Richmond Field Station
Grassland Constraints Analysis

FINAL

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TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF TABLES

SUMMARY

The University of California proposes to establish a new major research campus at properties it owns in Richmond, California, including the Richmond Field Station (RFS), for consolidation of biosciences programs of the Lawrence Berkeley National Laboratory (LBNL) and for development of additional research-related facilities for both LBNL and UC Berkeley (UCB). The University proposes to rename a subset of the properties as the "Richmond Bay Campus" ("RBC").

The RFS, a satellite property for UCB which is located in the City of Richmond in the western portion of Contra Costa County, supports a coastal terrace prairie grassland vegetation community, which is a unique natural vegetation community in the region. Since 1993, numerous vegetation community studies have been conducted and restoration and management activities have taken place within the RFS site.

Wildlife Research Associates and Jane Valerius Environmental Consulting were commissioned by the University to conduct a constraints analysis of the coastal terrace prairie grassland. The intent of this analysis is to compile available information, consider these resources present on-site and provide some insight into environmental issues that should be addressed during environmental review processes under the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA). As part of the analysis of the current condition of the coastal terrace prairie grassland on the RFS site, we evaluated these meadow areas based on a variety of Special Status vegetation criteria established by the California Department of Fish and Wildlife (CDFW), as well as on other parameters that are unique to the site. The habitat value affecting qualifiers (e.g., size of the meadow, whether it is spatially isolated, hydrologically changed, etc.) are evaluated per meadow, which provides a more precise description of the existing grasslands values. Based on this review, potential impacts from the proposed development can be better addressed during the NEPA and CEQA process.

Located on the eastern edge of the San Francisco Bay, in the City of Richmond, the RFS is bounded by Meade Street, which runs parallel to Interstate 580 to the north, by Meeker Slough/Regatta Boulevard to the west and by South 46th Street to the east. The East Bay Regional Park District Bay Trail traverses the western portion of the property along the West Stege saltmarsh. The entire RFS campus encompasses 162 acres, of which 42 acres are undeveloped meadows that support grasslands. The site topography consists of gently south-facing, sloping lands with poorly drained clay soils.

The coastal terrace prairie grassland has undergone on-site restoration as part of the mitigation required for impacts of on-going remediation of historic contamination at the site. A collaborative effort between Jepson Herbarium and other UCB staff and faculty, the Watershed Project Staff, and local restoration experts, resulted in creation of grassland goals and objectives for the area identified for mitigation restoration. In 2003, the restoration was begun and monitoring occurred for four years. In 2007 a grassland maintenance regime that included mowing schedules per season, with appropriate heights to ensure survivorship of perennial grasses was instigated.

This analysis is an update describing existing conditions on the site and new vegetation classifications. We ranked the quality of coastal terrace prairie grassland habitat based on presence of absolute cover of California oatgrass (>25%) and/or purple needlegrass (5%) as described by the membership rule of the series in the Manual of California Vegetation (Sawyer, et al. 2009).

Coastal Terrace Prairie Grasslands Constraints
In general, lands used for mitigation cannot be impacted with future projects. Therefore, the southern portion of the Big Meadow and central portion of the West Meadow cannot be impacted due to their designation as mitigation lands, because remediation of the Western Stege Marsh in 2003 required unavoidable paving of a portion of historic grassland to create asphalt mixing pads for sediments removed from the marsh (The Watershed Project 2007, p. 4 of 77). On-site restoration of an ecosystem that has been degraded, damaged, or destroyed is often used as in-kind mitigation for impacts to sensitive communities and mitigation ratios have been developed for similar vegetation communities.

According to David Amme (2005), there are no other sites that match the soils and hydrology that occur at the RFS. If insufficient acreage occurs on the RFS site to mitigate for impacts to the coastal terrace prairie, then off-site creation mitigation may potentially be required, which would also require consultation with the agencies during the CEQA review. Such opportunities would have to be further investigated.

A buffer or set back should be developed between any buildings and the coastal terrace prairie grassland so that factors associated with construction and structures (i.e., soil compaction, high flow runoff from the roofs, etc.) do not impact the edges of the prairie grasslands. These factors potentially impacting the grasslands would have to be investigated and addressed during the CEQA review.

A geotechnical study would be required to determine adverse effect to the soils and hydrology in the Big Meadow if trenching, excavation or underground tunneling is proposed that will disrupt the soil profile. The grasses can reach 3 to 4 feet in rooting depth and California oatgrass is associated with mesic sites so any alteration of the hydrology, whether surface or groundwater, could have an adverse impact.

Although green roofs, similar in concept to the replanting of a concrete berm, often use native plant species, they are typically species that are adapted to shallow soils, usually less than 12 inches in depth, and are fragile in windy areas. In addition, the slopes of berms would require complex drainage and watering systems to prevent water from taking the path of least resistance and to remain on the berm long enough for adequate moisture.

Wildlife Constraints
Removal of the Eucalyptus grove may result in impacts to the monarch butterfly habitat, which is limited in the San Francisco Bay Area. Further analysis would be required to consider possible alternative species plantings that may also provide monarch habitat.

Removal of the Eucalyptus grove and existing shrubs may result in impacts to nesting birds if conducted during the nesting season (March through August). It is recommended that removal occur outside the nesting season.

Removal of existing buildings may impact roosting bats. A bat habitat assessment evaluating the potential for roosting is required prior to any removal and can be conducted at any time of the year. If suitable roosting habitat is determined to be present, it is recommended that removal of such habitat occur outside the hibernation season (October through February) and the maternity season (April through August).

1.0 INTRODUCTION

Wildlife Research Associates and Jane Valerius Environmental Consulting were commissioned to conduct a constraints analysis of the coastal terrace prairie grassland. The purpose of this constraints analysis is to assist the University of California, Berkeley (UCB) and Lawrence Berkeley National Laboratory (LBNL) with the identification of key environmental issues that should be analyzed during the planning and preliminary analysis of proposed development at the University of California Richmond Field Station, located in the southern portion of the City of Richmond, Contra Costa County, with regards to biological resources. This constraints analysis primarily focuses on environmental compliance with respect to the coastal terrace prairie grassland, a vegetation community that is unique to this portion of the western Contra Costa County.

Considered one of the largest and best-preserved remaining areas of native coastal grasslands once prevalent throughout the San Francisco Bay Area (Tetra Tech and Sea Engineering 2007), the coastal terrace prairie grassland at RFS, as described by *A Manual of California Vegetation* (Sawyer, et al. 2009), which provides a standardized, systematic classification and description of vegetation in the California, is made up of two vegetation alliances. These alliances are the California oatgrass prairie (*Danthonia californica*) (#41.050.00) and purple needlegrass grassland (*Nassella pulchra*) (#41.150.00) and are identified in the California Natural Diversity Data Base, run by the California Department of Fish and Wildlife (CDFW), as coastal terrace prairie grassland and valley needlegrass grassland, respectively.

The intent of this analysis is to compile available information, consider these resources present on-site and provide some insight into environmental issues that will need to be addressed during the environmental review and permitting process. As part of the analysis of the current condition of the coastal terrace prairie grassland on the RFS site, we evaluated these meadow areas based on a variety of Special Status vegetation criteria established by the CDFW, as well as on other parameters that are unique to the site. The habitat value affecting qualifiers (e.g., size of the meadow, whether it is spatially isolated, hydrologically altered, etc.) are evaluated per meadow, which provides a more precise description of the existing grasslands values. Based on this review, potential impacts from the proposed development can be better addressed and the grassland areas that are identified with higher values than other areas can be better protected. Specifically, the purpose is to (1) determine whether there are potential liabilities or "fatal flaws" that would preclude or prohibit project implementation and (2) assess the project and recommended alternatives from an environmental permitting/compliance perspective including potential permitting and mitigation requirements, timelines and costs.

1.1 Existing Area Description

The Richmond Field Station, located at 1301 South 46th Street in Richmond California, is currently owned by the University of California Regents for use by the UCB campus. Once part of the larger Rancho San Pablo, the RFS is located on the eastern edge of the San Francisco Bay, in the south central portion of the City of Richmond (Figure 1). The RFS is bounded by Meade Street, which runs parallel to Interstate 580 to the north, by Meeker Slough/Regatta Boulevard to the west and by South 46th Street to the east. The East Bay Regional Park District Bay Trail traverses the southern portion of the property along the Western Stege saltmarsh. Totaling 162 acres, the upland habitat encompasses 96 acres, which is comprised of industrial-zoned land used primarily for research and education (Tetra Tech and Sea Engineering 2007). Of these 96 acres, approximately 42 acres are undeveloped meadows that support grasslands.

