RUSSELL RANCH MITIGATION AREA
CONCEPT PLAN

Prepared by

Russell Ranch Mitigation Area Design Concept Committee
University of California, Davis

2002

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INTRODUCTION

The 1994 UC Davis Long Range Development Plan[1] (LRDP) identified land use designations on the main campus and the Russell Ranch. The 1994 LRDP Environmental Impact Report (EIR), identified potential impacts to biological values that could occur if lands identified in the 1994 LRDP were fully developed. The 1994 LRDP EIR identified several mitigation measures for impacts to biological resources. The Regents adopted these mitigation measures in October 1994. One of the mitigation measures in the 1994 LRDP EIR was to convert two parcels on the Russell Ranch from agricultural use to habitat managed specifically for three special status species.

In addition to identifying the Russell Ranch mitigation sites in the 1994 LRDP EIR, the campus has publicly stated that it will use campus expertise to design the mitigation areas. The stated intent was to design the areas not only to serve the mitigation goals but to do so in a way that informs and improves future mitigation efforts by the campus and the public at large. Moreover, the campus recognizes the importance of the areas for teaching and research purposes. Consistent with those commitments, the Russell Ranch Mitigation Area Design Concept Committee was appointed in April 1999. The charge to the committee was:

> *to develop the design concept for the mitigation area. First and foremost, the site must be designed to benefit Swainson's Hawks, Burrowing Owls, and Valley Elderberry Longhorn Beetles. Consistent with the University's mission of teaching, research, and public service, it should also be designed to the extent practical to help inform future mitigation efforts by the University and the public at large. Thus, the design may include monitoring efforts for this purpose. Consistent with the goal of providing habitat for the identified species, it also should be designed to be used by instructors, students, and researchers that may wish to use the site*.

The Russell Ranch Mitigation Area Concept Plan reports the recommendations of the Russell Ranch Mitigation Area Design Concept Committee for the development, implementation, and management of the mitigation area. The committee has identified the following goals for the creation and management of the mitigation lands and the Russell Ranch:

- Fulfill the University's legal and regulatory requirements for biological mitigation in response to development contemplated in the 1994 LRDP.

[1] The 1994 LRDP and LRDP EIR have been amended since originally adopted in October 1994. References to these documents in this plan refer to the 1994 LRDP and LRDP EIR as amended.

- Evaluate the efficacy and success of mitigation efforts in order to contribute to the greater body of knowledge about mitigation. That is, mitigation should not be done without evaluation, as is often the case. Important questions that should be addressed are whether mitigation works in the long-term, whether mitigation for a few species is compatible with natural habitat restoration, and how to address conflicts when dealing with multi-species mitigation.

- View implementation of the concept plan as part of a larger effort to improve habitat values on west campus lands, including the Putah Creek Riparian Reserve, Russell Ranch, and field teaching and research lands.

- Design the Russell Ranch mitigation area to be used as an outdoor classroom for use by campus classes, faculty, and students.

- Engage the community in the creation and management of the mitigation area to the extent feasible and consistent with management of the area for wildlife and habitat values,

SPECIAL STATUS SPECIES

The Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*) or VELB is listed as a threatened species under the federal Endangered Species Act. The geographic range of the VELB is limited to California's Central Valley, where it is found in association with elderberry shrubs (*Sambucus* species), which are the host plants for the larval stages of this beetle. Elderberry shrubs naturally occur in riparian forests and in elderberry savannas adjacent to riparian vegetation. On the UC Davis campus, elderberry shrubs occur primarily: (1) along Putah Creek in the Putah Creek Riparian Reserve; and (2) as scattered patches or individual shrubs located along fences and beneath telephone wires where birds may have dropped seeds. Elderberry shrubs on campus are potential VELB habitat. However, the presence of VELB on the campus has not been confirmed. Campus development of lands designated in the 1994 LRDP could affect some of these isolated shrubs and several shrubs already have been transplanted to Mitigation Site A (described below).

