Appendix L
Functional Assessment

WETLAND FUNCTIONS AND VALUES ASSESSMENT
ELVERTA SPECIFIC PLAN
SACRAMENTO COUNTY, CALIFORNIA

PREPARED FOR:

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INTRODUCTION

The Clean Water Act (33 U.S.C. 1344) directs the Secretary of the Army, acting through the Chief of Engineers, to issue permits for the discharge of dredged or fill material in "waters of the United States" after notice and opportunity for public hearing. Wetlands and other special aquatic sites are, by definition, waters of the United States and therefore subject to jurisdiction under 404 (33 U.S.C. 1344, Section 328). Regulations governing the administration of 404 are outlined in the Corps Regulatory Program Regulations (33 CFR Sections 320-330) and the EPA 404(b)(1) Guidelines (40 CFR Section 230). These regulations and guidelines have been subject to interpretation through Regulatory Guidance Letters, interagency Memoranda of Agreement, and the courts.

Section 320.4(a)(1) of the Corps regulations summarizes the objectives and requirements for determining whether a permit to discharge dredged or fill material in waters of the United States should be issued. As indicated in the following excerpt, a variety of factors are considered during the public interest review, although wetlands have become a primary focus of attention in the review process:

> *"The decision whether to issue a permit will be based on an evaluation of the probable impacts, including cumulative impacts, of the proposed activity and its intended use on the public interest. Evaluation of the probable impact which the proposed activity may have on the public interest requires a careful weighing of all those factors which become relevant in each particular case. The benefits which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. The decision whether to authorize a proposal, and if so the conditions under which it will be allowed to occur, are therefore determined by the outcome of this general balancing process. That decision should reflect the national concern for both protection and utilization of important resources. All factors which may be relevant to the proposal must be considered including the cumulative effects thereof: among those are conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shore erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber production, mineral needs, considerations of property owners, and in general, the needs and welfare of the people."*

The sequence for reviewing 404 permit applications is prescribed in the EPA 404(b)(1) Guidelines (40 CFR Part 230) and includes the following steps:

Step 1: *Determine whether the proposed project is water dependent.*

Step 2: *Determine whether practicable alternatives exist for the proposed project.*

Step 3: *Identify the potential impacts of the proposed project on wetland functions in terms of project-specific and cumulative effects*

Step 4: *Identify how potential project impacts can be avoided or minimized in terms of project-specific and cumulative effects.*

Step 5: *Determine appropriate compensatory mitigation for unavoidable project impacts.*

Step 6: *Grant or deny a permit to discharge dredged or fill material based on a comparison of the value of the benefits gained from the proposed project versus the value of benefits lost from the proposed project.*

Step 7: *If a permit is granted, monitor compensatory mitigation to determine compliance.*

There are a number of steps in this sequence that require the assessment of wetland functions (Corps and EPA 1990 Mitigation MOA). For example:

Step 2 – *wetland impacts associated with each alternative should be assessed and compared based on function to determine the least damaging alternative.*

Step 3 – *wetland functions should be assessed and compared under pre- and post-project conditions to determine what project-specific and cumulative impacts may result.*

Steps 4 & 5 – *impacts to wetland functions should be assessed to determine how to avoid or minimize impacts and to identify appropriate compensatory mitigation for unavoidable impacts.*

Step 7 – *wetland functions should be assessed and compared before and after the mitigation project is completed to determine whether objectives have been met.*

Some methods developed during the past 15 years to assess wetland functions have been designed specifically for wetlands, while others were adapted from methods developed originally for upland or aquatic ecosystems. Lonard et al. (1981) reviewed methods developed prior to 1981 to determine the feasibility of using them in the 404 process, concluded that none were appropriate in their current format, and recommended specific revisions to make them more useful. The U.S. Environmental Protection Agency (1984) also reviewed assessment methods to determine *"…their potential ability to determine adverse effects of projects on wetland functions"* and also concluded that none were appropriate.

The current Wetland Functions and Values Assessment for the Elverta Specific Plan (ESP) follows the U.S. Army Corps of Engineers' 1995 technical report, *An Approach for Assessing Wetland Functions Using Hydrogeomorphic Classification, Reference Wetlands, and Functional Indices*[1], and is based on previous scientific surveys conducted for the Elverta Specific Plan EIR, along with focused field surveys and a *California Rapid Assessment Methodology* (CRAM)[2] assessment study conducted specifically for this project. Representative wetland features (i.e., swales, vernal pools, and ponds) within the ESP and reference wetlands from comparable sites in the region were evaluated in the qualitative functional assessment. Results of an intensive CRAM assessment of wetlands at several sites within the region are also presented to facilitate a quantitative comparison of similar features at these respective locations. The current F&V Assessment corresponds, therefore, to the 1995 *Approach* that is both qualitative and quantitative in nature.

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[1] Smith, R. Daniel. An Approach for Assessing Wetland Functions Using Hydrogeomorphic Classification, Reference Wetlands, and Functional Indices. Prepared for U.S. Army Corps of Engineers; Wetlands Research Program, Technical Report; WRP-DE-9. 88 p.

[2] Collins, J.N., E.D. Stein, M. Sutula, R. Clark, A.E. Fetscher, L. Grenier, C. Grosso, and A. Wiskind. 2008. California Rapid Assessment Method (CRAM) for Wetlands and Riparian Areas (website). www.cramwetlands.org

PROJECT DESCRIPTION

The Elverta Specific Plan (ESP; Study Area) is an approximately 1,745-acre area of northern Sacramento County comprised of 104 parcels (agricultural-residential "ranchettes", farms) in a semi-rural environment that is experiencing increasing urbanization from general build-out of the greater Sacramento metropolitan area. The Specific Plan properties, ranging in size from ~0.6 acre to ~245 acres, are generally located west of Gibson Ranch County Park, east of Verano Avenue, north of U Street, and south of Kasser Road in Sacramento County, California. The area is mapped within Sections 15, 16, 21, and 22 (Township 10 North; and Range 5 East) of the Rio Linda 7.5 minute USGS topographic quadrangle. Within the Plan Area, 15 parcels representing 684.43 acres have been actively pursuing approvals for residential/commercial development, currently known as Phase 1 Development, as outlined in the Specific Plan approved in 2007. FIGURE 1 is a vicinity map showing the general location of the Study Area; FIGURE 2 shows the location of existing Elverta Specific Plan properties and highlights those properties include in Phase 1 Development.

A majority of the properties included in the Study Area are undeveloped parcels characterized by flat to slightly-undulating terrain, supporting a predominance of ruderal (i.e., disturbed) habitat dominated by non-native annual grasses and broad-leaved plants. For the most part, these areas have been either heavily cultivated for rice and small grain production or utilized as rangeland for grazing livestock in the past. A portion of the properties support existing low-density agricultural-residential developments and access roads while others remain completely undeveloped.

BACKGROUND

Preparation of the Elverta Specific Plan was initiated on September 9, 1998 by adoption of Resolution No. 98-1068 by the Sacramento County Board of Supervisors. The Rio Linda / Elverta Community Plan (RLECP) – adopted earlier that year after nearly 10 years of community forums and public debate – had identified the need for a development that "emphasizes traditional, small-town mixed-use retail and residential land use patterns in the urban areas, encourages build-out of agricultural-residential areas [developments that avoid the appearance of urban subdivisions through incorporating open space in their design], and maintains agricultural and open space" (Sacramento County, 1997).

Community Plan Land Use Policy 7 (LU-7) stated that prior to the approval of any rezones or tentative maps within the Urban Policy Area, a Specific Plan shall be prepared that will, in addition to the standard land use component, contain design guidelines, an infrastructure assessment and a financing plan. The Community Plan went on to state that that the maximum unit count associated with the Urban Policy Area shall be 4,950 homes spread across a range of residential densities varying from AR 1-5 to RD 20. Of that total, 4,500 homes were allocated to a 1,190 acre urban portion of the plan with the remaining 450 homes included within the 643 acre large lot agricultural residential buffer.

Eleven citizens of the community were then appointed to a Citizens Advisory Committee (CAC) composed of property owners within the Specific Plan area, surrounding property owners, representatives from the Elverta Community Planning Advisory Council and representatives from the Rio Linda & Elverta Recreation & Park District, Placer County Municipal Advisory Council and Rio Linda-Elverta Library Foundation.

On September 6, 2000, DERA released a Notice of Preparation (NOP) for the Draft Elverta Specific Plan Environmental Impact Report. Additional changes to the project resulted in a revised NOP being released for public review in January 2001. A Draft Environmental Impact Report (EIR) for the Elverta Specific Plan was released in May 2003.

The land use plan analyzed in the original Draft EIR was refined in the later part of 2003 in response to a variety of new issues. While the total plan holding capacity of 4,950 dwelling units remained constant, the distribution of land uses changed, creating a more diverse community with a better defined "mixed-use town center." In addition, parcels planned for multiple-family housing were increased from one site to four and the amount of park acreage was increased from 20 to over 70 acres. The resultant plan embodied a variety of "smart growth" principles such as connectivity and diversity while maintaining certain distinct elements of the existing community such as unencumbered accessibility throughout the Specific Plan area by the local equestrian community.

The land use plan refinements required that the EIR be re-circulated for additional public review prior to the continuation of the public hearing process. In light of this, a new NOP was issued for public and agency review at the end of March 2004. Key issues requiring further analysis and updating included traffic, water, and infrastructure financing. Upon completion of these technical study updates, an additional Policy Planning Commission hearing was held in August of 2004 with release of the Draft EIR planned to follow shortly thereafter.

The Elverta Specific Plan was reviewed by the County Board of Supervisors at five public hearings held between May 8, 2007 and August 8, 2007. Subsequently, the Board of Supervisors certified the Final EIR on May 30, 2007, adopted the findings of overriding considerations and approved the General Plan Amendment. On August 8, 2007, the Board of Supervisors adopted the Elverta Specific Plan, community plan amendment, zoning ordinance amendment, rezones, and financing plan.

ASSESSMENT OBJECTIVES

A critical component of the Specific Plan is the proposed replacement of existing upland and wetland habitats, degraded over years of agricultural manipulation, with higher-quality, constructed intermittent stream (i.e. drainage) corridors. These corridors form the centerpiece of the open space component of the proposed Specific Plan. Functioning as connecting greenbelts between the various residential developments, parks, schools, and businesses, these corridors will provide: recreational opportunities for local residents (e.g., bike and pedestrian trails), wildlife viewing opportunities (e.g., birding, nature trails), critical habitat for local and migratory wildlife populations, increased biodiversity by creating riparian habitats within a perennial stream corridor setting, and improvements in overall water quality moving throughout the Specific Plan area via stormwater detention, biofiltration, and groundwater recharge.