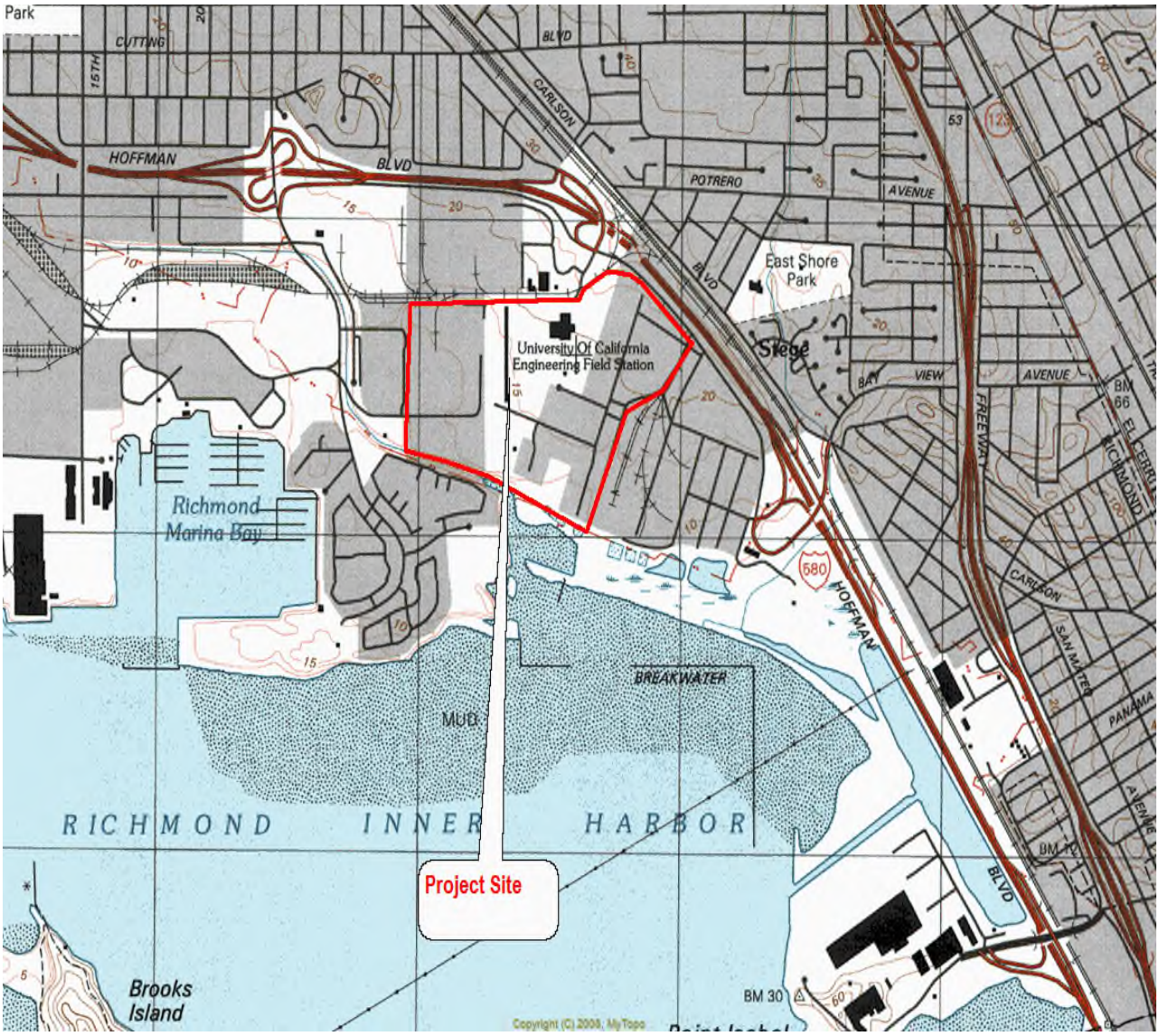

Figure 1 – Richmond Field Station Project Site

The undeveloped meadows, comprised of 13 discrete areas, are located primarily along the western portion of the RFS with the largest (Big Meadow) being 13 acres, as shown Figure 2 of the *Richmond Field Station Final Botanical Survey Report* (URS 2007) (Figure 2). All other meadows range in size between 1-5 acres. For purposes of this report, the property consists of those lands within the 96 acre property boundaries which comprise grasslands and seasonal wetlands.

The soil is a mixture of poorly drained clay of the Clear Lake –Cropley Association, that often forms a perched water table in the winter rainy season and has a high shrink-swell potential, and the Joice-Reyes association, that is very poorly drained saline mucks and silty clays on saltwater marshes and tidal flats (USDA 1977).

1.2 Background Studies

As described in the *Richmond Research Center Master Plan Environmental Impact Report: Existing Conditions of Grassland Resources* (David Amme Associates 1993), biological studies have been conducted at the RFS since 1963. Among the research completed are small mammal enclosure experiments, and inventories of flowering plants, reptiles, amphibians, mammals and birds. In the report, the study area was divided into three discrete areas, 1) the area east of the eucalyptus grove, 2) the area west of the eucalyptus grove, and 3) the created land south of the chain-link fence (now located south of the existing EPA building) (David Amme Associates 1993).

After conducting field surveys in October and November 1993, Amme further refined these three areas into grasslands that were classified into four categories and are described as follows (David Amme Associates 1993):

- Disturbed/closely mowed grassland – this vegetation type is directly related to mowing regime and is dominated by California oatgrass with purple needlegrass in fewer numbers.
- Disturbed/exotic grassland – this vegetation type is dominated by exotic grasses and weeds and existed where recent soil disturbance and compaction occurred.
- Disturbed coastal prairie – this vegetation type contains between 10 to 50% cover of native prairie plant species mixed with exotic weeds and grasses depending on the site, moisture regime or mowing frequency. In areas of irregular topography vernal standing water was evident. Small mounds of soil deposition allow for native perennial grasses and forbs
- Least disturbed coastal prairie – this vegetation type contains 50% cover of native prairie species. In some areas native vegetation constitutes up to 100% of vegetative cover.

Although coastal terrace prairie has been reported in other localities in Contra Costa County, the RFS site was identified as unique in that it represented the only coastal prairie grassland on lowland clay soils (David Amme Associates 1993). As a result, this original study concluded that the remnant coastal prairie grassland was scientifically and ecologically invaluable and virtually impossible to recreate (David Amme Associates 1993).

Since 1993, the science of restoration has progressed and evidence of restoration can be seen at the RFS. As mitigation for loss of an historic grassland area that was used for staging facilities as part of the marsh soil remediation for the Stege Marsh in 2003, as described in the *Berkeley*

URS	Richmond Field Station - UC Berkeley Project - 17325753.00	Study Area	Figure 2

Richmond Field Station Remediation and Restoration Project Habitat Restoration Progress Report 2003 – 2007 (The Watershed Project 2007), portions of the coastal terrace prairie on the RFS were restored. A collaborative effort between Jepson Herbarium and other UCB staff and faculty, the Watershed Project Staff and local restoration experts resulted in creation of grassland goals and objectives for the area identified for mitigation restoration.

The area chosen for restoration was within the 19-acres located in the western portion of the RFS, as depicted in Figure 10 of the *Richmond Field Station Working Paper* (UC Berkeley 2002). Within these 19 acres, UC Berkeley Chancellor Chang-Lin Tien (Tien 1996), describing a master plan for the Field Station that was never completed, identified 8.7-acres of coastal terrace prairie grassland "situated in the center of one of the largest contiguous open areas on the property" that would be set aside as a "valuable reserve." Chancellor Tien further stated that the Master Plan incorporated measures for protection of the habitat, such as no development of the coastal prairie grassland area and establishment of the area as a valuable reserve. The letter further identifies preservation measures, such as guidelines to protect the grassland, fencing to discourage human intrusion, preservation of a grassland corridor along the western boundary of the Richmond Field Station property between the prime grassland and the marsh and shoreline open space (Tien 1996).

Although the Richmond Field Station master plan was never completed, the preservation principle was carried forward. The *Richmond Field Station Working Paper* (UC Berkeley 2002), created to establish a land use framework for RFS that reflects "an optimal balance of program needs and environmental stewardship," further expands on Chancellor Tien's letter and proposes to preserve 19 acres of grassland and seasonal wetlands that occur in the western portion of the RFS (Figure 10, UC Berkeley 2002). Under the Recommended Development Principles in this paper is, "*Principle 1. Preserve the most valuable native grassland and wetland habitat areas on the site and link these to the salt marsh via a grassland corridor."*

Specific details on the mitigation requirements, goals, objectives and methods are described in the *Habitat Restoration Progress Report 2003 – 2007* (The Watershed Project 2007). The grassland resources at the RFS have been identified as areas of Unique Restoration Opportunities in the Baylands Ecosystem Habitat Goals Report (http://www.sfei.org/sfbaygoals/docs/goals1999/outline.html) completed through the Wetlands Ecosystems Goals Project (Tetra Tech and Sea Engineering 2007).

In 2004, to ensure control of non-native and invasive species in the mitigation restoration area, a pilot program of hand removal was instigated in the upland grassland plots identified for mitigation (The Watershed Project 2007). Various control methods were analyzed and included hand removal and mulching (with 3-6 inches of sterile rice straw), herbicide treatment (1.5 % glyphosate), herbicide treatment (1.5% glyphosate) and mulch (with 3-6 inches of sterile rice straw) and hand removal (Blasland, Bouck & Lee, Inc. 2004). Control efforts were further refined and presented in the *Richmond Field Station Remediation and Restoration Project Habitat Restoration Progress Report 2003 – 2007* (The Watershed Project 2007), with specific techniques identified per invasive species.

The results of the four years of monitoring of the coastal terrace prairie grassland, which was conducted prior to controlling invasive species, provided ocular estimates of invasive non-native species ranging between 60-70% of absolute cover for Harding grass, with an additional 15% of other invasive plant species (The Watershed Project 2007). Following treatments and 2 years of revegetation in the Big Meadow, non-native cover dropped to 25% with an average of 48% cover of natives, with the remainder being covered by mulch or bare soil, with high survivorship

(>60%) being reported (The Watershed Project 2007). The overall survivorship of planting the West Meadow was less (<30%), due to compacted substrate and fragments of cement and other debris (The Watershed Project 2007).