The Swainson's Hawk (*Buteo swainsoni*) is listed as a threatened species under the California Endangered Species Act. It is a relatively large bird-of-prey that typically nests in large trees in riparian habitat as well as isolated trees remaining in or adjacent to agricultural fields in the Central Valley. On the UC Davis campus and adjoining areas, these hawks also nest in large trees within developed urban areas. Swainson's Hawks forage in open grassland and ruderal habitats and have adapted to foraging in certain types of agricultural lands. Swainson's Hawks routinely nest on and adjacent to the UC Davis campus. Annual nest surveys have routinely located over 20 nests each year on campus lands or within ½-mile of the campus.

The Burrowing Owl (*Speotyto cunicularia*) has been identified as a species of special concern by the California Department of Fish and Game. Burrowing Owls are relatively small birds-of-prey with the unique habits of being active throughout the day and evening, and of nesting underground. They typically use burrow systems formerly occupied by ground squirrels. Burrowing Owls forage in grasslands and some native

scrub habitats, agricultural fields, and ruderal areas with short vegetation. Since the early 1980's, a population has intermittently occupied fields on the central campus in the general vicinity of the Health Sciences complex. During the early 1990s, the population on this part of campus disappeared. A single individual reoccupied the the field east of the Health Sciences complex in 1997. One breeding pair was present in the fields east of the Medical School in 1998, and in 1999 and 2000, two breeding pairs were present. A single pair was present there at the start of the breeding season in 2001. Campus development of lands designated in the 1994 LRDP would cause the loss of Burrowing Owl nesting and foraging habitat on the central campus.

RUSSELL RANCH MITIGATION SITES

The two habitat mitigation sites at the Russell Ranch are illustrated in Figure 1. Site A is located along Putah Creek on the southwestern border of the Russell Ranch. It is approximately 65 acres and is predominantly covered by kiwi and Asian pear orchards. A narrow band of riparian vegetation is located below the top of the slope immediately along Putah Creek. A portion of the riparian area has been removed and replaced with a variety of fruit trees. The northern boundary of the site parallels a continuous band of poplar trees along the south side of the Willow Canal. In addition, there are several rows of trees within the parcel.

Site B is located south of Russell Boulevard on the east side of County Road 98A. The southern boundary is Putah Creek and the northern boundary is along the north side of a swale that extends east from the intersection of Russell Boulevard and County Road 98A. It is approximately 93 acres and is used predominately for row crops including alfalfa. A small, area in the northwest portion of the site is unleveled and is used seasonally for sheep grazing. The swale along the northern edge of the property receives water from local stormwater drainage and agricultural runoff. The bottom of the swale supports wetland vegetation, but the sides of the swale support only forbs and grasses, except at the west end, where a small patch of riparian vegetation is present. The southern portion of Site B borders a well developed strip of riparian vegetation along Putah Creek. The area between Putah Creek and the willow canal is a kiwi orchard that has not been irrigated for several years. The Willow Canal borders the northern edge of the kiwi orchard, and poplars form a continuous line along the southern side of the canal.

RECOMMENDED ACTIONS

1. VELB MANAGEMENT

1.1 *Manage the Russell Ranch mitigation areas consistent with U.S. Fish and Wildlife Service guidelines*.

The U.S. Fish and Wildlife Service (USFWS) has published a set of mitigation guidelines for VELB. Management of VELB mitigation sites at the Russell Ranch must

be consistent with these guidelines and any applicable permits issued by the USFWS. During the permit application process the campus may request certain permit terms that will allow research and teaching uses.