While the original ecodiversity of Central Valley prairies, valley oak savanna, and various wetland habitats that occurred within the Study Area prior to Euro-American settlement cannot be replicated within the constraints of the proposed Specific Plan, it is the intent of this assessment to show that the created intermittent stream corridors will provide a greater degree of hydrologic, biogeochemical, and ecological wetland functions and values in an urbanized landscape setting than is currently provided by existing wetland features.

The analysis of historic aerial photography can be an effective method of interpreting changing environmental conditions against a referenced landscape setting. A sequence of aerial photographs taken in 1937, 1957, 1964, 1972, 1984, and 2006 are presented in FIGUREs 3 and 4 to illustrate how anthropogenic (i.e., human caused) activities – specifically historic agricultural land use patterns - have greatly altered the surficial geology and consequently the ecology and biodiversity of the Study Area. These activities included decades where existing wetlands were completely eliminated or severely degraded by agricultural practices, followed by periods where land use changes allowed some portions of the Study Area to remain fallow or begin the slow return of wetland communities through ecological succession and changes in hydrologic regimes. While qualitative, this photographic record does provide a powerful glimpse into how the landscape has changed over the past century and clearly illustrates how existing environmental conditions observed within the Study Area today are by no means "pristine" or static.

HYDROGEOMORPHIC & NATIONAL WETLAND INVENTORY CLASSIFICATIONS OF THE STUDY AREA[3]

Hydrogeomorphic classification[4] of extant wetland features within the Study Area consists of depressional and riverine wetlands.

Wetlands and "other waters" identified within the Study Area consist of:

System; Riverine
- Subsystem; Intermittent
  - Class; Streambed

System; Lacustrine
- Subsystem; Littoral
  - Class; Emergent Wetland

System; Palustrine
- Subsystem; none
  - Class; Unconsolidated Bottom

EXISTING ENVIRONMENT

Climate – Sacramento County has a Mediterranean climate characterized by hot, dry summers and cool, moist winters. Precipitation averages 43 centimeters (17 inches) per year and occurs primarily between November and March. Humidity is high during the moist winter months but extremely low in the summer, resulting in high evaporative-transpiration rates during the growing season.

Landform and Geomorphic Setting – The terrain in this portion of Sacramento County consists of relatively-level uplands and low terraces shallowly incised by low-gradient drainage ways. These drainage ways form the watersheds of various main-stem river systems, including the American and Sacramento. Pre-settlement landforms and alluvial deposition within the Study Area have also been strongly influenced by fluvial processes associated with the Dry Creek watershed. The current

3 Cowardin, et al. 1979. Classification of Wetlands and Deepwater Habitats of the United States. United States Department of the Interior; Fish and Wildlife Service. Washington, D.C.

4 Brinson, M. M. 1993. "A Hydrogeomorphic Classification for Wetlands," Technical Report WRP-DE-4, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

physiography of the Study Area has been greatly altered by anthropogenic activities over the past 150 years.

Soils and Surficial Geology – Soil map units identified within the Study Area include Bruella sandy loam, 2 to 5 percent slopes; Hedge loam, 0 to 2 percent slopes; San Joaquin fine sandy loam, 0 to 3 percent slopes; and San Joaquin fine sandy loams, 3 to 8 percent slopes. These are all moderately well-drained to well-drained soils not considered as hydric. However, they do have hydric inclusions in drainage ways and depressions, which are supported by an indurated or cemented duripan approximately 3 feet below the ground surface that is interrupted frequently by drainage channels, constructed ponds, highways and other access roads - all of which are anthropogenic impacts affecting the duripan contiguity. FIGURE 5 shows the location of mapped soil types across the Study Area. The soils formed in response to such factors as climate, living organisms, time, topography, and parent material. Much of the original micro-relief of the Study Area and original soil profiles have been disturbed and/or have been completely eliminated by historic agricultural and land use practices that include land-leveling, disking, grading, and various farmland conversions (e.g., dry-land farming to rice production).

Surface Hydrology – The 1,745 acre Elverta Specific Plan area is a portion of a much larger hydrologic basin commonly known as the Natomas East Stream Group (NESG)[5]. Historically, drainages in this area flow from northeast to southwest through a series of both natural and channelized, but mostly ill-defined, small drainages. Surface waters conveyed off-site by Study Area drainage ways eventually discharge into a maze of lateral canals and ditches farther west. Excess surface flows are eventually intercepted by the Natomas East Main Drainage Canal, approximately 2.3 miles downstream (west) of the Study Area.

Within the Study Area, there are four (4) main drainage ways that convey surface runoff from the northeast to southwest (FIGURE 6). These generally follow the historical hydrologic pathways, but exhibit only minor remnant qualities of this historic network of swales and pools, due to anthropogenic impacts. Surface runoff and depression storage within and tributary to the Study Area are generated from direct precipitation, subsurface lateral flow, overland flow, and stormwater runoff. When antecedent moisture conditions and rainfall intensities are not high, rainfall generally infiltrates into the sandy loam soils. The infiltrated water collects at the duripan, or a clay lens above the duripan, where it has not been substantially interrupted, to create a perched water table that slowly moves downslope due to gravity and is expressed as ponded water in remnant vernal pools and as surface runoff within wetland swales. If antecedent moisture conditions and/or rainfall intensities are high, then overland flow may occur, resulting in filling and/or overflow of pools and surface runoff in swales. In many locations within the Study Area, subsurface lateral flow and surface runoff, including irrigation return flows, are intercepted by agricultural ponds, ditches, highways and other access roads, substantially reducing and/or modifying the timing, frequency, and duration of swale and pool inundation. In other locations, the frequency and timing of swale inundation is more due to increased stormwater runoff volume, duration and frequency from surrounding urbanization, primarily to the east of the Study Area (increase in impervious, impermeable cover - paved roads, rural residential hardscapes), as well as the interception of the perched water table in rural roadside ditches and other channelized drainage ditches.

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[5] Borcalli & Associates. 1994. Natomas East Stream Group (NESG), hydraulic and hydraulic study. Sacramento Area Flood Control Agency; Sacramento, CA.

__Vegetation__ – The Study Area occurs within the Sacramento Valley subdivision of the California Floristic Province[6]. Plant communities found throughout the Study Area include degraded Central Valley prairie, ruderal grasslands, vernal pools, seasonal wetlands, swales, freshwater emergent marsh, channels, and ornamental landscapes; this assessment will focus primarily on describing wetland habitats identified within the Study Area.

__Vernal Pools__: These seasonal wetlands fill with water during the rainy season, slowly dry during the spring, and remain completely dry throughout the summer. Vernal pools undergo three distinct phases each year - aquatic, flowering, and drought. Vernal pools in the Study Area range from shallow pools that sustain one to six-inch ponding depths, medium-depth pools that sustain six to 12-inch ponding depths, and deep pools that sustain ponding depths of 12 to 16 or more inches. Vernal pools support a prevalence of annual, dwarfish plants that have life cycles closely tied to the pool's annual inundation/drought phases. Vernal pools within the Study Area were delineated based on the presence of certain diagnostic species either restricted to this habitat type, or closely associated with vernal pool habitats in terms of their overall frequency, density, and distribution[7]. Vegetative assemblages found in higher quality vernal pool habitats within this portion of the Sacramento Valley are well-represented by the following *Genera*: *Lasthenia*, *Plagiobothrys*, *Navarretia, Psilocarphus, Downingia, Trifolium, Pogogyne*, and *Juncus*.

__Seasonal Wetlands__: These types of wetlands within the Study Area resemble vernal pools in relation to landscape position and hydrology, but do not support plant assemblages representative of vernal pool habitats. They occur in basins and linear depressions which sustain ponding and/or saturation for long duration for a portion of the growing season, but tend to dry up by early summer. Shallow seasonal wetlands are characterized by perennial rye grass and Mediterranean barley. In contrast, deeper seasonal wetlands are characterized by common spikerush, Italian ryegrass, curly dock, annual beardgrass (*Polypogon monspeliensis*), iris-leaved rush (*Juncus xiphioides*), and common knotweed (*Polygonum arenastrum*).

__Seasonal Swales__: These features within the Study Area occur as low-gradient, gently concave linear depressions which tend to sustain saturation during the rainy season, transport (but do not pond) seasonal surface flows and runoff, and contain no evidence of surface scour or defined bed, bank, and channel with an ordinary high water mark (OHWM). Representative examples of swales in the Study Area are dominated by Italian ryegrass and Mediterranean barley. Common wetland associates include common spikeweed, turkey mullein, curly dock, coyote thistle, annual beardgrass, popcornflower, red-stem filaree, vinegar weed (*Trichostema lanceolatum*), pitgland tarweed (*Holocarpha virgata*), soft chess (*Bromus hordeaceus*), rattail fescue (*Vulpia myuros*), and toad rush (*Juncus bufonius*).

__Ponds__: Vegetative assemblages dominated by robust perennial monocots were observed in two ponds identified in the Study Area. These features sustain ponding for long duration during the rainy/growing season, but eventually dry up in middle to late summer in most years. The ponds within which the emergent marshes occur were artificially created by past excavation and berm construction and support a mix of vernal pool, seasonal wetland, and emergent marsh plant species which tend to segregate based upon depth and duration of ponding regimes on any given year. The deepest portions of these ponds support emergent marsh habitat characterized by common spikerush, arrowhead (*Sagittaria* sp.), cattail (*Typha* sp.), and least spikerush

6 Hickman, J. (ed.). 1993. The Jepson Manual: Higher Plants of California. University of California Press, Berkeley.

7 Elan, D., Flint, S., Keeler-Wolf, T., Lewis, K. 1998. California Vernal Pool Assessment; Preliminary Report. Department of Fish and Game, State of California.

(*Eleocharis acicularis*); incipient woody species include Fremont's cottonwood (*Populus fremontii*), and willow (*Salix* spp.).

<u>*Channels*</u>: These features are narrowly incised ephemeral drainages that sustain seasonal flows during and following significant precipitation events during the rainy season, which have been historically augmented from hardscape runoff from roads and subdivisions in the area, as well as irrigation tailwater from surrounding farmlands. Some of these drainages have been dredged and channelized in the recent past. Channels were delineated during the 1999 field delineation based on clear evidence of regular sustained flows, which included the presence of a defined bed and bank, scouring and deposition of sands and gravel substrates, and the absence of perennial upland vegetation and topsoil. Field indicators of the OHWM were used as a basis for defining the landward extent of the channels. Plant species observed in representative drainageways included curly dock, red-stem filaree, vetch (*Vicia* sp.), prickly lettuce (*Lactuca serriola*), soft chess, and Italian ryegrass.

