOGICAL RESOURCES ASSESSMENT





Photograph 1: Building site characteristics. Photo taken on May 12th 2017 at waypoint N 34°11.210' by W 116°54.371' facing compass bearing 199°.



Photograph 2: Building site characteristics. Photo taken on May 12th 2017 at waypoint N 34°11.210' by W 116°54.371' facing compass bearing 239°.



Photograph 3: Habitat characteristics in the NW portion of the site. Photo taken on May 12th 2017 at waypoint N 34°11.326' by W 116°54.549' facing compass bearing 312°.



Photograph 4: Riparian habitat characteristics in the SW portion of the site. Photo taken on May 12th 2017 at waypoint N 34°11.153' by W 116°54.575' facing compass bearing 90°.



Photograph 5: Habitat characteristics in Converse creek in the NW portion of the site. Photo taken on May 12th 2017 at waypoint N 34°11.323' by W 116°54.523' facing compass bearing 130°.



Photograph 6: Evidence of large coarse woody debris (>10cm diameter) near the development site. Photo taken on May 12th 2017 at waypoint N 34°11.225' by W 116°54.393' facing compass bearing 4°.



Photograph 7: Evidence of large coarse woody debris (>10cm diameter) near the development site. Photo taken on May 12th 2017 at waypoint N 34°11.253' by W 116°54.430' facing compass bearing 23°.



Photograph 8: Evidence of well decayed large coarse woody debris (>10cm diameter) near the development site. Photo taken on May 12th 2017 at waypoint N 34°11.244' by W 116°54.427' facing compass bearing 240°.



Photograph 9: Evidence of high snag structures near the development site. Photo taken on May 12th 2017 at waypoint N 34°11.259' by W 116°54.430' facing compass bearing 75°.



Photograph 10: Evidence of large standing snags (>10cm diameter) near the development site. Photo taken on May 12th 2017 at waypoint N 34°11.163' by W 116°54.397' facing compass bearing 64°.



Photograph 11: Evidence of large standing snags (>10cm diameter) near the development site. Photo taken on May 12th 2017 at waypoint N 34°11.210' by W 116°54.371' facing compass bearing 349°.



Photograph 12: Evidence of parasitic mistletoe brooms, which could provide nesting habitat (drey). Photo taken on May 12th 2017 at waypoint N 34°11.148' by W 116°54.413' facing compass bearing 334°.



Photograph 13: Evidence of parasitic mistletoe brooms, which could provide nesting habitat (drey). Photo taken on May 12th 2017 at waypoint N 34°11.154' by W 116°54.537' facing compass bearing 334°.



Photograph 14: Evidence of potential cavity nesting sites in a live black oak near the building site. Photo taken on May 12th 2017 at waypoint N 34°11.209' by W 116°54.388' facing compass bearing 260°.



Photograph 15: Evidence of potential cavity nesting sites in a dead snag in the Converse creek bed. Photo taken on May 12th 2017 at waypoint N 34°11.205' by W 116°54.475' facing compass bearing 164°.