In 2007, URS recommended a native grassland maintenance and exotic plant control mowing regime that included mowing in the spring and summer, at an appropriate height of 6 to 8 inches to ensure survivorship of perennial grasses (URS 2007).

1.3 Regulatory Considerations

This vegetation community and individual plants are not protected under the Federal Endangered Species Act. At the State level, the CDFW has designated some plant communities as "sensitive natural communities" (CDFG 2013). The primary purpose of the classification is to assist in the location and determination of significance and rarity of various vegetation types. Thus, ranking of natural communities by their rarity and threat is an important facet of the classification. In the List of California Terrestrial Natural Communities Recognized by The California Natural Diversity Database (CNDDB) April 2013 Edition document, as in previous CNDDB community lists, asterisks (*) denote special communities that are either known or believed to be of high priority for inventory in CNDDB. Lead and trustee agencies may request that impacts to these communities be addressed in environmental documents. Local agencies may also have policies requiring avoidance of rare community types. Our professional experience and industry standards have shown that mitigation is typically required (LSA Associates 2006; WRA 2008), and varies between restoration of degraded habitats on-site to creation of new habitats located off-site.

Although no specific mitigation requirements are established for impacting coastal terrace prairie grassland under CEQA, industry standards have shown that mitigation ratios of 1:1 for on-site restoration are typical (LSA Associates 2006; WRA 2008). Restoration, as defined by The Society for Ecological Restoration (www.ser.org) and quoted by Stromberg, et.al. (2007), is, "…the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed." An ecosystem has recovered and is considered restored through a variety of parameters, such as, a) it contains a characteristic assemblage of the species that occur in the reference ecosystem and that provide appropriate community structure, b) the physical environment of the restored ecosystem is capable of sustaining reproducing populations of the species necessary for its continued stability, c) it apparently functions normally for its ecological stage of development, and signs of dysfunction are absent, d) it is suitably integrated into a larger ecological matrix or landscape, with which it interacts through abiotic and biotic flows and exchanges, and e) it is sufficiently resilient to endure the normal periodic stress events in the local environment that serve to maintain the integrity of the ecosystem, among others.

If insufficient acreage occurs on the RFS site to mitigate for impacts to the coastal terrace prairie, then off-site creation mitigation may potentially be required, which would also require consultation with the agencies during the CEQA review. Therefore, the requirements for off-site creation are unknown at this time.

2.0 METHODS AND LIMITATIONS

For this constraints analysis, we reviewed the following reports (chronological order) and articles prepared for the RFS:

- Richmond Field Station Final Botanical Survey Report - URS 2007
- Current Conditions Report, University of California, Berkeley, Richmond Field Station, Richmond, California - Tetra Tech EM Inc and Sea Engineering Inc. 2007
- Final Report for the University of California, Berkeley Richmond Field Station Remediation and Restoration Project Habitat Restoration Progress Report (2003 – 2007), and Appendices – The Watershed Project 2007.
- UC Richmond Field Station's Remnant Coastal Terrace Grassland – Amme 2005
- Invasive/Exotic Vegetation Management Program – Blasland, Bouck and Lee, 2004
- West Stege Marsh Upland Revegetation Plan (2003-5) U.C. Berkeley Field Station Aquatic Outreach Institute 2004
- Invasive/Exotic Vegetation Management Program. University of California, Berkeley, Richmond Field Station - BBL, Inc. January 2004.
- Richmond Field Station Remediation Project: Initial Study California Environmental Quality Act – URS 2003
- Richmond Field Station Working Paper - U.C. Berkeley 2002
- Baylands Ecosystem Habitat Goals: A report of the habitat recommendations - San Francisco Bay Area Wetlands Ecosystem Goals Project 1999.
- Letter to Honorable Tom Bates, Member of the Assembly - Chancellor Tien, C. 1996.
- Richmond Research Center Master Plan. Environmental Impact Report. Existing Opportunities and Constraints Report - Brady & Associates Planners and Landscape Architects 1994.
- Richmond Research Center Master Plan, Environmental Impact Report: Existing Conditions of Grassland Resources - Amme 1993
- Native Perennial Grass Establishment and Management – Paul Kephart and David Amme 1992.
- The Natural Areas of the University of California Richmond Field Station - Gutstein 1989.

Two site visits were conducted, on April 19 and May 15, 2012, by Wildlife Research Associates ecologist Trish Tatarian, and Jane Valerius Environmental Consulting botanist and plant ecologist Jane Valerius. The site visits were conducted to ground truth and update the results of the *Richmond Field Station Final Botanical Survey Report* (URS 2007), in which coastal terrace prairie grassland was identified and mapped based on the presence of either California oat grass or purple needle grass, as well as with ≥6 other East Bay California Native Plant Society (EBCNPS) ranked A or B plant species. This update reflects the latest rankings of grassland habitats adopted by the agencies.

2.1 Standardized Grassland Evaluation

To update the results from the URS (2007) report, we ranked the quality of coastal terrace prairie grassland habitat based on presence of absolute cover of purple needlegrass (5%) and/or California oatgrass (>25%), as described by the membership rule of the series in the Manual of California Vegetation (MCV) (Sawyer, et al. 2009) (Appendix A), and was not dependent on the presence of other native plant species. The rankings at the RFS meadows are as follows:

High Quality: California oatgrass (>50%) and/or purple needlegrass (20%)
Medium Quality: California oatgrass (25-50%) and/or purple needlegrass (5-19%)
Low Quality: California oatgrass (0-24%) and/or purple needlegrass (0-4%)

To determine absolute cover, Jane Valerius conducted reléve surveys (Mueller-Dombois, et al. 1974; CNPS 2000), which entailed focused walking transects through the known vegetative community/alliance (i.e., California oatgrass). Relevés can be used in vegetation studies as a practical, relatively fast means of collecting information on vegetation. We assumed, based on the information provided on soils and other site factors presented in the Richmond Field Station Final Botanical Survey Report (URS 2007), that the sampling was homogeneous for coastal terrace prairie grassland and we were able to focus on the percent cover of each species to determine if the plot (i.e., meadow allocation) supported the minimum percentage of individuals to allow it to qualify for either California oatgrass or purple needle grass.

This reléve methodology allowed us the quickest way to analyze and evaluate the areas using the membership rules from MCV (Sawyer et al 2009). This method consisted of subjective sampling, and was qualitative, allowing us to estimate species cover based on basal area rather than measure it, but also allowed for quantitative measurements for the two target species: California oatgrass and purple needlegrass.

2.2 Qualitative Grassland Evaluation Criteria

We further evaluated the quality of the coastal terrace prairie grasslands beyond the membership rule of the series in the MCV (Sawyer, et al. 2009). We used the California Department of Fish and Game (CDFG) method for *Addressing High Priority Vegetation Types* (http://www.dfg.ca.gov/biogeodata/vegcamp/natural_comm_background.asp), which allows for judgment of quality based on a flexible set of criteria such as the range of existing sustainable occurrences of this element or vegetation type based on site quality, defensibility, size, and surrounding landscapes. These criteria vary based on the type of vegetation or natural community and the range of existing occurrences known. For example, high quality natural vegetation will have the following characteristics:

- lack of invasive exotic species,
- no evidence of human-caused disturbance such as roads or excessive livestock grazing, or high-grade logging,
- evidence of reproduction present (sprouts, seedlings, adult individuals of reproductive age), and
- no significant insect or disease damage, etc.

We also used criteria for evaluating impacts to Natural Communities (DFG *Protocols for Surveying and Evaluating Impacts to Special Status Natural Communities* - http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/Protocols_for_Surveying_and_Evaluating_Impacts.pdf), but did not evaluate potential impacts to the community from a specific project. We evaluated the quality of the grassland community based on the following:

- consideration of nearby populations and total species distribution;
- the consideration of nearby occurrences of special status communities and natural community distribution; and
- analysis of potential threats, including those from invasive species, to the plants and natural communities.

Based on the above criteria and evaluations, the following value affecting qualifiers were used for the coastal terrace prairie at the RFS, using the background reports stated above for baseline information. The Big Meadow was used as the control meadow for the following qualifiers:

- Acreage – Larger, contiguous areas have more value than smaller, disconnected areas. We evaluated the meadows from the potential effects from eucalyptus trees, which are non-native, provide a very high canopy cover, and are allelopathic (i.e., chemical leachates from leaves and bark cause understorey suppression) reducing the viability of native herbaceous grasses. As a result, eucalyptus trees were removed from the acreages of meadows available.
- Location to eucalyptus grove – areas located east of the eucalyptus grove are smaller in size, shaded and surrounded by development and receive landscaping/maintenance mowing regime. All of these factors reduce the value and integrity of the grassland areas. Areas to the west of the eucalyptus are larger in acreage, are spatially connected, are not shaded, have less development and invasive plant control mowing regime.
- Management Regime (mowing) - a) *Exotic plant control* -The URS (2007) report recommended that exotic plant species be controlled by mowing, which entailed spring and summer mowing at a height of 6-8 inches.
  b) *Landscaping/maintenance* – landscape mowing which typically occurs once a month, reduces the non-vegetative reproduction (i.e., seed source).
- Previous disturbances (1993-2012) – such as soil deposition, are based on Amme (1993).
- Wetlands present - Wetlands were identified based on Current Conditions Report (Tetra Tech and Sea Engineering 2007).
- Hydrology alteration – coastal terrace prairie grassland requires wetland mesic soil conditions. If the hydrology is altered (i.e., channelized for directing locational flow for purposes of draining a meadow) to reduce the mesic conditions, then the value for the community is reduced.
- Reproduction present/absent – 2012 surveys not conducted during the flowering season.
- Insect/disease -
- Species diversity – Species composition is based on the URS (2007) report.
- Threats – a) *Invasive species* (Shrub/Herbaceous) – invasive control required for coyote bush and Harding grass
  b) *Disconnected spatially* – trees located between meadows that reduce seed dispersal
  c) *Surrounded by development* – buildings reduce seed dispersal, roadways are not considered barriers other than hydrologic alteration from channelization
  d) *Wind isolated* – prevailing wind direction occurs from the south and southeast from Richardson Bay.