<u>Land use</u> – Prior to the Euro-American settlement of the Sacramento Valley region, local landscapes consisted of an ecologically diverse mosaic of aquatic, wetland, and terrestrial habitats, including riverine systems associated with the Sacramento River and its tributaries, vernal pools, seasonal wetlands, tule marshes, riparian woodlands, and other transitional wetland types. Upland habitats consisted of extensive prairies interspersed with groves of valley oak savanna. Anthropogenic changes in the landscape by Native American peoples exploiting the abundant natural resources were temporary and minor, but with the advent of Euro-American settlement, the water, mineral, prairie, and woodland resources of the area were quickly exploited by agrarian and "Gold Rush" settlers, resulting in the rapid growth of farms, communities, and cities throughout the region. One hundred years ago, Elverta was a typical agricultural community, with businesses supported in large part by prosperous farms and ranches. However, within the past 40 years, increasing urban build-out throughout the greater Sacramento metropolitan area has resulting in increasing conversion pressures on traditional agricultural lands into residential, commercial, and business developments. Many of the existing parcels within the Study Area consist of small farms and rural residential "ranchettes". Increasing urban build-out is occurring within the general area, especially to the east, along Watt Avenue and to the north, from Rocklin along the Sacramento – Placer County line. The proposed Specific Plan is located within the *Urban Services Boundary*, which was established by the 1993 Sacramento County General Plan.

The progression of land use change within the Study Area over the last 80 years has led to dramatic changes in hydrology over this period. In the 1930s, the landscape of the Study Area typically supported limited dryland farming, grazing and orchards; leaving the micro-relief associated with the wetland swales and the vernal pool/ swale complexes relatively intact.

By as early as the mid-1950s, however, intensive irrigated agriculture already dominated the Study Area and surrounding region with contoured and leveled rice farming and furrowed, irrigated fields. This relatively rapid landscape transformation resulted in a significant loss of wetland habitat. Contoured rice farming filled-in and feathered natural wetland swales and obliterated vernal micro-relief, as soils very near the land surface were skimmed to create downslope water checks, most noticeably in northeastern corner of the Study Area. These contoured rice checks are still visible today in the many portions of the Study Area. The handful of relatively large, remnant (and hydrologically isolated) vernal pools that persist today were integrated into the placement of contoured rice checks resulting in small berms along the pools' periphery. Surface water impoundments or agricultural ponds also appeared at this time, as natural drainageways were aligned to intercept and store subsurface, lateral and irrigation return flows. These agricultural ponds further exacerbated surficial and ecological impacts to wetland swales and vernal pools in the downstream natural drainageways by modifying the amount and timing of water available to sustain wetland form, function, and ecological response. Also by this time, many natural wetland swales were channelized and straightened to reclaim fields and more efficiently convey runoff and irrigation flows.

A slow, incremental loss of wetlands continued through the mid-1980s, as dryland agriculture waned and the number of farmsteads and rural residences steadily increased, along with the number of agricultural ponds (especially in the northwestern Study Area). By the turn of the century, most of the actively farmed fields in the Study Area had been fallowed to support livestock grazing. Though number of wetlands has changed very little over the last 20 years, most are a clear expression of a heavily-manipulated agricultural landscape. In addition, the previously channelized sections of wetland swales have incised to the duripan and show continued evidence of headcutting and widening due to bank erosion.

QUALITATIVE ASSESSMENT OF REPRESENTATIVE WETLAND FEATURES WITHIN THE ESP STUDY AREA

Wetland features within the ESP Study Area include vernal pools, seasonal wetlands and swales, bermed wetlands, ponds, and channels; FIGURE 7 shows the location of all wetland features verified by the Corps between 2005 and 2007. These seasonal wetlands and swales, bermed wetlands, and vernal pools appear to be hydrologically sustained for brief periods by direct precipitation, subsurface lateral flow, and overland runoff from surrounding uplands during the rainy season; the channels likely intercept and convey irrigation tailwater runoff, while the ponds intercept runoff and store surface waters for prolonged periods. These features, along with an analysis of their current wetland functions and values, are discussed in greater detail in the following sections.

We conducted a field survey of nine representative *Wetland Assessment Areas* (WAAs) within the ESP on December 18, 2008. A list of plant species observed within each feature was recorded, and directional photo-point locations were established for visual reference (Appendix A). Identification conventions for each WAA, where applicable, correspond with those identified in Gibson & Skordal's 1999 wetland delineation.

Vernal Pools 34, 26, 24 – Three representative vernal pools in the southern portion of the Study Area were identified during the December 2008 field survey – VP34, VP26, and VP24 (FIGURE 7 and Appendix A). Due to winter-season timing of the field survey, it was difficult to positively identify some taxa in the field from the previous season's growth, as cured aerial stems often disarticulate upon desiccation. Plant species observed, however, within these features included Italian ryegrass (*Lolium multiflorum*), Pacific bentgrass (*Agrostis avenacea*), Mediterranean barley (*Hordeum marinum* ssp. *gussoneanum*), common spikerush (*Eleocharis macrostachya*), popcornflower (*Plagiobothrys* sp.), coyote thistle (*Eryngium* sp.), clover (*Trifolium* sp. – likely *T. variegatum*), Carter's buttercup (*Ranunculus bonariensis* var. *trisepalus*), common spikeweed (*Centromadia pungens*), turkey mullein (*Croton setigerus*), curly dock (*Rumex crispus*), cut-leaf geranium (*Geranium dissectum*), field bindweed (*Convolvulus arvensis*), and red-stem filaree (*Erodium cicutarium*).

It is increasingly recognized among vernal pool ecologists that uplands surrounding vernal pools provide critical habitat for many wildlife species, including a high percentage of invertebrates such as specialist bees[8]. Herbaceous cover surrounding vernal pools at the Study Area included extensive

8 Thorp, R.W. 2009. Electronic Document. Vernal pool flowers and their specialist bee pollinators. University of California, Davis. www.vernalpools.org

stands of soft chess, which appeared to be the dominant graminoid in terms of its overall frequency, density, and distribution throughout grass-dominated areas. Other grasses observed included rip-gut brome (*Bromus diandrus*), medusa head (*Taeniantherum caput-medusae*), and hare barley (*Hordeum murinum* ssp. *leporinum*). Broad-leaved plants observed included red-stem filaree, pitgland tarweed, annual fireweed, turkey mullein, and vetch (*Vicia* sp.); there was no discernable evidence of cured stems of perennial geophytes such *Brodiaea*, *Dichlostemma*, *Triteleia*, and *Chlorogalum* from last year's growing season. These species typically persist even in heavily degraded prairies throughout the Central Valley and would be expected to occur. However, their absence throughout this portion of the Study Area indicates that extirpation of original vegetative assemblages of native perennials has been nearly complete, resulting in a persistent cover of retrogressive vegetation[9].

Analysis of Historic Aerial Photographs (FIGUREs 3 & 4)

1937: This portion of the Study Area had already undergone significant physiographic changes via dry-land farming land use conversions; some portions remained as unplowed rangeland/valley prairie for grazing livestock. VP34 is still evident in 1937, even though the area was dry land farmed at the time. VP 24 can be positively identified in the southeastern corner of this area, but VP 26 was more likely a vernal swale downslope of a vernal pool, as this portion remained as open grassland/pasture in 1937. .

1957: The large-scale conversion from dry-land farming to contoured rice production had already occurred within the area, resulting in degradation of the three reference vernal pools. Berms around VPs 24 and 34 were likely the result of contoured rice checks. VP26 integrated into the Surrounding land uses included rangeland for livestock pasture, small residential orchards, and dry-land farming. Although not formally assessed for this study, the bermed wetland (BW7) in close proximity to VPs 24 and 26 was bermed by 1957 upon conversion to contoured rice.

1964: The landscape previously under rice production appears at this time to be fallow and successionally dominated by weedy species (or planted to a small grain crop such as wheat) on both sides of 16th Street. Surrounding land uses include rangeland for grazing livestock and increasing residential build-out.

1972: It appears that the open areas containing VP34, 24, and 26 are reverting back to ruderal grassland, with a better representative example to the north (west of 16th Street). Surrounding land use is rangeland for grazing livestock along with increasing urban build-out along the southern boundary.

1984: It appears that the open areas containing VP34, 24, and 26 are reverting back to ruderal grassland; surrounding agricultural land use now appears to be almost exclusively rangeland for grazing livestock; urban build-out increases along the southern and eastern boundaries.

<u>*Swale (WS6)*</u> – This wetland feature is located in the southern portion of the Study Area and is bisected by 16th Street; it generally runs along an east-west axis and emanates from the base of the

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[9] Ecological succession typically leads to communities with greater complexity and biomass and to habitats that are progressively more mesic (moist); retrogressive succession leads in the opposite direction, towards simpler, more depauperate communities (with fewer species) and toward either a more hydric (wet) or more xeric (dry) habitat (From: *Terrestrial plant ecology*. 1987. Barbour, et al). Past anthropogenic and continued disturbances to the edaphic layer from land use practices within the Study Area maintains retrogressive conditions within extant vegetative assemblages.

pond along the southeastern corner of the Study Area (FIGURE 7). The drainage pattern is poorly defined along its course through the Study Area and has vegetative assemblages common both to upland and wetland habitats. Plant species observed in this feature include Italian ryegrass and Mediterranean barley, which make up the dominant vegetative cover. Other species observed include curly dock, red-stem filaree, cut-leaf geranium, turkey mullein, common spikeweed, popcornflower, baby blue-eyes (*Nemophila menziesii*), pitgland tarweed (*Holocarpha virgata*), vinegar weed (*Trichostema lanceolatum*), and soft chess (*Bromus hordeaceus*). Slightly deeper microtopographical depressions along the swale contain small colonies of vernal pool buttercup (*Ranunculus bonariensis* var. *trisepalus*) and common spikerush (*Eleocharis macrostachya*). The once complex mosaic of braided and sinuous low-gradient swales appears to have been effectively reduced or nearly extirpated over the past 70 years; current drainageways (in 2008) are hydrologically reductive (i.e., less complex) and ecologically retrogressive.

Analysis of Historic Photographs

1937: This portion of the Study Area has undergone significant physiographic changes via land use conversions including dry-land farming, and orchard; some portions remained as unplowed rangeland/open grassland for grazing livestock. Existing drainage patterns were a complex mosaic of braided and sinuous swales; this hydrologic complexity has been completely extirpated over the past 70 years; current drainageways in 2008 are hydrologically reductive and ecologically retrogressive.

1957: The swale west of 16th Street was completely extirpated by this time due to contoured rice farming through the swale; the portion east of 16th Street is evident, but constrained on both sides by dry-land farming. Surrounding land uses included open grassland for livestock pasture, small residential orchards, and dry-land farming.

1964: The original drainageway west of 16th Street has been effectively extirpated; a faint trace can be seen east of 16th Street. The only evidence of runoff ponding along the course of this drainageway is the darker saturation zone located where 16th Street crosses over the feature (likely via a culverted structure). Surrounding land uses include rangeland for grazing livestock and increasing residential build-out.