1.2 ***Incorporate VELB mitigation at the Russell Ranch into: (a) riparian habitat improvement along Putah Creek in Sites A and B, and along the swale on the north side of Site B; and (b) as a "elderberry savannah" outside the Putah Creek Channel on Site A*****.**

On Sites A and B, elderberry shrubs should be planted as part of riparian habitat restoration along Putah Creek. The mixture of shrubs in the restoration area should be native species found naturally along the creek, derived from local stocks, and consistent with USFWS guidelines for VELB mitigation areas. Along the creek, the riparian zone could extend a short distance above the top of slope into the adjacent grasslands. In addition, small areas of "elderberry savannah" (i.e., scattered elderberry shrubs on the terrace above the creek) could be established within the grassland to mimic a wider range of landscapes where elderberry shrubs occur.

Along the swale on the north side of Site B, riparian habitat restoration should be concentrated at the east and west ends of the swale where some taller vegetation already exists. Between these areas, initial plantings for habitat restoration should not include tall trees and should generally stay below the top of the bank so that the vegetation does not create perch sites for predators that could take Burrowing Owls from the adjacent fields. However, natural recruitment after initial restoration plantings may result in establishment of trees in this area.

1.3 ***Design the VELB mitigation areas to receive shrubs transplanted from campus sites and to serve as a mitigation bank for VELB*****.**

Due to the presence of elderberry shrubs within the urban and agricultural landscape on campus, future projects will undoubtedly require the relocation of shrubs from these sites. The riparian habitat restoration areas on Sites A and B, should be designed as the receiver site for these shrubs. However, the habitat restoration should proceed in advance of relocating shrubs. Habitat restoration should provide sufficient mitigation for campus needs and can be done in advance of projects that require relocation of shrubs.

1.4 ***Use a variety of sources for elderberry shrubs planted at the mitigation site to test the role of source materials in VELB establishment*****.**

Many VELB mitigation areas rely on healthy appearing shrubs available from commercial nurseries as the source used in restoration efforts. The Russell Ranch mitigation area should use a variety of seed or plant stocks including, but not limited to seeds, seedlings or cuttings from nursery stock of known provenance, shrubs along Putah Creek at the Russell Ranch, shrubs from elsewhere along Putah Creek, and shrubs known to support VELB. Various stocks planted could then be monitored to determine whether VELB has a preference for particular plants and which shrubs do

better. Any necessary permits needed to take cuttings should obtained from the USFWS.

1.5 *Promote establishment of VELB at the mitigation sites by transplanting shrubs known to support VELB*.

Recent surveys along Putah Creek and on the campus have failed to find VELB. The distance over which VELB can disperse to locate potential host plants is unknown. It is possible that if suitable VELB habitat is created on the Russell Ranch, it may be too far from an existing population to be successfully colonized. The campus should work with the USFWS to find opportunities to transplant shrubs that do support VELB to the site. Inhabited shrubs may then serve as an inoculum to establish a larger population on the Russell Ranch. However, campus willingness to accept shrubs inhabited by VELB should not serve as a reason for moving existing populations of VELB, and the Russell Ranch should not serve as a mitigation site for non-campus projects.

1.6 *Investigate the possible role of introduced Argentine ants (Linepitherma humile) in the decline of the VELB*.

The Argentine ant is a non-native species that has a profound negative impact on the local insect fauna. Preliminary evidence exists suggests that Argentine ants and VELB do not occur together. These ants may eliminate VELB and prohibit their establishment. Alternative approaches to controlling Argentine ants on the mitigation site should be explored to determine whether or not VELB could be established in their absence.

2. SWAINSON'S HAWK MANAGEMENT

2.1 *Establish and manage low, open vegetation on Sites A and B that will allow foraging throughout the breeding season*.

Swainson's Hawks require low, open vegetation for foraging. Even alfalfa, the preferred foraging habitat in local agricultural landscapes, is not suitable foraging habitat once it becomes too tall and dense for the hawks to detect and capture prey. On campus, most of the potential foraging habitat for this species is generally kept low through grazing, mowing, plowing, harvesting, or some other means. Grassland habitat created on the Russell Ranch for Swainson's Hawk will require management to keep the proper vegetation structure and monitoring to determine the types and structure of native grassland used by foraging Swainson's Hawks. The techniques that appear to be most appropriate include mowing, grazing, and burning. A management regime must be established and maintained to sustain habitat with this structure.