In summary, at the landscape level, on the east side of the eucalyptus groves, the barriers between the meadows (i.e., Eucalyptus Meadow, North Meadow Far North Meadow, etc.) include the trees and the buildings. On the west side, at the landscape level, these barriers are not present between the meadows.

To provide further ranking of these criteria per meadow, we assigned the number "1" when it was beneficial for grasslands (i.e., wetlands present) and a "0" when it was not beneficial (e.g., hydrology altered). For the standardized evaluation of vegetative presence, we rate high quality with "3" and low quality with "1". The following are the rankings.

Table 1: Qualitative Criteria Rankings

Standardized evaluation based on % cover	**H=3, M=2, L=1**	
Acreage [a]	**>3 = 1**	**<3 = 0**
Location to eucalyptus grove	**W = 1**	**E = 0**
Management Regime (mowing) [b]		
Exotic plant control	**Y = 1**	**N=0**
Landscaping/ maintenance	Y = 0	N= 1
Previous disturbances (1993-2012) [c]	**Y=0**	**N=1**
Wetlands Present [d]	**Y=1**	**N=0**
Hydrology altered	**N=1**	**Y=0**
Reproduction present	**Y=1**	**N=0**
Insect/disease	**n/a**	**n/a**
Species diversity [e]	**>6 =1**	**<6 = 0**
Threats		
Invasive species (Shrub/Herbaceous)	n/a	n/a
Disconnected spatially	Y=0	N=1
Surrounded by development [f]	Y=0	N=1
Wind isolated	Y=0	N=1

Note: Value 1 = beneficial to grasslands
Value 0 = not beneficial to grasslands

3.0 EXISTING CONDITIONS

3.1 Setting

The 162-acre RFS parcel is located within the San Francisco Bay Coastal Bioregion (Welsh 1994). This bioregion is located within central California and is located on the east side of the San Francisco Bay. Habitats within this bioregion include both mesic (moist) habitats, such as saltwater and freshwater marsh along the bay, and xeric (dry) habitats, such as chaparral and coastal sage scrub in the hills, and are typical of a Mediterranean type climate. Annual winter precipitation has averaged 25.4 inches over the past 200 years (Welsh 1994). The dominant prevailing wind directions in this portion of the San Francisco Bay are from the south southeast, as measured at the Richmond Pier (http://www.windfinder.com/windstats/windstatistic_richmond_pier.htm).

The Richmond Field Station, located at 1301 South 46th Street in Richmond California, is currently owned by the U.C. Regents for the use by the UCB campus. Once part of the larger Rancho San Pablo, the RFS is located in the eastern edge of the San Francisco Bay, in the City of Richmond (Figure 1). The RFS is bounded by Meade Street off Interstate 580 to the north, by Meeker Lough/Regatta Boulevard to the west and by South 46th Street to the east. The East Bay Regional Park District Bat Trail traverses the western portion of the property. Totaling 162 acres, the upland habitat encompasses 96 acres, which is comprised of industrial-zoned land used primarily for research and education. Of these 96 acres, approximately 42 acres are undeveloped meadows that support native grasslands.

Aerial analysis on Google Earth shows that in 1939 the area was surveyed and sidewalks appear to be installed but no grading had occurred. Structures and eucalyptus trees are present on the main portion of the RFS at this time.

3.2 Vegetation Communities

Several vegetation communities, as described by Holland (1986), occur on the RFS site. This classification of overall community identification will provide an easier understanding for the reader and provides an umbrella that is encompassing the specific alliances, as described in Sawyer, et al. (2009). The communities described below refer to those that are located within the 96-acre portion of the RFS and are based on descriptions from the *Manual of California Vegetation* (Sawyer, et al. 2009).

Coastal terrace prairie is typically found within a belt extending from the coast to a few kilometers and usually contains significant amounts of both native and exotic perennial species. California oatgrass (*Danthonia californica*) is the characteristic species in the northern and more coastal part of coastal prairie grassland with purple needle grass (*Nasella pulchra*) also being abundant in this region (D'Antonio, et al. 2000).

3.2.1 Coastal Terrace Prairie Grassland

Danthonia californica Herbaceous Alliance or California oat grass prairie – California oat grass prairie is defined as being dominant or co-dominant in the herbaceous layer with a variety of other native and non-native species and must comprise greater than 50% relative cover or 25% absolute cover in the herbaceous layer (Sawyer et al. 2009). California oatgrass is a perennial bunchgrass with loosely clustered, coarse stem or culms. This species is supported in a habitat that is seasonally or permanently saturated with a shallow water table. Water chemistry can

include both freshwater and saline water. It can occur in valley bottoms, and the lower portions of alluvial slopes as well as in uplands on coastal bluffs, terraces, slopes and ridges. The national list of wetland plants (NWPL 2012 (http://rsgisias.crrel.usace.army.mil/NWPL/doc/proc_2012/ERDC-CRREL_TR-12-11_NWPL_2012.pdf) lists California oatgrass as a facultative species. Often considered part of coastal prairie, this alliance extends from coastal terraces to inland bald hills. Species dominance varies at a fine scale. It often mixes with tree series at a coarser scale, such as Douglas-fir - tanoak series, Oregon white oak series, Redwood series.

California oatgrass is one of the only perennial bunchgrasses with long-lived seed and a stand can be rapidly revived from a latent seed bank with mowing, weeding and clearing. This species establishes very slowly but is a persistent grower and it roots can eventually reach down to 3 or 4 feet. It thrives in rich, loamy and clay soils (Amme 2003b).

Nasella pulchra Herbaceous Alliance or Purple needle grass grassland – Purple needle grass is dominant or characteristically present in the herbaceous layer and occurs with other perennial grasses and usually has 10% relative cover or 5% absolute cover in the herbaceous layer (Sawyer, et al. 2009). Purple needle grass is a native, cool-season perennial bunch grass that expands when tussocks fragment. The plant produces large quantities of viable seed, but seedling establishment is generally low (Sawyer, et al. 2009). This species occurs in all topographic locations, typically on soils with a high clay content. Vegetative growth of purple needlegrass is greatest from March through late May or early June, depending on onset of drought. Flowers begin to develop in early May, and seed is mature and dispersed by late July. Stands of this once extensive series now typically include non-native annual species mixed with the perennial grasses and herbs. Purple needle grass regenerates primarily by tillering (i.e. root spreading) and, similar to bulbs and rhizomes, fragmentation of bunches. Fragmentation is an important form of regeneration for purple needle grass; it is an adaptation that allows recovery from defoliation by high-intensity, short-duration grazing and/or fire. Ripgut, soft chess, and foxtail chess are common, as are slender oats, wild oats, and Italian ryegrass. Foothill needlegrass, nodding needlegrass, and purple needlegrass occur sympatrically, but do not typically mix. The species tend to segregate based on substrate and slope factors.

Purple needlegrass is a species with wide ecological tolerance and excellent restoration potential (Ludlow, et al. 2007). It is a long-lived bunchgrass and thrives on sunny, south-facing slopes and plain of the foothill grassland. It stays green into the early summer and gradually becomes dormant in mid to late summer. This species also forms a deep root system 3 to 4 feet deep. Purple needle grass has good seedling vigor and can be seeded or planted by plugs (Amme 2003a).

Recruitment of purple needle grass has been shown to be reduced by the adverse environment created by high densities of non-native annual species (Dyer and Rice 1997). Successful attempts to increase populations of purple needle grass must involve management to reduce the negative effects or competition of non-natives through effective management techniques such as weeding and grazing.

3.2.2 Standard Grassland Evaluation

From a botanical analysis, using the MCV (Sawyer, et al. 2009) requirements for % of absolute cover for a vegetation alliance alone, our evaluation resulted in two of the meadows meeting the high quality habitats standard, compared to the URS (2007) evaluation, in which three meadows were evaluated as being high quality habitat. The habitat quality evaluation of on-site meadows, past and present, are presented in Table 2. However, we further identified five meadows as being moderate quality habitat, whereas URS (2007) did not have any; nor did they identify any low quality habitat. Our analysis identified seven meadows with low quality habitat based on a botanical presence of absolute cover of either *Danthonia* or *Nassella*. The differences between the two habitat ratings are discussed in the methods section, and reveal the changes in vegetation classification in the past five years.

Table 2: Comparison of evaluations of the meadows habitat quality – Richmond Field Station, Richmond, CA.