1972: A faint drainage pattern can be seen west of 16th Street; in general, drainage patterns are ill-defined on the east side. Surrounding land uses include rangeland for grazing livestock and increasing urban build-out along the southern boundary.

1980: Surrounding land use is rangeland for grazing livestock.

1984: While existing physiographic conditions seem less disturbed, a well-defined drainage pattern is difficult to discern in the aerial photograph. Surrounding agricultural land use now appears to be almost exclusively rangeland for grazing livestock; urban build-out increases along the southern and eastern boundaries.

Pond (east of 16th Street) – This feature was created sometime after 1972 by constructing a berm across the WS6 swale. This 3.39-acre, shallow, concave basin supports vegetative assemblages associated with vernal pool and seasonal wetland habitats. While vegetation in the pond is generally sparse, plant species observed during the December 2008 field survey include vinegar weed, popcornflower, common spikerush, common spikeweed, curly dock, clover (*Trifolium* sp.), and sand-spurrey (*Spergularia* sp.); the only woody vegetation observed around the edges of this feature are three Goodding's willow (*Salix gooddingii*) in poor condition, which appear stunted by repeated stem cutting and rootwad undercutting.

Analysis of Historic Photographs

> 1937: This portion of the Study Area has undergone, by this time, significant physiographic change via land use conversions including dry-land farming and orchards; some portions remained as unplowed rangeland/open grassland for livestock pasture. The pond does not appear in the 1937 photograph.
>
> 1957: The pond had not yet been constructed and surrounding land uses included open grassland for grazing livestock, small residential orchards, and dry-land farming.
>
> 1964: The pond had not yet been constructed and surrounding land uses include rangeland for grazing livestock and increasing residential build-out. Larger vernal pools and the bermed wetland in the Study Area's southeastern corner are quite prominent.
>
> 1972: The pond has not been constructed and surrounding land use includes open rangeland for grazing livestock; vernal pools and swales are evident within the general area.
>
> *1980*: The darker wetland signature of the pond is now evident by 1980. Surrounding land use is rangeland for grazing livestock and dry land farming, along with increasing urban build-out of the Gibson Ranch residential development along the eastern boundary. Increasing alteration and impacts to headwater drainage patterns within this area are now apparent in the aerial photograph.
>
> *1984*: The darker wetland signatures of the pond do not appear well-defined; surrounding agricultural land use now appears to be almost exclusively rangeland for grazing livestock; urban build-out increases along the southern and eastern boundaries.

Drainage Ditch (DD1c; west side of Palladay Road) – Vegetation within this feature is extremely sparse and dominated by a few weedy species, including curly dock, red-stem filaree, and common spikeweed. The once complex mosaic of braided channels and swales appears to have been completely eliminated over the past 70 years. The current (2008) channelized drainageways in the study area are hydrologically reductive and ecologically retrogressive.

Analysis of Historic Photographs

> 1937: This portion of the Study Area has undergone, by this time, significant physiographic changes via land use conversions, including dry-land farming and orchard; some portions remained as unplowed rangeland/open grassland for grazing livestock.
>
> 1957: This area appears to be dry-land farmed. Surrounding land uses included open grassland for grazing livestock, dry-land farming, and some irrigate fields; by this time, there appears to be an increase in the number of farm/rural residences within the general area. The reference drainage ditch appears by 1957.
>
> 1964: Large-scale farming (i.e., rice production, dry-land farming) appears to be waning by this time and grazing appears to be the primary land use in the surrounding area.
>
> 1972: Surrounding land uses include grazing livestock on open rangeland and increasing residential build-out within the general area.

1980: Surrounding land use is rangeland for grazing livestock, some dry land farming, and increasing agricultural-residential development within the general area.

1984: A faint trace of the linear drainageway can be discerned in the aerial photograph; surrounding land use is rangeland for grazing livestock and scattered dry land fields. Increasing agricultural-residential development is increasing along the western boundary.

Ditch (east side of Pallady Road) – The vegetation observed within this feature is dominated by weedy grasses and broad-leaved plants including Italian ryegrass, rip-gut brome, soft chess, curly dock, and vetch.

Analysis of Historic Photographs

1937: This portion of the Study Area has undergone significant physiographic changes via land use conversions including dry-land farming and orchard; some portions remained as unplowed rangeland/open grassland for livestock pasture. This area was under rice production in 1937, but the same drainageway in 2008 is hydrologically reductive and ecologically retrogressive.

1957: Based on dark wetland signatures on the aerial, this area appears to be part of a large flood-irrigated field for either livestock grazing or alfalfa production. There is the faint trace of a drainage ditch along the southern boundary, which conveys excess runoff under Palladay Road into the meandering stream channel. Surrounding land uses include open grassland for livestock pasture and dry-land farming and, by this time, there appears to be an increase in the number of farm residences within the general area.

1964: The channel is faint, with evidence (i.e., darker saturation) that the large field to the north may still be irrigated for hay production/livestock. Grazing appears to be the primary land use in the surrounding area.

1972: The open field north of the channel appears to no longer be irrigated for alfalfa production or pasture and surrounding land uses include grazing livestock on open rangeland and increasing residential build-out within the general area.

1980: Although likely extant, this feature is not discernable in the aerial photograph. Surrounding land use is rangeland for grazing livestock, some dry land farming, and increasing agricultural-residential developments within the general area.

1984: The faint trace of a drainage channel can be seen in the aerial photograph; surrounding land use appears to be rangeland, with a return of ruderal vegetative cover. Surrounding land use appears to be primarily rangeland for grazing livestock.

Swale (west side of 16th Street) – The swale is dominated by grasses including Italian ryegrass, hare barley, soft brome, and rattail fescue (*Vulpia myuros*); broad-leaved plants observed include curly dock, turkey mullein, and prickly lettuce (*Lactuca serriola*).

Analysis of Historic Photographs

1937: This portion of the Study Area has undergone significant physiographic changes via land use conversions including dry-land farming and orchard; some portions remained as unplowed rangeland/open grassland for livestock pasture. Sometime before Gibson & Skordall's field delineation in 1999, the original headwater drainage patterns east of 16th Street were altered by redirecting runoff via culverts, ditches, etc.

1957: The swale appears as a prominent dark wetland signature and appears to convey excess runoff from an irrigated field located east of 16th Street. Water for the irrigated field is redirected from the swale immediately to the east. Surrounding land uses included some pasture (primarily around farmsteads), rice production, and dry-land farming.

1964: The formerly irrigated field appears to be inactive and the reference swale appears to no longer convey significant discharges/runoff and is now only a faint trace on the aerial photo. It also appears that significant portions of surrounding agricultural land has been allowed to revert to pasture from the dry-land farming practices prevalent in 1957.

1972: The swale is still visible and grazing appears to be the primary land use in the surrounding area. Large-scale farming practices (i.e., rice production, dry-land farming) are waning.

1980: The swale, while its signature is visible on the aerial photograph, is part of a larger dry land farmed field. Surrounding land use is rangeland for grazing livestock and dry land farming.

1984: The previously dry land farmed field now appears to be segregated into smaller units, possibly for grazing paddocks for livestock. The faint signature of the swale is visible in the aerial photograph. Surrounding land use within the immediate vicinity is rangeland for grazing livestock, although extensive rice production occurs to the northeast of this area.

Upland (east side of 16th Street) – The original drainageway has been replaced by a rural residence and landscape plantings.

Analysis of Historic Photographs

1937: This portion of the Study Area, while possibly used as pasture for grazing livestock, appears to have retained its original, unplowed vegetative cover of grassland embedded with a mosaic of swales and vernal pools. Surrounding areas appear to have undergone significant physiographic changes via land use conversions including dry-land farming and orchard.

1957: A residential residence/farmstead has been built on the east side of 16th Street, redirecting flows from not only the newly created shallow basin reservoir to the north, but from an additional basin located in the southeast corner of the parcel - as evidenced by an additional swale appearing as a prominent dark wetland signature. Surrounding land uses include some pasture (primarily around farmsteads), rice production, and dry-land farming. A complex of undeveloped swales and vernal pools can be seen immediately to the east of this area.

1964: The shallow basin reservoir within the farmstead parcel does not appear active and the majority of open lands east of 16th Street appear to be used as open rangeland for livestock.

1972: The residence/farmstead is well developed with a second pond (east of 16th Street) now evident. Grazing appears as the primary land use in the surrounding area, although extensive fields to the north indicate saturated soils from flood irrigation.

1980: The residence/farmstead (east of 16th Street) is well developed; the pond visible in 1972 no longer is evident. Grazing appears as the primary land use to the east – note the dramatic wetland signatures marking vernal swales in this area. Large basins are also prevalent throughout this area.

1984: The residence/farmstead (east of 16th Street) is well developed; the pond visible in 1972 no longer is evident. Grazing continues to be the primary land use east of this area.

In summary, these photographs show that anthropogenic land-use patterns within the past ~80 years have been frequent, varied, and pronounced, often eliminating or at the very least, severely impacting the ability of existing wetland features to perform their optimal biological, chemical, and hydrological functions within the landscape setting. Most extant wetland features are currently hydrologically reductive (i.e., less complex due to anthropogenic modifications such as channeling) and ecologically retrogressive (i.e., stands of existing vegetation tend to be dominated by r-selected species[10], with little or no recruitment of climax species (i.e., K-selected species) within the context of their functions and values. This Functions & Value Assessment must therefore take into account these constantly changing conditions within the Study Area over the past century and recognize in this evaluation that what occurs in the Study Area today is vastly different than the pre-settlement landscape.

QUALITATIVE ASSESSMENT OF FUNCTIONS & VALUES OF EXISTING WETLANDS IN THE ESP STUDY AREA

In general, wetland functions within the Study Area are primarily hydrologic, biogeochemical, and ecological. Societal values are subjective and difficult to quantify, but in general, people tend to place a high value on wetlands for natural resource functions (e.g., recharging of groundwater supplies, providing habitat for fish and other wildlife species), as well as aesthetic, educational, and cultural values.

WETLAND FUNCTION — The primary productivity of any ecological system is measured by the amount of biomass produced by plants and is expressed in terms of its primary productivity (kilocalories/meters^2/year). Globally, patterns of primary productivity vary both spatially and temporally. The most productive ecosystems are systems with high temperatures, ample water, and abundant available soil nitrogen. Tropical rain forests, estuaries, and swamps and marshes have the highest overall net primary productivity (9,000 kilocalories/meters^2/year) of the earth's major biomes; temperate grasslands exhibit a net primary productivity of 2,000 kilocalories/meters^2/year[11]. In semi-arid environments like California's Central Valley, wetlands such as streams, marshes and vernal pool / swale complexes exhibit some of the highest productivity in the region.

[10] r-selected species (primarily annuals and biennials) tend to be opportunistic, and typically have short maturation times, short life span, and produce many offspring quickly.