2.2 *Remove existing windbreaks to reconnect the riparian vegetation along Putah Creek to the adjacent landscape*.

Swainson's Hawks forage from the wing and on the ground, and throughout their range forage and nest in areas with only scattered trees. Site A and the southern part of Site B have been isolated visually from the landscape to the north by existing poplar

windbreaks along the south side of the Willow Canal. Several rows of trees also have been planted within Site A. All or a large portion of these trees should be removed to provide open foraging habitat for Swainson's Hawks and to reconnect the mitigation areas to the adjacent landscape.

3. BURROWING OWL MANAGEMENT

3.1 *Focus Burrowing Owl mitigation actions on Site B*.

Active measures such as the installation of artificial burrows should occur primarily at Site B. This location is preferred because much of it is away from large trees serving as perch sites for predators that may prey on Burrowing Owls. Site A may serve as foraging habitat, and Burrowing Owls possibly could become established there but this would not be the site of active recruitment and establishment measures.

3.2 *Establish and manage low, open grassland vegetation on Site B*.

Burrowing Owls, like Swainson's Hawks, require inhabit sites with low, open vegetation. They require these habitat conditions for foraging and for visibility around their burrows. Thus, a management regime must be established and maintained to sustain habitat with this structure. See recommended action 2.1.

3.3 *Promote ground squirrel populations so that burrows will become available to Burrowing Owls*.

Ground squirrels are the source of most natural burrows used by Burrowing Owls. Therefore, management of the mitigation site should be done to promote establishment of ground squirrel populations. Existing literature should be reviewed and experts consulted to identify techniques that could be used to promote and maintain ground squirrel populations.

3.4 *Attempt to passively recruit Burrowing Owls to the site before attempting to relocate owls to the site*.

The preferred method for establishing Burrowing Owls on the mitigation site is by creation of suitable habitat and passive recruitment. Thus, the low, open grassland habitat should be created and the actions to promote ground squirrel populations should be implemented in order to attract naturally dispersing owls to the site. Approximately 6-8 artificial burrow structures should be provided, especially while ground squirrel populations increase. If after five to seven years, owls have not become established on the site at all or in sufficient numbers, then recommended action 3.5 should be implemented.

3.5 *If relocation of Burrowing Owls from other areas is tried, use and improve the latest relocation techniques*.

If relocation of Burrowing Owls is implemented, research on relocation techniques should be reviewed to determine the most successful current methods, then improved to help learn how this last-ditch method of mitigation for impacts to owls might be made more successful. The owls relocated to the mitigation site should come from sites as near as possible to prevent possible mixing if different genetic lineages. However, relocating Burrowing Owls to these sites should not serve as a reason for eliminating existing populations of Burrowing Owls, and the Russell Ranch should not serve as a mitigation site for non-campus projects.

4. RIPARIAN AND GRASSLAND RESTORATION IN MITIGATION AREA A

4.1 *Remove the windbreaks along the south side of the Willow Canal, within the interior of the site, and along the top of the Putah Creek bank*.

This recommended action is consistent with actions 2.1, 2.2, 3.2, and 5.1. These trees should be removed in order to create an open landscape for Swainson's Hawks and Burrowing Owls.

4.2 *Remove the orchard plantings within the Putah Creek banks and establish riparian vegetation with elderberry shrubs as a primary component of the restoration design*.

This recommended action for management of Site A is consistent with action 1.2.

4.3 *Remove the existing agricultural crops and replace with grasslands using native species*.

The low, open habitat type required by Swainson's Hawks and Burrowing Owls should be a grassland habitat that is composed of native species. Due to the relatively small size of the mitigation areas, the same mix of plant species should be established over the two soil types on Sites A and B. Recommended planting mixes are presented inAppendix B.