Meadows	Acreage	Quality of Habitat		
		D. Amme Associates (1993)[1]	URS (2007)[2]	Wildlife Research Associates (2012)[3]
Northwest	3	Disturbed/closely mowed	None	Medium
West	4	Disturbed/exotic/disturbed coastal prairie	High	High
EPA South	1	Disturbed/exotic	None	Low
EPA North	2	Disturbed coastal prairie/closely mowed	High	Medium
Big *	13	Disturbed coastal Prairie/Least disturbed coastal prairie	High	High
Central	2.8	Disturbed/closely mowed	None	Medium
Gull	1	Disturbed/closely mowed	None	Low
North	5	Disturbed/closely mowed	None	Low
Eucalyptus	5	Disturbed/closely mowed	None	Medium
Far North	1	Disturbed/closely mowed	None	Low
East	1	Disturbed/closely mowed	none	Low
Northeast	1	Disturbed/closely mowed	none	Low
580	2	Disturbed/closely mowed	none	Low

Note – Quality of Habitat Evaluated Based on:

1 = vegetation surveys conducted outside flowering season.

2 = grassland and presence of > 6 native plant species.

3 = % of species absolute cover, with *High Quality*: California oatgrass (>50%) and/or purple needlegrass (20%); *Medium Quality*: California oatgrass (25-50%) and/or purple needlegrass (5-19%), and *Low Quality*: California oatgrass (0-24%) and/or purple needlegrass (0-4%)

*= the Northern portion of the Big Meadow, which is disturbed, is not included in the 13 acres.

In 1993, several areas were identified as disturbed coastal prairie, specifically a portion in the west central area of the Big Meadow, the central portion of the West Meadow and a strip of disturbed/closely mowed grassland surrounding the disturbed coastal prairie and a block that is shown as recent disturbance of the EPA Meadow N (David Amme Associates 1993).

In our analysis we also identified the northern portion of the Big Meadow, which is not part of the 13 acres identified above (URS 2007), as being disturbed grassland, lacking any native species. Please refer to the *Richmond Field Station Habitat Enhancement and Mitigation Analysis* (Wildlife Research Associates 2013) for further analysis.

The EPA Meadow S area is also identified as an area that has been disturbed, has uneven or higher elevations, and where native grasses and plants are lacking and would be a good candidate for coastal prairie grassland creation. The URS (2007) maps also show that this area lacks native grasses and sensitive plants, although California oatgrass and sun cups (*Camissonia ovata*) are mapped in this area (URS 2007).

3.2.3 Qualitative Grassland Evaluation

After evaluating the meadows based on the standardized criteria of percent cover, as explained in Chapter 2, Table 3 provides a synopsis of the refinement of the habitat qualities of the meadows.

Table 3: Meadow Qualitative Evaluations - Richmond Field Station, Richmond, CA

Meadow characteristics	Big Meadow	Northwest	West	EPA north	EPA south	North	580	Central	Eucalyptus	Gull	East	Northeast	Far North
Acreage [a]	13	3	4	2	1	3.9	1	2.5	1.8	1	1	1	1
Location to eucalyptus grove	W	W	SW	SW	SW	E	NE	S	E	E	E	E	N
Management Regime (mowing) [b]													
Exotic plant control	Y	N	Y	Y	N	N	N	N	N	N	N	N	N
Landscaping/ maintenance	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Previous disturbances (1993-2012) [c]	Y	Y	N	Y	Y	N	N	N	N	N	N	N	N
Potential* Wetlands Present** [d] ***(visual obs.)	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N
Hydrology altered	N	N	N	N	N	Y	Y	N	Y	Y	Y	Y	na
Reproduction present/absent	P	P	P	P	P	A	A	A	A	na	na	na	na
Insect/disease	na	na	na	na	na	na	na	na	na	na	na	na	na
Species diversity [e]	6+	4	6+	6+	1	3	1	1	2	1	2	2	0
Threats													
Invasive species (Shrub/Herbaceous)	S	S	S	H	S	H	H	H	H	H	H	H	H
Disconnected spatially	N	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Surrounded by development [f]	N	N	N	N	N	N	Y	Y	N	Y	Y	Y	N
Wind isolated	N	N	N	N	N	Y	Y	N	Y	Y	Y	Y	Y

Notes:
a = URS (2007) acreages and modified for removal of eucalyptus trees in Eucalyptus Meadow, North Meadow and Central Meadow.
b = URS (2007) recommended mowing regimes.
c = Previous disturbances, such as recent soil deposition from ~1993, are based on Amme (1993).
d = Wetlands were identified based on Current Conditions Report (Tetra Tech and Sea Engineers 2007) and visual observations in the field in 2012.
e = Species diversity was based on the URS (2007) report and includes those native species that were identified by the EBCNPS for Ranks A and B, excluding the two grass species, *Nassella* sp. and *Danthonia* sp.
f = Development is classified for this report as buildings and does not include roadways.

The following is a description per meadow identifying the criteria and qualities present in each meadow. These evaluations are then applied in the *Richmond Field Station Habitat Enhancement and Mitigation Analysis* (Wildlife Research Associates 2013). A synopsis of these attributes is presented in Table 4 (page 22).

Big Meadow: Big Meadow, approximately 13.3 acres in size (URS 2007), is the largest of the grassland areas on the RFS site. It has the highest plant species diversity and is being managed via a mowing regime to maintain and increase the native grasses and forbs. This area has benefited from exotic species control and is rated as a high quality grassland area for the site based on the percent cover of plants. It is composed primarily of coastal terrace prairie grassland; however, the northern portion, located outside the URS (2007) designated 13 acre, is comprised of low quality habitat. It has been moderately disturbed due to subdivision work conducted in the early 1900s (Amme 1993). Despite this historical disturbance, the coastal terrace prairie is more or less intact. The Big Meadow has high presence of California oatgrass and purple needlegrass in addition to seventeen (17) species of listed sensitive plants, 10 of which are EBCNPS Rank A or B (URS 2007), along with many common native species. The remnant coastal terrace prairie grassland in Big Meadow is largely undisturbed, is scientifically and ecologically invaluable, and is virtually impossible to recreate from a non-coastal terrace prairie habitat (Amme 1993). In summary, the qualitative evaluations presented in Table 3 are as follows:

- Large area (relative to other areas on site)
- West of the Eucalyptus grove - is an open area with no shade from trees.
- Highest species diversity of all the other areas on site.
- Invasive exotics are controlled via mowing program
- Not channelized
- Good reproduction of natives.
- Not disconnect spatially
- Not surrounded by development
- Not wind isolated.
- Wetlands present.

Due to these factors, Big Meadow is designated as high quality grassland habitat (Table 4)

Northwest Meadow: Northwest Meadow, approximately three acres in size, is located west of the Eucalyptus grove and west of the Big Meadow. Although it is separated from the Big Meadow by the Fog Buildings is it spatially connected and contiguous to the Big Meadow and West Meadow. According to the URS (2007) report, adjacent roadwork and building construction has somewhat disturbed this site. Seven listed plant species (EBCNPS Rank A, B or C) were mapped for this area in addition to California oatgrass and purple Needlegrass and other, common native plants. Only 4 of the 7 listed plant species were Rank A or B so this area did not meet the URS criteria for defining high quality grassland habitat. However, since 2007 the presence of California oatgrass and purple Needlegrass has increased in this area making it a high quality grassland habitat based on the membership rules as defined by the Manual of California Vegetation (Sawyer, et al. 2009). In summary, the qualitative evaluations presented in Table 3 are as follows:

- Located west of the Eucalyptus grove in the relatively undeveloped portion of the campus and in an open area with not shade from trees
- High species diversity.
- Not channelized

- Good reproduction of natives.
- Not disconnect spatially
- Not surrounded by development
- Not wind isolated.
- Wetlands present.

Due to these factors, Northwest Meadow is designated as high quality grassland habitat (Table 4)

West Meadow: West Meadow, approximately four acres in size, is located west of the Eucalyptus grove and is connected spatially to the Big Meadow, Northwest Meadow and EPA Meadows North and South. This grassland is composed of both disturbed/exotic grassland and disturbed coastal prairie, with an isolated patch of minimally disturbed coastal prairie (URS 2007). A small concrete foundation is present in the middle of the site along with coyote bush which is invading into the grassland area. Eleven species of EBCNPS listed sensitive plants and 6 EBCNPS Rank A or B plant species were mapped for this area in addition to California oatgrass and purple Needlegrass. Based on the URS (2007) the West Meadow has received some disturbance but because there are 6 EBCNPS Rank A or B plants present, the site met the URS (2007) definition of high quality grassland habitat. In summary, the qualitative evaluations presented in Table 3 are as follows:

- Located west of the Eucalyptus grove in the relatively undeveloped portion of the campus and in an open area with not shade from trees
- High species diversity.
- Invasive exotics are controlled via mowing program
- Not channelized
- Good reproduction of natives.
- Not disconnect spatially
- Not surrounded by development
- Not wind isolated.
- Wetlands present.

Due to these factors, West Meadow is designated as high quality grassland habitat (Table 4)

EPA Meadow North: EPA Meadow North, approximately two acres in size, is located in the western portion of the campus southwest of the Eucalyptus grove. EPA Meadow N is a regularly mowed grassland with one small structure present on the site. The grassland in EPA Meadow N is somewhat disturbed and 12 sensitive plant species occur at this location in addition to California oatgrass and purple Needlegrass. The site also supports 6 other EBCNPS Rank A or B plant species sot that this area meets the URS operational definition of high quality grassland habitat. In summary, the qualitative evaluations presented in Table 3 are as follows:

- Located west of the Eucalyptus grove in the relatively undeveloped portion of the campus and in an open area with no shade from trees
- High species diversity.
- Invasive exotics are controlled via mowing program
- Not channelized
- Good reproduction of natives.
- Not disconnect spatially
- Not surrounded by development

- Not wind isolated.
- Wetlands present.