[11] Fundamentals of Physical Geography. *www.physicalgeography.net/fundamentals/91.html*

Other important functions include water storage, water filtration, and biological productivity. While the wetland features within the Elverta Specific Plan may contribute somewhat to local biodiversity of the Study Area, above-ground vegetation is sparse[12] and provides only marginal nesting and cover for only those year-round and migratory wildlife species adapted to disturbed habitats and urbanized landscapes. These features also likely exhibit a low net primary productivity based on existing vegetative stands and disturbed edaphic conditions from historic land use changes associated with various agricultural practices. Most of the wetlands in the Specific Plan area are currently dominated by shallow-rooted annual monocots and dicots instead of robust, rhizomatous perennial monocots such as cattails, tules, rushes, and sedges.

Hydrologic Function – Hydrologic function (i.e. how water enters, moves, and is stored in a system) is a key element in describing and delineating wetland habitats. The velocity and movement of water across a wetland during an overflow event are controlled by the width, slope, and surficial geology of the area being inundated. The capacity of wetlands to capture moving water for periods during seasonal precipitation events is called "dynamic surface water storage" – the longer water is held, the greater the wetland's potential to perform its necessary functions. The soil's ability to absorb and retain water for long periods of time often favors plant, invertebrate, and vertebrate species that can survive during long periods of inundation and saturation (e.g., obligate and facultative wetland hydrophytes). In California, the benefits in unique natural storage situations often result in the formation of vernal pool ecosystems and these wetlands in the Central Valley's semi-arid environments provide critical habitat for many species.

Many historic wetland features within the Study Area have been extirpated over the past 80 years – cultivated, isolated, or channelized as the vernal pool landscape was converted to grazing, dryland and irrigated croplands, and rural residential land use conversion. Dry-land farming was already prevalent within the Study Area by the mid-1930s, yet much of the wetland micro-relief appeared to be intact; indicating that soil disturbance by plowing was at a minimum during this time. However, by the mid-1950s, extensive irrigated agriculture dominated the Study Area, with contoured rice farming in the south, irrigated fields and channelization in the west, significant land leveling and surface water impoundments in the northeast to accommodate rice farming and furrow irrigated fields, and continued dryland farming in the interior. Through the mid-1980s, the number of farmsteads, rural residential lots, and smaller surface water impoundments increased along, with offsite residential neighborhoods to the east.

Contouring for rice farming in the 1950s and 60s significantly disturbed the ground surface throughout the Study area, as soil was skimmed to create shallow downslope rice checks. The duripan was also interrupted in many places with the construction of drainage ditches, agricultural ponds, and roadways. It is also possible that deep-ripping or other duripan disturbances occurred during this period of severe land use conversion. Many of the prominent vernal pools (in both size and depth) in the southern portion of the Study area were likely bermed, prominent swales farmed-over and filled in, and less prominent wetland features extirpated by this contoured rice farming. These rice fields in the south were subsequently reclaimed to dryland farming (with frequent plowing and discing) or livestock grazing after the 1960s. Much of this surface manipulation is still evident today in the form of fallowed furrows and rice checks crisscrossing the landscape, which in turn enhances infiltration and prolongs soil water storage and subsurface lateral flow.

The more prominent vernal pools in the area have survived this long history of land manipulation, but

[12] Although no quantitative studies (e.g., vegetation sampling surveys) have been conducted for this assessment, field observations indicate that ruderal (i.e., disturbance) species of non-native annual and biennial plants form the dominant vegetative cover in terms of their overall frequency, density, and distribution throughout the Study Area.

are now, for the most part, hydrologically isolated. and exhibit a significantly reduced hydrologic function due to the substantially disturbed and modified micro-relief and stratigraphy of these remnant pools and their downstream connections over the decades, effecting large changes to the hydrologic frequency, duration, timing, and depth of inundation – and consequently ecologic function – of the system as a whole. Smaller remnant pools have a lower hydrologic function because the severe hydrologic changes have an even more pronounced effect on the hydrologic or water level regime of the pools, which in turn influences ecological response. Other pools (and seasonal wetlands) with low hydrologic function include those that are an artifact of a fallowed landscape following decades of surface manipulation, simple depressions in the landscape (e.g. old rice checks) that perch or pond water for which the water level regime is ill-defined.

The extant wetland swales in the Study Area exhibit the least hydrologic function, especially those forming what are now the most apparent drainageways. Most swales have been either farmed over or channelized and water delivery to these features has been locally augmented (i.e. by roadside ditches, which concentrate and convey hardscape runoff; and by intercepted subsurface lateral flow) and/or significantly impeded (i.e. by surface water impoundments that retain surface runoff). The swales have consequently all but lost their micro-relief, have been filled in with top soil and crisscrossed with old furrows, resulting in a less sinuous wetland signature with an ill-defined water level regime. Channelized swales that are presently mapped as ditches and channels, where straightened to more efficiently convey surface runoff, resulting in incised channels with active signs of headcutting and bank erosion. Other swales have been widened in place and also show signs of active headcutting. The net effect of channelization, independent of whether surface runoff to the swales is augmented from rural residential hardscapes or retained in manmade ponds, is a cycle of continued degradation that, while resulting in a more efficient draining of the landscape, has severely reduced the historic function of these once-natural wetland systems.

Field observations during the December 2008 field survey - standing water, drift lines (drainageways), and sediment deposits (vernal pools; seasonal wetlands) that occurred during overflow events - would indicate that the wetland habitats within the proposed project area perform, at best, only a moderate surface water storage function. Bermed wetlands and ponds support most of the ponding in the Study Area, but still exhibit only a moderate dynamic surface water storage function and value. Prolonged soil saturation from this artificial, long-term storage of surface water can actually have adverse ecological consequences. An evaluation of historic aerial photographs reveal that many of the extant wetland features (e.g., vernal pools, seasonal wetlands) are, in fact, of relatively recent origin,

The current hydrologic function of existing wetlands, described above, is summarized in the following table:

Feature Type	Hydro Function	Historic Disturbance	Current Value

Landscape	*Soil water storage*	• Disturbance of surficial soils and duripan from land-leveling, deep ripping, ditching, artificial ponds, roads, etc.	Moderate • Plow pan[13] maintains reduced infiltration and increased surface runoff
Vernal pools (Remnant)	*Pond water*	• Most smaller pools & swales extirpated, except in areas where historic ag-modification less pronounced • Remnant pools disconnected and isolated, with connecting swales largely extirpated • Duripan continuity interrupted land-leveling, deep ripping, ditching, artificial ponds, roads, etc.	Low • Substantially modified water level regime[14] from altered micro-relief and stratigraphy, due to agricultural reclamation. • Ponded water in abandoned furrows and rice • Little surface connectivity and artificially manipulated water level regime
Swales (remnant)	*Convey water slowly*	• Ill-defined swales with abandoned furrows and rice checks an artifact of historic ag use (e.g. rice)	Low • In-filled swales and man-made ponds = reduced drainage sinuosity & modified water level regime
Swales (channelized)	*Convey water quickly*	• Swales straightened for ag reclamation • Active headcutting, with bank erosion and incision to the duripan	Low • Artificial water regime exacerbated by increased hardscape runoff and water table interception
Ponds (man-made)	*Store water*	• Created to support irrigated agriculture • Some excavated into duripan	Low • Random surface water retention adversely modifies existing drainage efficiency; • Some ponds losing water through perforated duripan

Biogeochemical Function – Biochemical function describes fundamental and essential ecosystem processes upon which wetlands depend. The following is a discussion on the biochemical functions of nutrient cycling and removal of imported elements and compounds for this assessment.

Nutrient cycling is a fundamental ecosystem process that changes elements from one form to another. Estimation of vegetative cover is one means of assessing the extent of nutrient cycling within a site - with vegetation density being directly proportional to supportable biomass. The existing vegetative cover within nearly all mapped wetland features of the Study Area is sparse, patchy, and generally poor in terms of species richness and diversity. Current physiographic and

[13] A **plow pan** is a subsurface horizon or soil layer having a high bulk density and a lower total porosity than the soil directly above or below it as a result of pressure applied by normal tillage operations. Plow pans are not cemented by organic matter or chemicals. Plow pans are the result of pressure exerted by humans, whereas hard pans occur naturally. What this means is that an artificial hardpan halfway to the distance of the natural duripan has been created by repeated plowing, etc.

[14] The **water level regime** is the change frequency and duration of inundation relative to the topography of the pools, which in turn affects ecological response. A disturbed pool could have been shallowed or even deepened, hence, a change in the water level regime substantially impacts wetland ecological function.

edaphic conditions in the Study Area suggest that these features do not function at their optimal level and therefore reflect a relatively low value of available wetland and wildlife habitats. Portions of the Study Area dominated by non-native annual and perennial grasses also appear to have a relatively low value for wildlife and wetland habitat, reflected by a low diversity (and therefore function) in these habitats as well. The aggregate values of upland and wetland habitats throughout the Study Area are therefore considered to be low.

Imported elements and compounds are removed from the aggregate wetland features during overflow and precipitation events, but the overall value of this function within the Study Area appears marginal at best, as the lack of a diverse and complex vegetative cover (such as extensive areas of freshwater emergent marsh and riparian scrub vegetation) within the Study Area greatly restricts the function of vegetative assemblages to remove imported elements and compounds. And while the Study Area's overall biochemical (e.g., microbial decomposer) and hydrologic processes play an important role in the removal of small amounts of soluble organic and inorganic debris in standing and moving water columns, they are not likely sufficient to remove larger elements, as evidenced by the amount of litter and insoluble debris found throughout the Study Area.

<u>Habitat Function</u> – Habitat function describes how vegetative communities and the taxa occupying them are related, based on their proximity and connectivity to surrounding habitats. Habitat connectivity plays an important role in the long-term ecological integrity and viability of each community type. Native plant communities in the Study Area include degraded valley prairie and vernal pools, but the vast majority of the Study Area is dominated by extensive stands of non-native annual and biennial vegetation. The present extent and distribution of wetland habitats within the Study Area appear to be primarily the result of historic agricultural land use practices (e.g., discing, grading, maintenance of drainage ditches via periodic excavations, rural residential development). The only relatively undisturbed wetland features are restricted to the extreme northwestern portion of the Study Area, along the boundaries between Sacramento and Placer Counties (FIGURE 7). The current functionality of the extant wetlands appears to be limited by *in situ* and surrounding land uses, existing physiographic conditions, and previous anthropogenic impacts (illustrated by the previous analysis of historic aerial photographs presented in this assessment).

A wetland's vegetative heterogeneity reflects its ability to support dependent wildlife populations. We observed the relative abundance, density, and diversity of standing vegetation in the field to assess this function. The general lack of riparian scrub and woodland habitat in the Study Area supports a relatively low avian diversity, and mammals either residing or passing through the area include those species adapted to survival in an urban landscape setting such as raccoon and coyote, as well as domestic dogs, cats, rats and other rodent species. While the aggregate wetlands within the Study Area do provide some essential ecological system inputs to local plant and wildlife populations, wetlands values are considered to be low because they provide only marginal wildlife habitat.