4.4 *Develop and implement a grassland management plan designed to keep the vegetation low and open*.

This recommended action for management of Site A is consistent with actions 2.1 and 3.2.

5. RIPARIAN AND GRASSLAND RESTORATION IN MITIGATION AREA B

5.1 *Remove the windbreak along the south side of the Willow Canal*.

This recommended action is consistent with actions 2.1, 2.2, 3.2, and 4.1. All or a large portion of these trees should be removed in order to create an open landscape for Swainson's Hawks and Burrowing Owls.

5.2 *Establish riparian vegetation along the swale with elderberry shrubs as a primary component of the restoration design*.

This recommended action is consistent with action 1.2.

5.3 *Remove the existing agricultural crops and replace with grasslands using native species of relatively short stature*.

The low, open habitat type required by Swainson's Hawks and Burrowing Owls should be a grassland habitat that is composed of native species. Due to the relatively small size of the mitigation areas, the same mix of plant species should be established over the two soil types on Sites A and B. Recommended planting mixes are presented inAppendix B.

5.4 *Develop and implement a grassland management plan designed to keep the vegetation low and open*.

This recommended action for management of Site B is consistent with actions 2.1 and 3.2.

6. OTHER RUSSELL RANCH AREAS

6.1 *Add parcel M-3 located between Russell Boulevard and the swale on the north side of Site B to the mitigation area*.

This approximately 20-acre parcel should be added to Site B to extend the mitigation area and minimize negative effects of agricultural activies on the swale and restoration area. Since much of the remainder of the mitigation area will be closed to general use by the public, this parcel should be designed to inform the public about the mitigation project and to be used by larger groups that might be inappropriate for the remainder of the site.

6.2 *Preserve the option to expand the mitigation area to include lands south of Russell Boulevard, east of Kinsella Lane, and west of Road 95A*.

As the campus grows, it likely will need additional mitigation lands to offset the effects of campus growth. Parcels K-4, L-1, L-2, L-3, and M-1 total approximately 230 acres and should be held as the possible site for additional mitigation lands. No permanent land assignments of these parcels should occur until the option of using

them for biodiversity conservation and restoration is considered. Adding these parcels to the mitigation area would have the benefits of linking with Sites A and B and creating one contiguous parcel of approximately 390 acres. Large mitigation areas are more valuable than small, disjunct sites. In addition, the site would provide a much-needed teaching area within close proximity to the campus.

6.3 *Preserve some of the landscaping around the former houses in Site A*.

In recognition of the past uses at the Russell Ranch some of the existing landscaping that surrounded the former ranch buildings on Site A should be preserved as part of the site design. Adventitious, noxious species should not be retained.

7. IMPLEMENTATION AND MONITORING

7.1 *Provide staffing to oversee implementation of the concept plan*.

Staffing must be provided to: (1) implement the management measures described above; (2) ensure that long-term scientific monitoring data are collected as described in Tasks 7.2, 7.3, and Appendix C; (3) allow for adaptive management in response to changed conditions and development of new information; (4) coordinate efforts at the Russell Ranch with habitat enhancement efforts on other west campus lands, and (5) develop an educational and community outreach program including coordinating internships and class involvement. A separate proposal to address the staffing issue has been developed and funded. That proposal included staffing needs for the Putah Creek Riparian Reserve as well as mitigation lands at the Russell Ranch.

7.2 *Conduct baseline studies on the mitigation lands prior to implementing the mitigation measures.*

Baseline data on the mitigation lands would be developed to catalog and describe resources that are currently on the site. These studies would focus on characterization of the existing vegetation and special status species. The results would be used to help finalize and implement the mitigation plan and would serve as a basis for comparison to determine the effectiveness and efficacy of the mitigation efforts.