Due to these factors, EPA Meadow North is designated as high quality grassland habitat (Table 4)

EPA Meadow South: EPA Meadow S, approximately one acre in size, is located south of the EPA Laboratory. This area is regularly mowed (URS 2007) and the soils in this area have been partially disturbed in the past as evidenced by mounding and uneven grades in this area. California oatgrass and purple needlegrass occur on the site but in low cover. Brown-headed rush (*Juncus phaeocephalus*), an EBCNPS Rank B species also occurs in proximity to the site along with 3 species of sensitive plants. The site does not meet the URS (2007) operational definition of high quality grassland habitat. This site is dominated primarily by non-native species along with coyote bush which is invading into the grassland area along with non-native blackberry. In summary, the qualitative evaluations presented in Table 3 are as follows:

- The grassland area is small and highly disturbed with uneven grades and areas where soil material has been dumped.
- Presence of invasive herbaceous and shrub species.
- Low species diversity.

Due to these factors, EPA Meadow South is designated as medium quality grassland habitat (Table 4).

North Meadow: North Meadow, approximately five acres in size, is the second largest grassland on the RFS site. This area is located east of the Eucalyptus grove and east of the Big Meadow. According to the URS (2007) report this area is regularly mowed and while the site has experienced disturbance, one EBCNPS Rank B and 6 EBCNPS listed sensitive plants occur on the site in addition to California oatgrass and purple needlegrass. This site did not meet the URS criteria of a high quality grassland habitat because it lacked the 6 or greater EBCNPS ranked A or B plant species. In summary, the qualitative evaluations presented in Table 3 are as follows:

- Located east of the Eucalyptus grove in the more developed portion of the campus.
- Receives higher maintenance (mowing regime) for landscaping purposes and not specifically for exotic control.
- Hydrology channelized
- Presence of invasive, herbaceous species;
- Disconnect spatially
- Wind isolated.

Due to these factors, North Meadow is designated as low quality grassland habitat (Table 4).

580 Meadow: 580 Meadow, approximately two acres in size, is located in the far northeastern corner of the campus, east of the Eucalyptus grove. A complex of buildings occurs along its west boundary with Interstate 580 and a rail line along the northeast boundary and Robin Drive on its south boundary. It is located in an area with a long history of industrial use and has been disturbed since the turn of the twentieth century (URS, 2003 & 2007). This meadow is composed of regularly mown grassland and non-native plants with a few stands of coyote bush. This site has experienced disturbance and four listed sensitive plants occur on the site. The site did not meet the URS operational definition of high quality grassland habitat, since only one EBCNPS

Rank B plant species occurs in this area in addition to California oatgrass and purple needlegrass. In summary, the qualitative evaluations presented in Table 3 are as follows:

- Small size.
- Located east of the Eucalyptus grove in the more developed portion of the campus.
- Receives higher maintenance (mowing regime) for landscaping purposes and not specifically for exotic control.
- Hydrology channelized
- Presence of invasive, herbaceous species;
- Disconnect spatially.
- Surrounded by development.
- Wind isolated.

Due to these factors, 580 Meadow is designated as low quality grassland habitat (Table 4).

Central Meadow: Central Meadow is composed of a 2.5-acre open area and is located south of the Eucalyptus grove and in the developed eastern campus area. The 0.3-acre area included in the URS (2007) report was dropped from this analysis due to the eucalyptus cover. This site is regularly mowed and has experienced disturbance because part of it was used as a staging area during the remediation project (URS 2007). Six EBCNPS listed sensitive plants were mapped in this area in addition to California oatgrass and purples needled grass. However, only 3 EBCNPS Rank B plant species were mapped so that this area does not meet the URS operational definition of high quality grassland habitat. In summary, the qualitative evaluations presented in Table 3 are as follows:

- Located in the eastern, more developed portion of the campus.
- Receives higher maintenance (mowing regime) for landscaping purposes and not specifically for exotic control.
- Presence of invasive, herbaceous species;
- Disconnect spatially.
- Surrounded by development.

Due to these factors, Central Meadow is designated as low quality grassland habitat (Table 4).

Eucalyptus Meadow: Eucalyptus Meadow was identified as a five acres site in the URS 2007 report but this includes 3.24 acres of Eucalyptus trees leaving only 1.76 acres of open grassland. This area is regularly mowed and has several structures, an access road bisecting the meadow and several small parking lots. This site has experienced disturbance in the past (URS 2007). Six listed sensitive plants were mapped for the site, however the site does not meet the URS operational definition of high quality grassland habitat, since only three EBCNPS Rank A or B plant species occur in addition to California oatgrass and purple needlegrass. In summary, the qualitative evaluations presented in Table 3 are as follows:

- Located in the eastern, more developed portion of the campus.
- The grassland area is small, isolated and surrounded by Eucalyptus trees.
- Receives higher maintenance (mowing regime) for landscaping purposes and not specifically for exotic control.
- Presence of invasive, herbaceous species;
- Hydrology channelized.
- Disconnect spatially.

- Surrounded by development.

Due to these factors, Eucalyptus Meadow is designated as low quality grassland habitat (Table 4).

Gull Meadow: Gull Meadow, approximately one acre in size, is located east of the Eucalyptus grove in the more developed portion of the campus. Its few open areas are regularly mowed and the meadow has been disturbed by the construction of a small complex of structures and a parking lot. California oatgrass and an isolated patch of small-bract sedge (*Carex subbracteata*) occur on the site. Two listed sensitive plants occur on the site in limited numbers. This site has experienced extensive disturbance and site does not meet the URS operational definition of high quality grassland habitat. In summary, the qualitative evaluations presented in Table 3 are as follows:

- Located in the eastern, more developed portion of the campus.
- The grassland area is small, isolated, and altered by past disturbance.
- Receives higher maintenance (mowing regime) for landscaping purposes and not specifically for exotic control.
- Presence of invasive, herbaceous species;
- Hydrology channelized.
- Disconnect spatially.
- Surrounded by development.
- Wind isolated.

Due to these factors, Gull Meadow is designated as low quality grassland habitat (Table 4)

East Meadow: East Meadow, approximately one acre in size, is located in the more developed eastern portion of the campus east of the Eucalyptus grove. This site is regularly mowed and has been previously disturbed with the construction of a parking lot, and two structures. Four EBCNPS listed sensitive plants and 3 EBCNPS Rank B plant species occur on the site in addition to California oatgrass and purple needlegrass. The site does not meet the URS operational definition of high quality grassland habitat. In summary, the qualitative evaluations presented in Table 3 are as follows:

- Located in the eastern, more developed portion of the campus.
- The grassland area is small, isolated, and altered by past disturbance.
- Receives higher maintenance (mowing regime) for landscaping purposes and not specifically for exotic control.
- Presence of invasive, herbaceous species;
- Hydrology channelized.
- Disconnect spatially.
- Surrounded by development.
- Wind isolated.

Due to these factors, East Meadow is designated as low quality grassland habitat (Table 4).

Northeast Meadow: Northeast Meadow, approximately one acre in size, is located in the more developed eastern portion of the campus east of the Eucalyptus grove. It is regularly mowed and has been disturbed in the past. A parking lot, a several small structures and a large paved area are present on the site and topsoil in a portion of the site appears to have been removed (URS 2007). Four EBCNPS listed sensitive plants and one EBCNPS Rank B plant species occur here in

addition to California oatgrass and purple needlegrass. The site does not meet the URS operational definition of high quality grassland habitat. In summary, the qualitative evaluations presented in Table 3 are as follows:

- Located in the eastern, more developed portion of the campus.
- The grassland area is small, isolated, and altered by past disturbance.
- Receives higher maintenance (mowing regime) for landscaping purposes and not specifically for exotic control.
- Presence of invasive, herbaceous species;
- Hydrology channelized.
- Disconnect spatially.
- Surrounded by development.
- Wind isolated.

Due to these factors, Northeast Meadow is designated as low quality grassland habitat (Table 4).

Far North Meadow: Far North Meadow, approximately one acre in size, is located in the northeastern corner of the campus outside of the RFS boundary fence. Interstate 580 and a rail line are the northwest boundary, three RFS buildings are near its east boundary, and Eucalyptus Meadow forms the south boundary. It is located in an area with a long history of industrial use and has been thoroughly disturbed since the turn of the twentieth century (URS 2003). This meadow is overgrown with non-native herbaceous species and no listed plants were observed in this area. In summary, the qualitative evaluations presented in Table 3 are as follows:

- The grassland area is small, isolated, and altered by past disturbance.
- Receives higher maintenance (mowing regime) for landscaping purposes and not specifically for exotic control.
- Presence of invasive, herbaceous species.
- No coastal grass species present.
- Dominance by non-native plants.
- Disconnect spatially.
- Wind isolated.

Due to these factors, Far North Meadow is designated as low quality grassland habitat (Table 4).

Based on the above criteria and evaluations, the meadows are ranked as to their quality of habitats, whether certain attributes are beneficial to the grassland meadow or not beneficial, and are presented in Table 4 Quality of Meadow Habitat.