Habitat function within Study Area wetlands and "other waters" is also constrained by surrounding land uses, which have resulted in increasing fragmentation of the relatively small remaining patches of remaining "undisturbed" habitat as a result of urban build-out and historic anthropogenic (e.g. agricultural) impacts on the landscape. Species richness is driven by hydrologic variation and the structure of the associated vegetative assemblages found throughout the area, which is generally poor to marginal, at best.

Connectivity of wetland habitats is essential to the movement of aquatic organisms. Complexity of aquatic and terrestrial trophic levels is a measure of the capacity of a wetland to provide both biotic and abiotic functions, which in turn provide and promote habitat diversity, movement corridors for migratory species, and refugia for plants and animals (where urbanization encroaches on remaining regional upland and wetland habitats). The frequency of seasonal flooding and the duration of surface flows are important in facilitating plant (seed, rhizome, propagule), invertebrate, and vertebrate dispersal, as well as allowing organisms sufficient time to access wetlands to complete important developmental stages. Surface and subsurface flows allow for an interspersion and dispersal of aquatic organisms among habitat types and a contiguous vegetative cover between uplands and wetlands also facilitates terrestrial wildlife movement. Unfortunately, wetland habitats within the Study Area are highly fragmented and do not provide contiguous cover or suitable migratory corridors for vertebrate wildlife species, though they do provide some habitat value for locally common species adapted to urbanized environments (e.g., striped skunk, opossum, raccoon, coyote). Therefore, although the Study Area does not provide particularly valuable or ecologically diverse habitat for a wide range of animal or plant species, it does provide marginal functions for locally common wildlife species, and provides some limited habitat refugia for birds and insects as well as marginal areas for wildlife movement and dispersal. Overall, however, the Study Area, in our opinion, has a low function and value for wetlands-driven connectivity.

The capacity of wetland habitats within the Study Area to maintain the density and spatial distribution of aquatic invertebrates was assessed by reviewing the results of United States Fish and Wildlife Service (USFWS) protocol-level dry- and wet-season sampling for vernal pool crustaceans conducted in 2008[15]. The results of these surveys indicated that large branchiopod species – vernal pool fairy shrimp, California fairy shrimp, California clam shrimp, and lentil clam shrimp were observed at 11 of 19 properties sampled within the Elverta Specific Plan, indicating moderately high species diversity for vernal pool branchiopods. Apart from vernal pool crustaceans, however, the habitat value of existing wetland features for local vertebrate wildlife populations appears to be low, as existing wetland habitats lack adequate structural diversity and complexity in standing vegetative cover to provide sufficient cover, foraging, and nesting habitat.

WETLAND VALUE — Determining the value of individual wetlands is difficult because they differ widely and do not all perform the same functions or perform functions equally well. On a limited scale, the Study Area does contribute to the local biodiversity of the general area, and extant wetlands do, to a limited extent, help recharge and purify local groundwater supplies. However, based on the existing plant cover (dominated by stands of annual and biennial herbaceous vegetation), aesthetic, recreational, and commercial opportunities (e.g., bird watching, recreational exercise) that may be associated with these features would, in our opinion, be extremely low.

BOTANICAL COMPARISON OF ESP WETLANDS WITH SIMILAR REGIONAL (REFERENCE) WETLANDS

EMPIRE RANCH IN FOLSOM, CALIFORNIA – The Empire Ranch residential development has significant open space elements incorporated into a greater greenbelt complex represented by a mosaic of valley prairie, oak woodland, riparian, vernal pool, seasonal wetland, and freshwater emergent marsh habitats along seasonal and perennial stream corridors (*Willow Creek* is the primary intermittent blue line feature on the Clarksville USGS topographic map) and engineered stormwater detention basins. We believe that some of the existing upland and wetland features at Empire Ranch serve as suitable comparative models for several of the existing wetland types in the Elverta Specific Plan area.

15 Helm, B. 2008. Wet-season (Dry-season) sampling for federally-listed large branchiopods at the Elverta Specific Plan properties. Helm Biological Consulting, LLC. Lincoln, CA

We conducted a field survey of the Empire Ranch wetlands on January 16, 2009, choosing comparable wetland assessment areas (WAAs) to those within the ESP (FIGURE 8), recorded a list of plant species observed within each feature, and established photo-points for visual reference of the various wetland habitats assessed (Appendix B).

Seasonal Wetlands – Seasonal wetlands occur along low terraces above various seasonal and perennial stream corridors throughout the WAA. Plant species in this habitat type include Baltic rush, tall flatsedge, iris-leaved rush, Muhlenberg's centaury, common spikerush (*Eleocharis macrostachya*), salt grass (*Distichlis spicata*), and hyssop loosestrife (*Lythrum hyssopifolium*).

Plant species observed in ESP seasonal wetlands included creeping [common] spikerush, Mediterranean barley, perennial [Italian] rye grass, annual rabbit-foot grass, curly dock, iris-leaved rush (*Juncus xiphioides*), and prostrate knotweed (*Polygonum aviculare)*. "Bermed wetlands" in the ESP supported creeping [common] spikerush, coyote thistle, slender popcorn flower, smooth goldfields, tall flatsedge, annual [beardgrass] rabbit-foot grass, swamp timothy, and Bermuda grass (*Cynodon dactylon*). The frequency, density, and distribution of non-native species within these mapped features is higher than for native species.

Vernal Pools – Vernal pools at Empire Ranch have been protected in permanent mitigation preserves within a greater greenbelt complex. Plant species in these habitats include popcornflower (likely P*. stipitatus* var. *micranthus*), hawkbit (*Leontodon taraxacoides*), brodiaea (likely *B. minor*), vernal pool buttercup (*Ranunculus bonariensis* var*. trisepalus*), common spikeweed (*Centromadia pungens*), coyote thistle (*Eryngium* sp.), goldfields (*Lasthenia* sp.), water-starwort (*Callitriche marginata*), cut-leaf geranium (*Geranium dissectum*), annual hairgrass (*Deschampsia danthanioides*), Mediterranean barley (*Hordeum marinum* spp. *gussoneanum*), and cladophora (*Cladophora* spp. [algae]).

Shallow vernal pools in the ESP (in 1999) supported perennial [Italian] rye grass, Mediterranean barley, coyote thistle, slender popcornflower, smooth goldfields, Fremont's goldfields (*Lasthenia fremontii*), purple [annual] hairgrass (*Deschampsia danthonioides*), woolly marbles (*Psilocarphus brevissimus*), Carter's buttercup (*Ranunculus bonariensis* var. *trisepalus*), and bractless hedge-hyssop (*Gratiola ebracteata*); deeper vernal pools contained creeping [common] spikerush, smooth goldfields, annual rabbit-foot grass, and Carter's buttercup. Vernal pools examined in 2008 contained Italian ryegrass (*Lolium multiflorum*), Pacific bentgrass (*Agrostis avenacea*), Mediterranean barley (*Hordeum marinum* ssp. *gussoneanum*), common spikerush (*Eleocharis macrostachya*), popcornflower (*Plagiobothrys* sp.), coyote thistle (*Eryngium* sp.), clover (*Trifolium* sp. – likely *T. variegatum*), Carter's buttercup (*Ranunculus bonariensis* var. *trisepalus*), common spikeweed (*Centromadia pungens*), turkey mullein (*Croton setigerus*), curly dock (*Rumex crispus*), cut-leaf geranium (*Geranium dissectum*), field bindweed (*Convolvulus arvensis*), and red-stem filaree (*Erodium cicutarium*). A slightly higher percentage of vernal pool species were recorded in 1999 and a slightly higher percentage of non-native species (e.g., curly dock, cut-leaf geranium, field bindweed, red-stem filaree) observed in 2008. This could be a result of continued degradation of the area as a result of grazing regime.

Freshwater Emergent Marsh – Plant species within this habitat type at Empire Ranch include broad-leaved cattail, smartweed, curly dock, clustered dock (*Rumex conglomeratus*), tule (*Schoenoplectus* sp.), pennyroyal (*Mentha pulegium*), yellow water primrose (*Ludwigia peploides*), Santa Barbara sedge (*Carex barbarae*), common rush (*Juncus effusus*), cocklebur (*Xanthium strumarium*), and mosquito fern (*Azolla filiculoides*).

This habitat type within the ESP occurs primarily along the edges of stock ponds within saturation zones of varying width. Plant species observed in these areas include creeping [common] spikerush, arrowhead (*Sagittaria* sp.), cattail (*Typha* sp.), least spikerush (*Eleocharis acicularis*), Fremont's cottonwood shrubs (*Populus fremontii*), and willows (*Salix* spp.). The sides and perimeters of the ponds supported a mix of seasonal wetland and vernal pool species including tall flatsedge, slender popcornflower (*Plagiobothrys stipitatus* var. *micranthus*), smooth goldfields (*Lasthenia glaberrima*), annual [beardgrass] rabbit-foot grass (*Polypogon monspeliensis*), and swamp timothy (*Crypsis schoenoides*). Although we observed cattail, tall flatsedge, and other native species strongly associated with this habitat type, it is unclear what the frequency, density, and distribution of these species is within these features.

Based on the species observed, the relative habitat values for local wildlife in this medium-density residential setting appear to be high, especially for avian species such as waders, raptors, and passerines. The stream features throughout the Empire Ranch development are dedicated open space, and provide important migratory corridors for local resident and transient wildlife species, including river otter, deer, fox, coyote, and anecdotal observations of mountain lion. The vernal pools, while not a substantial component of the overall wetland types, provide important potential habitat for vernal pool crustaceans and endemic plants. The wetlands mosaic at Empire Ranch provides a number of important hydrologic services including local groundwater recharge, and biofiltration; the large basin located north of Silberhorn Drive provides critical stormwater retention during the rainy season.

<u>ORCHARD CREEK IN PLACER COUNTY, CALIFORNIA</u> – The WAA located along Orchard Creek in southern Placer County is a city-owned parcel north of the Lincoln Wastewater Treatment Facility, northwest of the Wildlands Orchard Creek Conservation Bank, and east of the *Moore Ranch Wetland Preserve* (FIGURE 9). This ±200-acre site supports significant natural areas, including valley oak riparian woodland along the perennial channel of Orchard Creek, freshwater emergent marsh, and a mosaic of vernal pool, swale, and seasonal wetland complexes. We believe that existing wetland features at this Orchard Creek site can be compared to similar wetland types in the ESP and serve as possible reference models for drainage corridor enhancement proposed as part of the ESP development.

We conducted a field survey of the Orchard Creek reference wetlands on April 13, 2009, where he chose locations to serve as comparative WAAs for the Elverta Specific Plan (FIGURE 3), recorded a list of plant species observed within each selected feature, and took representative photographs of the various wetland habitats assessed (Appendix F).