7.3 *To contribute to knowledge about mitigation, develop and implement a scientific monitoring plan to evaluate the efficacy and success of mitigation efforts.*

As described at the beginning of the concept plan, one of goals for the mitigation area is to evaluate the efficacy and success of mitigation efforts. A sound scientific protocol is needed to measure relevant variables to make these determinations. A preliminary list of criteria for determining mitigation success is included in Appendix C. These criteria should be modified, if appropriate, as more is learned about the site and results of the mitigation actions. Reporting should be done at least annually.

7.4 ***Provide annual funding for two research assistantships to create an inventory of resources on the site before implementing habitat restoration and to monitor resources on the site after the restoration measures are implemented.***

These research assistantships would fund students to collect the data needed to implement tasks 7.2 and 7.3; research assistants also will aid the site manager with other data collection efforts.

SCHEDULE

- Recruit and hire manager/steward – Spring 2002
- Conduct pre-project baseline studies – Spring 2003
- Begin implementation of habitat restoration – Fall 2002 through Fall 2003
- Ongoing site management and monitoring studies - indefinite

APPENDIX A

MEMBERS OF THE RUSSELL RANCH MITIGATION AREA DESIGN CONCEPT COMMITTEE

Members:

Associate Professor Ford Denison, *Agronomy and Range Science*
Environmental Planner Sid England, *Co-Chair, Planning and Budget*
Professor Susan Harrison, Co-Chair, *Environmental Science and Policy*
Postdoctoral Researcher Gary Huxel, *Environmental Science and Policy*
Management Services Officer Dave Klippert, *Agricultural Services*
Graduate Student Colleen Lenihan, *Wildlife Fish and Conservation Biology*
Graduate Student Dan Leroy, *John Muir Institute of the Environment*
Professor Maureen Stanton, *Evolution and Ecology*
Senior Animal Technician Bret Stedman, *Animal Resources Service*
Professor David Robertson, *English*
Reserve Steward Dan Tolson, *Natural Reserve System*
Associate Professor Truman Young, *Environmental Horticulture*

Consultants to the Committee:

John Anderson, Hedgerow Farms
Jim Estep, Jones & Stokes Associates
Harry Oakes, Jones & Stokes Associates

Other contributors:

Research Associate Brenda Johnson, Formerly with UC Davis *Center for Ecological Health Research*

APPENDIX B

GRASSLAND SITE PREPARATION, SEEDING AND MANAGEMENT PLAN

- **SITE PREPARATION AND MANAGEMENT RECOMMENDATIONS**
  - **Winter 2002/Early Spring 2003**
    - Document alien weedy species to assess weed seed bank and future management protocols. Fallow all sites assuming existing vegetation is dominated by exotic weedy species. The goal is to eliminate weed seed production.
    - The following treatments can be used for fallowing.
      - Disk all areas before seed has formed. The advantage of disking is that a good seed bed can be established and deep soil moisture will be retained to aid in fall establishment in lieu of dry conditions; or
      - Chemically fallow with herbicides (glyphosate and possibly others depending on weeds). A prescribed fire may be appropriate prior to seeding to reduce thatch.
  - **Summer 2003**
    - Control late maturing summer weeds with herbicides or disking.
  - **Fall 2003 (October-November**)
    - Following germinating rains, seed appropriate mixtures with a range drill.
    - Assuming a large flush of weedy species, apply glyphosate herbicide approximately 10 days following seeding or before seeded species have germinated. Weeds can be sprayed prior to seeding, but in general more will germinate in the delay window.
  - **Spring 2004 (February-April)**
    - Control broadleaf weeds with selective herbicides such as 2-4-D, MCPA, Banvyl, Buctil, and/or Transline.
    - If grass weeds are a problem, control with mowing, haying, grazing, burning or wick herbicides.