Table 4: Quality of Meadow Habitat - Richmond Field Station, Richmond, CA

Quality of Meadow	Big Meadow	Northwest	West	EPA north	EPA south	North	580	Central	Eucalyptus	Gull	East	Northeast	Far North
Standardized evaluation	3	2	3	2	1	1	1	2	2	1	1	1	1
Acreage	1	1	1	0	0	1	0	0	0	0	0	0	0
Location to eucalyptus grove	1	1	1	1	1	0	0	0	0	0	0	0	0
Management Regime (mowing)													
Exotic plant control	1	0	1	1	0	0	0	0	0	0	0	0	0
Landscaping/ maintenance	1	1	1	1	1	0	0	0	0	0	0	0	0
Previous disturbances (1993-2012)	0	0	1	0	0	1	1	1	1	1	1	1	1
Wetlands Present	1	1	1	1	0	0	0	0	0	0	0	0	0
Hydrology altered	1	1	1	1	1	0	0	1	0	0	0	0	0
Reproduction present	1	1	1	1	1	0	0	0	0	0	0	0	0
Insect/disease	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Species diversity	1	0	1	1	0	0	0	0	0	0	0	0	0
Threats													
Invasive species	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Disconnected spatially	1	1	1	1	1	0	0	0	0	0	0	0	0
Surrounded by development	1	1	1	1	1	1	0	0	1	0	0	0	1
Wind isolated	1	1	1	1	0	0	0	0	0	0	0	0	0
TOTAL	**14**	**11**	**15**	**12**	**7**	**4**	**2**	**4**	**4**	**2**	**2**	**2**	**3**
High	√	√	√	√									
Medium					√								
Low						√	√	√	√	√	√	√	√

Ranking Values (based on a maximum value of 15)
High = 11 or greater
Medium = 6 to 10
Low = 1 to 5

3.3 Wildlife Habitats

Several wildlife habitats, which include vegetation communities and anthropogenic structures, occur within the 96-acre property; however, the descriptions below pertain only to those habitats discussed in this constraints analysis, mainly the grasslands.

The value of a site to wildlife is influenced by a combination of the physical and biological features of the immediate environment. Species diversity is a function of diversity of abiotic and biotic conditions and is greatly affected by human use of the land. The wildlife habitat quality of an area, therefore, is ultimately determined by the type, size, and diversity of vegetation communities present and their degree of disturbance. Wildlife habitats are typically distinguished by vegetation type, with varying combinations of plant species providing different resources for use by wildlife. The following is a discussion of the wildlife species supported by the on-site habitats, as described by *A Guide to Wildlife Habitats of California* (Mayer and Laudenslayer 1989).

3.3.1 Grassland

Grassland habitat, including native and non-native grasslands, attract reptiles and amphibians, such as northern alligator lizard (*Gerrhonotus multicarinatus*), western fence lizard (*Sceloporus occidentalis*), and Pacific slender salamander (*Batrachoseps attenuatus*), which feed on invertebrates found within and beneath fallen logs or other debris within the vegetation community. This habitat also attracts avian seed-eating and insect-eating species of birds and mammals. California quail (*Lophortyx californicus*), mourning dove (*Zenaidura macroura*), and meadowlark (*Sturnella neglecta*) are a few seed-eaters that nest and forage in grasslands. One type of grassland bird guild (those that nest and forage in grasslands) includes California horned lark (*Eremophila alpestris actia*), savannah sparrow (*Passerculus sandwichensis*), and western meadowlark, all species of conservation and management concern, and can be indicators of the health of the habitat. During previous studies, two of the three species, savannah sparrow and western meadowlark, were reported occurring in the grasslands between 1987 and 1989 (Gustein 1989). Insect-eaters such as scrub jays (*Aphelocoma coerulescens*), barn swallows (*Hirundo rustica*), and mockingbirds (*Mimus polyglottus*) use the habitat for foraging only. Grasslands are important foraging grounds for aerial and ground foraging insect-eating bat species such as myotis (*Myotis* spp.) and pallid bat (*Antrozous pallidus*). A large number of other mammal species such as California vole (*Microtus californicus*), Botta's pocket gopher (*Thomomys bottae*), California ground squirrel (*Spermophilus beecheyi*) and black-tailed jackrabbit (*Lepus californicus*) also forage and nest within grasslands and have been reported on the site (Gustein 1989). Small rodents attract raptors (birds of prey) such as owls that hunt at night, as well as day-hunting raptors such as red-tailed hawks (*Buteo jamaicensis*), northern harrier (*Circus cyaneus*) and white-shouldered kite (*Elanus leucurus*), among others, which have been reported on the site (Gustein 1989). Black-tailed deer (*Odoicoileus hemionus californicus*) use grassland for grazing and, if the grass is tall enough, for nesting at night.

One invertebrate species, the Ohlone tiger beetle (*Cincidela ohlone*), is a specialist of the coastal terrace prairie grassland habitat. However, this species occurs in coastal terrace prairie habitats located south of San Francisco Bay and does not occur in the Richmond Area (CNDDB 2012).

3.4 Wildlife Movement Corridors

Wildlife movement includes migration (*i.e*., usually one way per season), inter-population movement (*i.e*., long-term genetic flow) and small travel pathways (*i.e.,* daily movement corridors within an animal's territory). While small travel pathways usually facilitate movement for daily home range activities such as foraging or escape from predators, they also provide connection between outlying populations and the main corridor, permitting an increase in gene flow between populations.

These linkages between habitat types can extend for miles between primary habitat areas and occur on a large scale throughout California. Habitat linkages facilitate movement between populations located in discrete areas and populations located within larger habitat areas. The mosaic of habitats found within a large-scale landscape results in wildlife populations that consist of discrete sub-populations comprising a large single population, often referred to as a meta-population. Even where patches of pristine habitat are fragmented, such as occurs with coastal terrace prairie grassland and other grasslands, the movement between wildlife populations is facilitated through habitat linkages, migration corridors and movement corridors. Depending on the condition of the corridor, genetic flow between populations may be high in frequency, thus allowing high genetic diversity within the population, or may below in frequency. Potentially low frequency genetic flow may lead to complete isolation and, if pressures are strong, potential extinction (McCullough 1996; Whittaker 1998).

As a vegetative community, the coastal terrace prairie grassland is isolated to the RFS; however, other grasslands (both native and non-native) occur in the general area and provide much of the same habitat value for wildlife as the coastal terrace prairies grassland. As a result, the grassland at the RFS provides the western most habitat available along the Inner Richmond Harbor. Movement corridors within the project area include the Stege saltmarsh on the southern border, the slough that runs along the western border, and the meadows located on the western portion of the site. The eucalyptus grove provides a movement corridor for those species that do not like to be exposed, such as California quail and brown towhees. The developed habitat provides an area for movement for raccoons, skunks and opossums.

Impacts and mitigation measures for these grasslands will be evaluated during the NEPA and CEQA process and are not part of this report. All opportunities for potential enhancement, restoration and creation will be also evaluated during that review.

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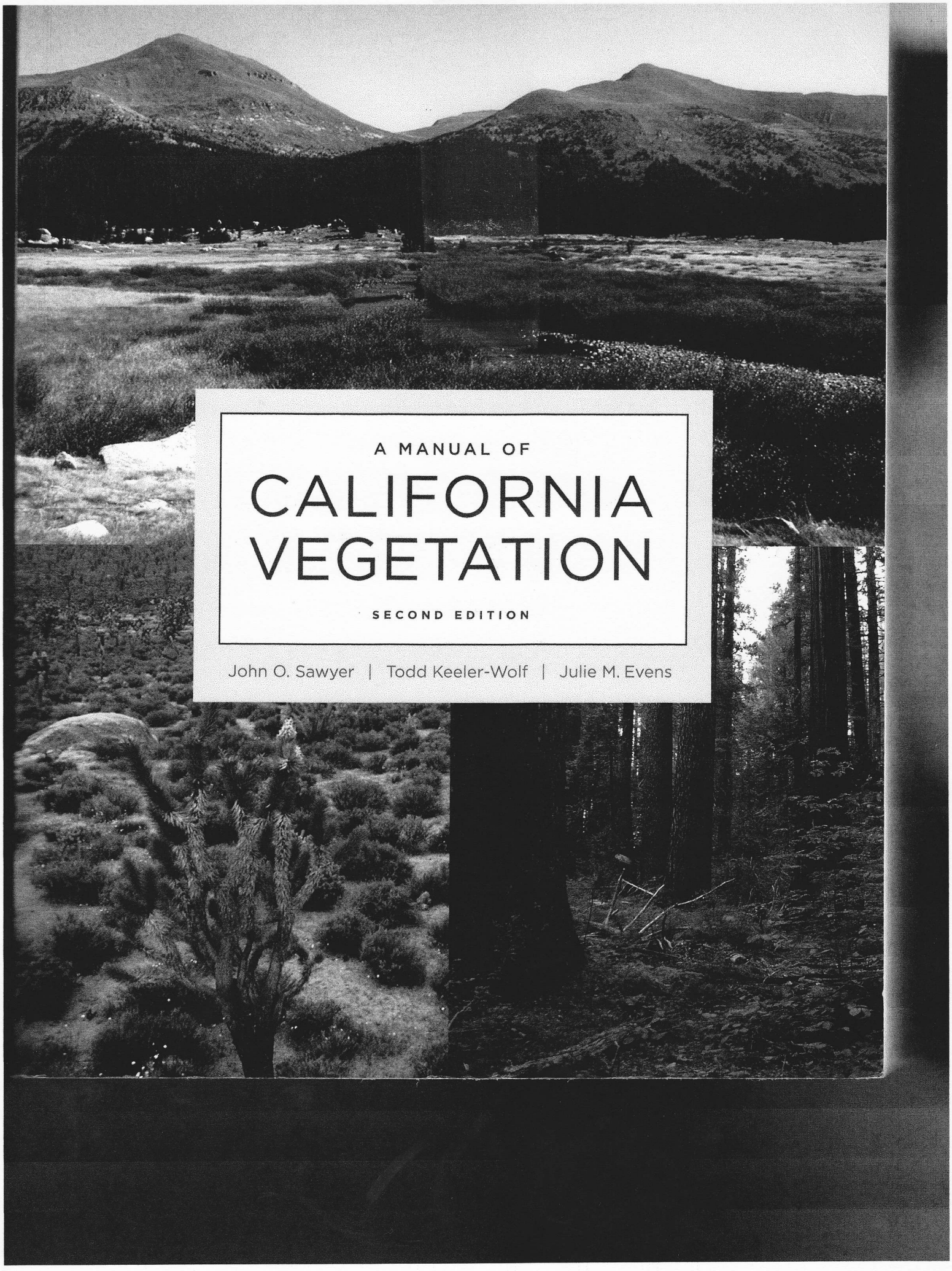
Fig. 3: Northwest Meadow looking north.