<u>Vernal Pools</u> – Plant species observed within the Orchard Creek WAA included Great Valley button celery (*Eryngium castrense*), stalked popcornflower (*Plagiobothrys stipitatus* var. *micranthus*), rayless goldfields (*Lasthenia glaberrima*), doublehorn calicoflower (*Downingia bicornuta*), white navarretia (*Navarretia leucocephala*), Carter's buttercup (*Ranunculus bonariensis* var. *trisepalus*), white meadowfoam (*Limnanthes alba*), and common spikerush (*Eleocharis macrostachya*).

Shallow vernal pools in the ESP (in 1999) supported perennial [Italian] rye grass, Mediterranean barley, coyote thistle, slender popcornflower, smooth goldfields, Fremont's goldfields (*Lasthenia fremontii*), purple [annual] hairgrass (*Deschampsia danthonioides*), woolly marbles (*Psilocarphus brevissimus*), Carter's buttercup (*Ranunculus bonariensis* var. *trisepalus*), and bractless hedge-hyssop (*Gratiola ebracteata*); deeper vernal pools contained creeping [common] spikerush, smooth goldfields, annual rabbit-foot grass, and Carter's buttercup. Vernal pools examined in 2008 contained Italian ryegrass (*Lolium multiflorum*), Pacific bentgrass (*Agrostis avenacea*), Mediterranean barley (*Hordeum marinum* ssp. *gussoneanum*), common spikerush (*Eleocharis macrostachya*), popcornflower (*Plagiobothrys* sp.), coyote thistle (*Eryngium* sp.), clover (*Trifolium* sp. – likely *T. variegatum*), Carter's buttercup (*Ranunculus bonariensis* var. *trisepalus*), common spikeweed (*Centromadia pungens*), turkey mullein (*Croton setigerus*), curly dock (*Rumex crispus*), cut-leaf geranium (*Geranium dissectum*), field bindweed (*Convolvulus arvensis*), and red-stem filaree (*Erodium cicutarium*). A slightly higher percentage of vernal pool species were recorded in 1999 and a slightly higher percentage of non-native species (e.g., curly dock, cut-leaf geranium, field bindweed, red-stem filaree) observed in 2008. This could be a result of continued degradation of the area as a result of grazing regime.

The vernal pools at the Orchard Creek site support considerably more native species than those within the ESP.

<u>Seasonal Swales</u> – Seasonal swales within the Orchard Creek WAA contained a large percentage of vernal pool associates, including coyote thistle, white navarretia, doublehorn calicoflower, rayless goldfields, common spikerush, short woollyheads (*Psilocarphus brevissimus* var. *brevissimus*), bractless hedge-hyssop (*Gratiola ebracteata*), Pacific foxtail (*Alopecurus saccatus*), tidy-tips (*Layia platyglossa*), and purslane speedwell (*Veronica perigrina* ssp. *xalapensis*). Other species observed included western rush (*Juncus occidentalis*), iris-leaved rush (*Juncus xiphioides*), and Johnny-tuck (*Triphysaria eriantha*).

Plant species observed in these features within the ESP included dominant stands of perennial [Italian] ryegrass and Mediterranean barley; associates included coyote thistle, toad rush, annual rabbit-foot grass, and slender popcornflower. There are a number of non-wetland swales throughout the Specific Plan Area, dominated by ryegrasses and/or Mediterranean barley, but lacking observable wetland associates and clear indicators of wetland hydrology and/or hydric soils.

As in vernal pools, swales at the Orchard Creek site supported significantly higher proportion of native species than those within the ESP.

<u>Freshwater Emergent Marsh</u> – This community type is typically dominated by perennial emergent monocots; dominant native plant species observed within the Orchard Creek WAA included robust obligate hydrophytes such as tule (*Schoenoplectus acutus* var. *occidentalis*) and broad-leaved cattail (*Typha latifolia*); graminoids included common rush (*Juncus effusus*), Baltic rush (*Juncus balticus*), and tall flatsedge (*Cyperus eragrostis*). Other herbaceous vascular plant species included western goldenrod (*Euthamia occidentalis*), Lady's-thumb (*Polygonum persicaria*), willowherb (*Epilobium ciliatum* var. *ciliatum*), and bitter-cress (*Cardamine oligosperma*).

This habitat type was detected primarily along the edges of stock ponds within saturation zones of varying width. Plant species observed during the field delineation conducted by Gibson & Skordall in 1999 included creeping [common] spikerush, arrowhead (*Sagittaria* sp.), cattail (*Typha* sp.), least spikerush (*Eleocharis acicularis*), Fremont's cottonwood shrubs (*Populus fremontii*), and willows (*Salix* spp.). The sides and perimeters of the ponds supported a mix of seasonal wetland and vernal pool species including tall flatsedge, slender popcornflower (*Plagiobothrys stipitatus* var. *micranthus*), smooth goldfields (*Lasthenia glaberrima*), annual [beardgrass] rabbit-foot grass (*Polypogon monspeliensis*), and swamp timothy (*Crypsis schoenoides*).

The mosaic of wetland types observed at the Orchard Creek site appears to display high ecological productivity, based on the diversity of vegetation types and species encountered. Habitat values for local wildlife also appear high, especially for avian species such as waders, raptors, and passerines and the open, adjacent grasslands provide good foraging and nesting habitat for a reptiles, birds, and mammals. The riparian woodland and riparian scrub along Orchard Creek offer outstanding foraging, nesting, and cover opportunities for local and migratory wildlife species, and the vernal pools, swales, and Orchard Creek itself provides important aquatic habitats for invertebrates, amphibians, reptiles, and birds. Nutrient cycling also appears to be high in these features. The mosaic of wetlands provides for local groundwater recharge and bio-filtration and the two large stock ponds, along with the large pond created by beavers along Orchard Creek provide significant stormwater retention from upstream watershed sources during the rainy season.

QUANTITATIVE ASSESSMENT OF ESP WETLAND FEATURES USING THE CALIFORNIA RAPID ASSESSMENT METHODOLOGY (CRAM)

Methods – The U.S. Army Corps of Engineers, U.S. EPA, and U.S. Fish & Wildlife Service suggested application of the *California Rapid Assessment Method* (CRAM) to:

1. Measure the "quality" of existing wetland features within a relatively disturbed environment, such as the Elverta Specific Plan Action Area;
2. Compare these to similar features within the relatively pristine Orchard Creek Conservation Bank in southwestern Place County – where vernal pools, swales and seasonal wetlands are preserved, enhanced and restored; and
3. Measure the "quality" of wetland features within the recently constructed (8-10 years old) Empire Ranch residential development in Folsom, in eastern Sacramento County. Flood detention basins and streamcourses were enhanced or created here as elements of the development's stormwater system and were identified by the Elverta applicants as approximating anticipated conditions within the ESP following the implementation of the project's Drainage Master Plan.

This quantitative approach to wetlands evaluation was implemented through a series of CRAM "modules" focused on characterizing a variety of wetland types (i.e. Assessment Areas [AAs], including seasonal depressions, riverine streamcourses, vernal pools, lakes, etc.) by measuring attributes for: buffer and landscape contexts, hydrology, and physical and biotic structure. All CRAM modules measure these same four attributes in all wetland (AA) types, though the metrics used in each module varies type-specific relationships for the various wetland features. In all modules, the CRAM "Index Score" is calculated as the average of these four attribute scores.

Field CRAM assessments were conducted at the ESP, Orchard Creek Conservation Bank, and Empire Ranch sites by agency-approved sampling teams from April 19th through April 22nd, 2010. A summary of the results of this study are presented in ATTACHMENT B to this bundled permit package – A full technical report is on file (both hard- and electronic copy) with the Corps, EPA, and FWS. It rained during much of the sampling period and many of the AAs were therefore saturated to inundated, and it appeared that the growth and flowering periods of vernal pool plants appeared to be generally "late."

Results – CRAM sampling of the four "wetland types" occurring at the three sampling sites employed the four appropriate CRAM assessment modules for: Depressional Wetlands; Riverine Wetlands; Single Vernal Pools; and Vernal Pool Systems. The following summarizes a comparison of each of these assessment modules among the three sites.

Depressional Wetlands – From the Table below, there appear to be no substantial differences in the index scores for these AAs across sites, i.e. depressional wetlands within the ESP site fall generally within the same range as the scores for depressional wetlands at Orchard Creek and Empire Ranch locations.

The mixed CRAM attribute scores for hydrology, physical and biotic structure of the ESP depressional wetland AAs, and generally poor conditions reflected by buffer and landscape context attribute scores appear consistent with past and current disturbance and modification of the site by human activity. The assessment area with the highest attribute scores for the site (EDW3) is arguably the most remote AA (i.e. least accessible), consistent with an interpretation that human disturbance is an important factor in determining conditions at this site.

CRAM Scores for Depressional Wetland AAs in the ESP, Orchard Creek Conservation Bank, and Empire Ranch Residential Development, Spring 2010.

Depressional Wetland Assessment Area	Index Score	Attribute Scores			
		Buffer / Landscape Context	Hydrology	Physical Structure	Biotic Structure
Elverta Specific Plan Site					
EDW1	61	45	75	50	75
EDW2	60	42	83	62	50
EDW3	75	48	100	75	78
EDW4	50	45	75	25	56
EDW5 [a, b]	63	48	67	62	75
EDW6	46	40	67	25	53
Orchard Creek Reference Site					
OCDW1	71	93	92	50	47
OCDW2 [c]	67	68	100	50	53
Empire Ranch Reference Site					
ERDW1 [d]	68	81	42	62	89
ERDW2 [d]	64	73	42	62	81
ERDW3 [d]	61	34	42	88	81
Wetland Mean	*64*	*63*	*42*	*77*	*84*

Notes:
- *a Assessment Area EDW5 was also CRAMmed as Single Vernal Pool AA EVP3*
- *b AA EDW5 was CRAMmed by all field personnel as a group as an initial exercise*
- *c Assessment Area OCDW2 was also CRAMmed as Riverine AA OCR1*
- *d AAs ERDW1, ERDW2, and ERDW3 were all located within a single wetland feature; see text*

In comparison, the two Orchard Creek depressional wetland AAs scored high for both hydrology and buffer/landscape context, in a pattern similar to other wetland classes at this site that are protected from human disturbance. Interestingly however, the physical and biotic stricture of these two sampled depressional wetlands scored low, in a pattern consistent with the riverine Orchard Creek AAs, but not for vernal pool AAs at the site (see below). While this relatively unexceptional condition of depressional wetlands within the Orchard Creek Conservation Bank was unexpected, the riverine Orchard Creek has long suffered from adverse effects of grazing (e.g. bank erosion) and wastewater discharge from the nearby Thunder Valley Casino and is only now reflecting recent management efforts to improve this habitat.