- **RECOMMENDED GRASSLAND SEED MIXTURES**
  - **Elderberry savannah on Yolo silt loam soils**
    - **Grasses**

Plant Species	Application (lbs/acre)	Live seeds per sq. ft.
Creeping wildrye (*Elymus triticoides*)	6	15.0
Blue wildrye (*Elymus glaucus*)	4	10.8
Yolo slender wheatgrass (*Elymus trachycaulus*)	2	3.6
Meadow barley (*Hordeum brachyantherum*)	6	9.6
TOTAL	18	39.0

    - **Forbs** – In lieu of an extensive broadleaf wed seed bank, forb species would not be planted the first year due to the necessity to use broadleaf herbicides. Forb species could be planted following a prescribed fire in the third or fourth year of the project. Recommended species include: gum plant (*Grendelia camporum*), yarrow (*Achillea millefolium*), Spanish clover (*Lotus purshianus*), tomcat clover (*Trifolium wildenovii*), bull clover (*Trifolium fucatum*), and arroyo lupine (*Lupinus succulentis*). Seeding rates would be higher than listed.

  - **Upland grassland on dryer site Corning gravelly loam and Rincon silty clay loam soils**
    - **Grasses**

Plant Species	Application (lbs/acre)	Live seeds per sq. ft.
Purple needlegrass (*Nassella pulchra*)	8	10.0
Nodding needlegrass (*Nassella cernua*)	3	10.0
One-sided bluegrass (*Poa secunda*)	2	27.6
Six weeks fescue (*Vulpia mychrostachya*)	1	15-20
Squirrel tail (*Elymus multicetus*)	3	4.5
California oniongrass (*Melica californica*)	3	13.8
TOTAL	20	80.9-85.9

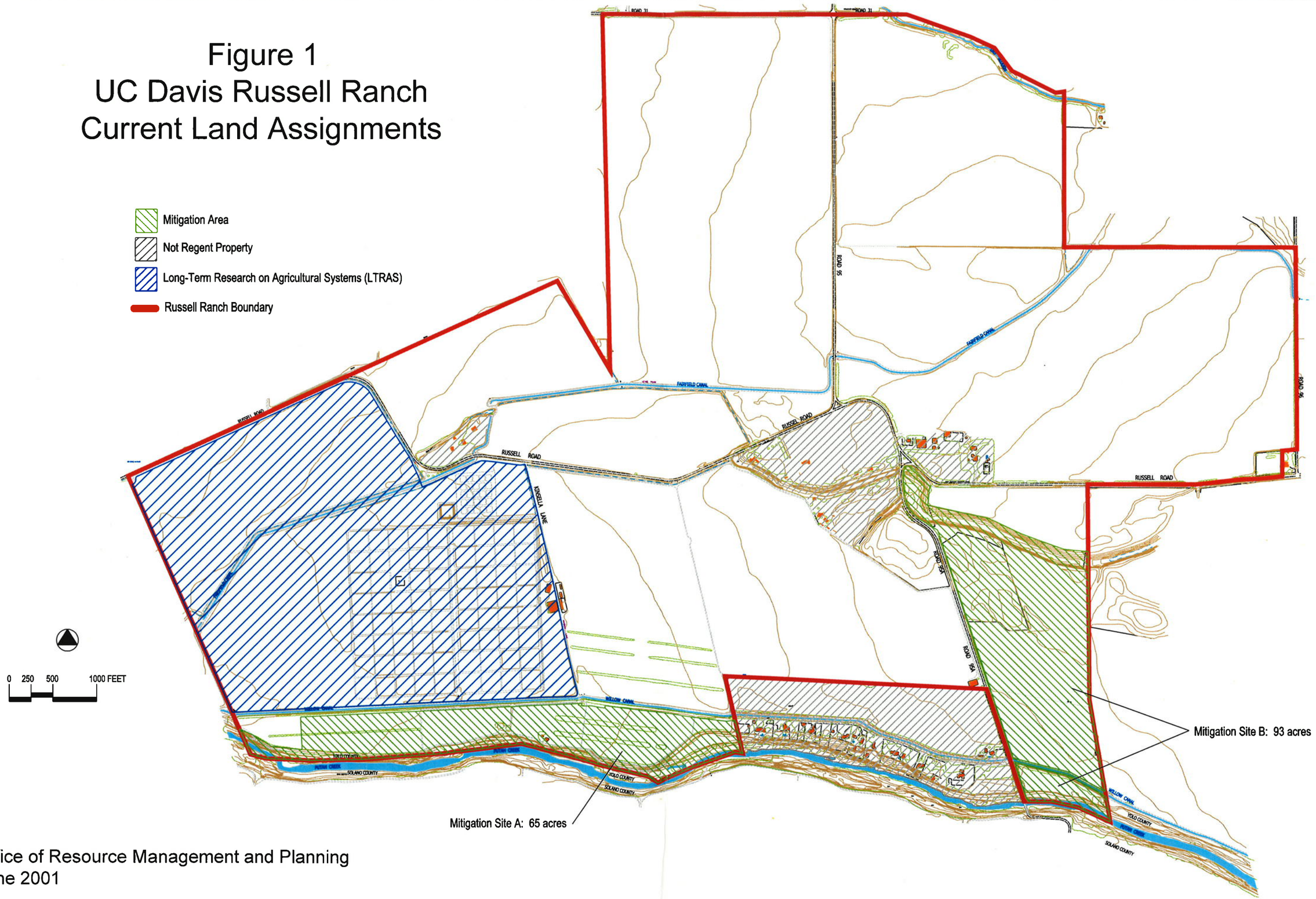
    - **Forbs** – In lieu of an extensive broadleaf wed seed bank, forb species would not be planted the first year due to the necessity to use broadleaf herbicides. Forb species could be planted following a prescribed fire in the third or fourth year of the project. Recommended species include: California poppy (*Eschscholzia californica*), yarrow (*Achillea millefolium*), red maids (*Calandrinia ciliata*), small-flowered lupine (*Lupinus bicolor*), Turkey mullen (*Eremocarpus setigerus*), vinegar weed (*Trichostoma lanceolatum*), spike weed (*Hemizonia pungens*), owl's clover (*Orthocarpus purpurascens*), and tomcat clover (*Trifolium wildenovii*). Seeding rates would be higher than listed.