Fig. 4: EPA Meadow South looking northeast.

Fig. 5: West Meadow looking south.

APPENDIX A: Manual of California Vegetation Membership Rules



A MANUAL OF CALIFORNIA VEGETATION

SECOND EDITION

John O. Sawyer | Todd Keeler-Wolf | Julie M. Evens

Danthonia californica Herbaceous Alliance

California oat grass prairie

***Danthonia californica* is dominant or co-dominant in the herbaceous layer** with *Aira caryophyllea, Anthoxanthum odoratum, Arrhenatherum elatius, Bromus carinatus, Carex tumulicola, D. pilosa, Epilobium* spp., *Festuca* spp., *Holcus lanatus, Iris douglasiana, Juncus arcticus, Lolium perenne, Muhlenbergia filiformis, Melica californica, Nassella pulchra, Plantago lanceolata, Poa pratensis, P. secunda, Potentilla gracilis, Pteridium aquilinum, Ranunculus californicus, R. occidentalis, Rumex acetosella,* and *Sisyrinchium bellum*. Emergent trees and shrubs such as *Baccharis pilularis* or *Lupinus rivularis* may be present at low cover. Herbs < 1 m; canopy is open to intermittent.

Habitats: Coastal bluffs, valley bottoms, floodplains, terraces, slopes, ridge tops. The USFWS Wetland Inventory (1996 national list) recognizes *Danthonia californica* as a FACW plant. **Elevation:** 0–2200 m.

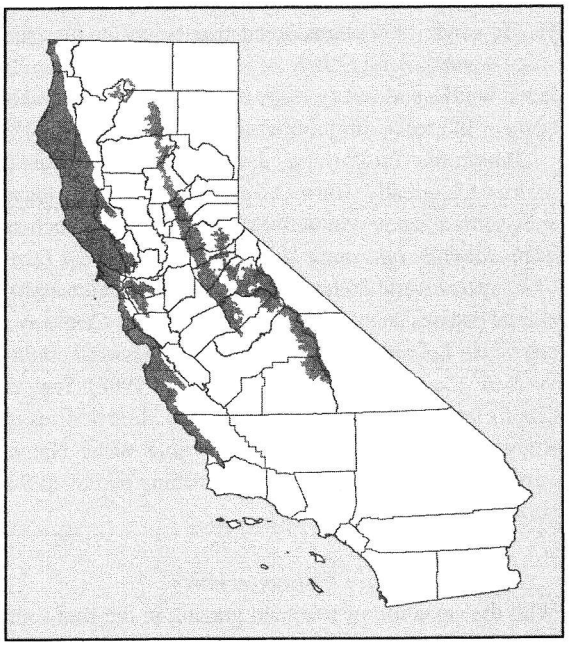
Rarity ranking: G4 S3. **MCV:** California oat grass series. **NVCS:** *Danthonia californica* herbaceous alliance. **Calveg:** Perennial grass/herbs. **Holland:** Bald Hills grassland, Coastal terrace prairies, Great Basin grassland. **Munz:** Coastal prairie. **WHR:** Perennial grassland.

Membership Rules

Danthonia californica > 50% relative cover in the herbaceous canopy (Keeler-Wolf et al. 2003a).

Life History Traits of Principal Species

Life forms	Polycarpic perennial; herb
Seed storage	Transient
Seed longevity	Short
Mode of dispersal	Animal; wind
Germination agents	None
Mode of sprouting	Underground structures (culms)
Survivability after fire/disturbance	Fire-hardy; high sprouter
Disturbance-stimulated flowering	No
Reproductive range	Life of plant
Recruitment	Medium
Regional variation	Low



Danthonia californica generally > 25% absolute cover in the herbaceous layer (S. Smith 1998).

Remarks

Danthonia californica is a perennial bunchgrass with loosely clustered, coarse culms. Seedlings establish on bare soil. Plants are tolerant of moderate grazing (Heady et al. 1963). It occurs in coastal prairies and woodlands. It also can dominate inland meadows at low and montane elevations.

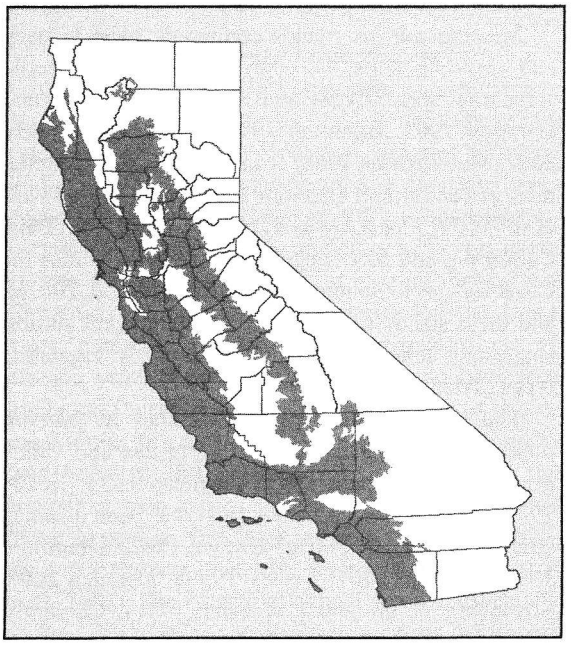
Perennial grasslands with rich, moist soils along the central coast are referred to as coastal prairie (Ford and Hayes 2007). On the north coast north of Marin Co., the coastal prairie occurs in two settings: terrace prairies along the coastline, and the Bald Hills prairies on inland ridges and hilltops. Stands with similar species composition also occur inland in California where annual rainfall is greater than 100 cm. We include grasslands on these two settings in this alliance. The type was also extensive in the Rogue,

Nassella pulchra Herbaceous Alliance
Purple needle grass grassland

***Nassella pulchra* is dominant or characteristically present in the herbaceous layer** with other perennial grasses, including *Elymus glaucus, Festuca californica, Hordeum brachyantherum, Koeleria macrantha, Lolium perenne, Melica californica, M. imperfecta, N. lepida, N. cernua,* and *Poa secunda,* and with perennials, such as *Calochortus* spp., *Calystegia* spp., *Sanicula* spp., and *Sisyrinchium bellum.* Annual herbs, including *Astragalus* spp., *Avena barbata, A. fatua, Bromus hordeaceus, B. rubens, Clarkia* spp., *Cryptantha* spp., *Eremocarpus setigerus, Erodium* spp., *Hirschfeldia incana, Holocarpha virgata, Lasthenia* spp., *Lepidium nitidum, Lupinus* spp., *Plantago* spp., and *Trifolium* spp., are common. Emergent *Artemisia californica, Eriogonum fasciculatum, Hazardia squarrosa,* and other shrubs and trees may be present at low cover. Herbs < 1 m; cover is open to continuous.

Habitats: Valley and foothill areas on all topographic locations. Inland soils are deep with high clay content, or shallow and rocky near the coast. **Elevation:** 0–1300 m.

Rarity ranking: *G4 S3?.* **MCV:** Purple needlegrass series. **NVCS:** *Nassella pulchra* herbaceous alliance. **Calveg:** Perennial grass/herbs. **Holland:** Valley needlegrass grassland. **Munz:** Valley grassland. **WHR:** Perennial grassland.



Membership Rules

Nassella pulchra usually > 10% relative cover of the herbaceous layer (Evens and San 2005, Klein and Evens 2005, Keeler-Wolf and Evens 2006).

Nassella pulchra > 5% absolute cover as a characteristic to dominant species in the herbaceous layer (Klein et al. 2007).

Life History Traits of Principal Species

Life forms	Polycarpic perennial; herb
Seed storage	Transient
Seed longevity	Short
Mode of dispersal	Animals; gravity; wind
Germination agents	None
Mode of sprouting	Buds on large branches or trunks (basal buds, tillers)
Survivability after fire/ disturbance	Fire-hardy; high sprouter
Disturbance-stimulated flowering	No
Reproductive range	Long-lived
Recruitment	High
Regional variation	Medium

Remarks

Nassella pulchra is a native, cool-season perennial bunch grass that expands when tussocks fragment. Plants produce large quantities of viable seed, but seedling establishment is generally low. Seedlings appear to establish more successfully on ground that is bare. *N. pulchra* varies with seasonal weather conditions, and the wet growing season favors plants (Steinberg 2002c, Stromberg et al. 2007). *N. cernua* sometimes occurs in the same area as this species, especially in southern California, but they do not typically mix (Steinberg 2002c). These needle grasses tend to segregate based on substrate and slope factors (Kellogg and