APPENDIX C

CRITERIA FOR ASSESSING MITIGATION SUCCESS

- **GRASSLAND RESTORATION**
    - Experiments: native grass plantings on 40-50 1-hectare plots, stratified by soil type; two levels of burning (yes/no); three levels of grazing (none/"best practice"/"usual practice")
    - Monitor: grassland composition - identity, number, percent cover of native and exotic species
    - Criteria: high diversity and cover of native species; low weed cover; and sustainability with low input
- **VALLEY ELDERBERRY LONGHORN BEETLE**
    - Experiments: 2-3 ant control treatments; 2 sources of bushes; 2-3 elderberry clump sizes (for effects on beetles); weed control and bird perches (for effects on elderberry recruitment)
    - Monitor: exit holes, ant densities, elderberry recruitment
    - Criteria: natural colonization, successful maturation, population increase and stability; densities comparable with known values for natural habitat
- **BURROWING OWLS**
    - Experiments: grassland treatments (above)
    - Monitor: abundance of ground squirrels; abundance of prey; foraging activity, nesting, and nesting success of owls
    - Criteria: stable, sustained burrowing owl population; burrow density and nest success comparable to values from natural habitat
- **SWAINSON'S HAWKS**
    - Experiments: grassland treatments (above)
    - Monitor: abundance of prey; foraging activity (compare with LTRAS agricultural plots)
    - Criteria: foraging activity at least equal to that on agricultural land; may be able to compare hawk and owl habitat gains at Russell Ranch with losses on the land converted to development

Figure 1
UC Davis Russell Ranch
Current Land Assignments



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