The Empire Ranch depressional wetland AAs demonstrate much higher attribute scores for physical and biotic structure, but much lower hydrology scores than similar features at either of the other two sites. This result may be explained somewhat by the relatively young age (~6-8 years) of these features and the primary function of the drainage corridors within which they occur as parts of the site's stormwater management program.

Riverine Wetlands – From the Table below, the index scores clearly indicate that riverine wetlands at the ESP site are in poorer condition than those at the Orchard Creek Bank or Empire Ranch – a result that appears to be directly attributable to the long history of agricultural land use within the ESP. Essentially, all wetlands of this type within the ESP are either naturally-occurring drainage swales that have been modified for use as agricultural drainages or ditches dug specifically for this use. Riverine wetlands at the Orchard Creek Bank and Empire Ranch received overall similar, higher overall scores than those in the ESP, though the reasons for these higher scores vary between the two sites – a more natural buffer/landscape and hydrology of the previously disturbed Orchard Creek, and a significantly more developed physical and biotic structure of the enhanced drainages within the Empire Ranch residential development.

CRAM Scores for Riverine AAs in the ESP, Orchard Creek Conservation Bank, and Empire Ranch Residential Development, Spring 2010.

Riverine Assessment Area	Index Score	Attribute Scores			
		Buffer / Landscape Context	Hydrology	Physical Structure	Biotic Structure
Elverta Specific Plan Site					
ER1	53	70	67	25	50
ER2	58	83	83	38	28
ER3	41	45	58	25	36
ER4	69	90	92	38	56
ER5 [a]	63	93	83	38	36
Orchard Creek Reference Site					
OCR1 [b]	69	93	92	38	53
OCR2	76	93	92	63	56
OCR3	74	93	83	50	69
Empire Ranch Reference Site					
ERR1	67	42	75	75	75
ERR2	78	75	75	88	75
ERR3	74	75	83	75	64

Notes: a *Assessment Area ER5 was also CRAMmed as Vernal Pool System AA EVPS3*
b *Assessment Area OCR1 was also CRAMmed as Depressional Wetland AA OCDW2*

The relatively high buffer/landscape attribute scores of the riverine AAs in the ESP reflect the relatively large (1744-acre) agricultural setting within which they occur and hydrological conditions typical of hydrologically unmodified, meandering swales in this setting. However, the low physical and biotic structure attribute scores reflect a poor condition consistent with historical and ongoing agricultural land use.

Orchard Creek is a natural waterway within a protected Conservation Bank and, consequently, demonstrates exhibits a robust hydrology (augmented by ongoing wastewater discharge from the nearby Thunder Valley Casino) and a buffer/landscape context consistent with a relatively undisturbed (though managed) habitat. The strikingly poor physical and biotic structure of these features reflect a long history of grazing impacts that are only now being reversed through active management of these habitats.

The Empire Ranch riverine AAs exhibit relatively high scores for all attributes – perhaps a result of management of the drainage system at the site for "woody riparian" vegetation and an ability to accommodate periodically elevated runoff flows. This pattern is not inconsistent with the assertion that increased wetland values of these habitats could accompany development, if managed properly.

<u>*Single Vernal Pools*</u> – From the Table below, the index scores indicate that the condition of single ESP vernal pools are comparable to those at Empire Ranch, while the condition of Orchard Creek Bank pools are considerably higher.

CRAM Scores for Single Vernal Pool AAs in the ESP, Orchard Creek Conservation Bank, and Empire Ranch Residential Development, Spring 2010.

Single Vernal Pool Assessment Area	Index Score	Attribute Scores			
		Buffer / Landscape Context	Hydrology	Physical Structure	Biotic Structure
Elverta Specific Plan Site					
EVP1	74	45	100	62	88
EVP2	69	48	100	50	79
EVP3 [a]	67	48	68	62	92
Orchard Creek Reference Site					
OCVP1	82	92	100	50	83
OCVP2	84	93	100	50	92
OCVP3	77	93	100	50	68
OCVP4	78	93	100	38	79
OCVP5	84	93	100	50	92
Empire Ranch Reference Site					
ERVP1	73	60	75	75	83
ERVP2	63	65	100	38	50
ERVP3	64	61	92	38	67

Notes: [a] Assessment Area EVP3 was also CRAMmed as Depressional Wetland AA EDW5

The attribute scores for the ESP single pools reflect a degraded buffer and landscape context typical of an area subjected to a history of agricultural land use, but a hydrology, common in grazing lands, that continues to maintain these wetland types. A high biotic structure attribute score suggests that ongoing grazing of these lands contributes to a poor physical structure of these habitats, while still encouraging a persistence of vernal pool plants, including those less common species.

The generally high attribute scores of single vernal pools at the Orchard Creek Bank are consistent with management of landscape, hydrology and habitat at the Orchard Creek site to maintain high habitat values for vernal pool organisms. A generally poor physical structure of these pools is, however, surprising, considering their management regime.

Though not widespread, overall attribute scores for single vernal pools within the Empire Ranch drainage corridors are average, indicating pools similar to those within the ESP. Examination of component attribute scores for these AAs, however, reflect a wide range of conditions contributing to this overall score – some pools exhibit excellent hydrology, but poor physical and/or biotic structure; while others exhibit moderate scores in all categories

Vernal Pool Systems – From the Table below, vernal pool systems within the ESP appear to be in substantially poorer condition than those more pristine systems at the Orchard Creek Bank. No vernal pool systems occur within the Empire Ranch drainage corridors.

CRAM Scores for Vernal Pool System AAs in the ESP, Orchard Creek Conservation Bank, and Empire Ranch Residential Development, Spring 2010.

Vernal Pool System Assessment Area	Index Score	Attribute Scores			
		Buffer / Landscape Context	Hydrology	Physical Structure	Biotic Structure
Elverta Specific Plan Site					
EVPS1	62	48	68	58	75
EVPS2	72	49	100	58	79
EVPS3 [a]	79	68	100	62	83
Orchard Creek Reference Site					
OCVPS1	94	93	100	92	92
OCVPS2	87	93	100	58	96
OCVPS3	91	93	100	75	96

Notes: [a] Assessment Area EVPS3 was also CRAMmed as Riverine AA ER5

Similar to single vernal pools, low buffer/landscape attribute scores for the Elverta vernal pool systems are low – likely attributable to a long history of agricultural land use. The relatively high hydrology attribute scores perhaps reflect a wet 2010 spring, but also appear to confirm that continued grazing of the area promotes a hydrology compatible with maintenance of a healthy biotic structure in these vernal pool systems, while contributing to degradation of the physical structure of these features through continued trampling and erosion by livestock.

As expected, vernal pool systems at the Orchard Creek Bank scored very high for all attributes, reflecting a landscape managed specifically for these habitats.

<u>Discussion</u> – This CRAM study was based on comparisons of observable metrics at “disturbed” (ESP), “managed” for residential (Empire Ranch), and conservation within a relatively “undisturbed” (Orchard Creek Conservation Bank) sites and, we believe, presents a reliable “snapshot” of existing conditions at the three locations. Examined carefully, the CRAM reflects subtle, yet distinct differences in wetland conditions among these sites, and can assist the resource agencies in reviewing existing vs. proposed conditions for the Elverta Specific Plan (Phase I) Development project.

Higher CRAM scores are generally associated with better wetland conditions and lower scores with poorer conditions. In interpreting the CRAM sampling results for this project, a difference of 10 or more points in mean index and attribute scores between wetlands of the same class at different locations should be a reliable indicator of real differences in the conditions in those wetlands. This comparison is presented in the Table below.

Mean Index and Attribute CRAM Scores for Wetland AAs within the ESP, Orchard Creek, and Empire Ranch Study Areas, Spring 2010.

Location	Mean Index	Mean Attribute Scores

		Buffer / Landscape Context	Hydrology	Physical Structure	Biotic Structure
Depressional Wetlands					
ESP	59	45	78	50	64
Orchard Creek Bank	69	80	96	50	50
Empire Ranch	64	63	42	71	84
Riverine Wetlands					
ESP	57	76	77	63	41
Orchard Creek Bank	73	93	89	50	59
Empire Ranch	73	64	78	79	71
Single Vernal Pools					
ESP	70	47	89	58	86
Orchard Creek Bank	81	93	100	48	83
Empire Ranch	67	62	89	50	67
Vernal Pool Systems					
ESP	71	55	89	59	79
Orchard Creek Bank	91	93	100	75	95

Both depressional and riverine wetlands in the Orchard Creek Bank appear to be in considerably better overall condition than those in the ESP, particularly in terms of buffer/landscape context and hydrology, although the physical and biotic structure of these wetlands, while similar for the ESP and Orchard Creek Bank drainages, is discernably better within the Empire Ranch streamcourses. The results for the Empire Ranch wetlands are consistent with a management focus for these drainages that maintains water quality, limits discharge, and encourages compatible depressional and riverine ("riparian") wetlands habitat within in a development setting.

Mean single vernal pool index scores for the ESP and Empire Ranch are similar, but those within the ESP appear to have a more robust biotic structure than those at Empire Ranch, even though the ESP pools seem to occur in a worse buffer/landscape context than the Empire Ranch pools. The relatively good condition of single vernal pools and vernal pool systems at the Orchard Creek Bank reflect an effective management regime for these habitats at this location.

In summary, the wetlands within the ESP exhibit conditions consistent with past land (particularly agricultural) uses and a current lack of any coherent wetlands management. This can be clearly seen, when compared with similar features within a relatively undisturbed landscape managed for these values (i.e. Orchard Creek Conservation Bank). Depressional and riverine wetland conditions are relatively more degraded than similar features within the Empire Ranch drainageways, that occur within a residential development and are actively managed for these values. Consequently, we believe that, with proper management and long-term montitoring, managed wetlands within the ESP should achieve moderately high function and value within a relatively short timeframe (i.e., 6-8 years) after project implementation.

(PROPPOSED) CREATION OF ESP ENHANCED, MULTIPLE-USE RIPARIAN (DRAINAGE) CORRIDORS

Potential Future Channel Evolution with Traditional Approaches to Stormwater Planning Channel

Management – The hydrologic connectivity of the historic vernal pool / swale system in the Study Area has been dramatically altered over the past 80+ years and, since the 1930s, and possibly before that time, topographic and land use changes had extensively modified the historic drainage network. The present-day system of channels and swales in the Elverta Specific Plan area clearly exhibit various stages of hydrologic, geomorphic and ecologic degradation and land use modification for grazing, and urbanization continue to cause geomorphic degradation in the form of channel incision.

Two main approaches to traditional stormwater management have typically been followed (FIGURE 10):

1. *An Engineered Stormwater Channel* has typically been designed to convey stormwater flows, in many cases up to the 100-year event, as rapidly and efficiently as possible to the receiving waters, such as a flood detention basin or a river/estuary. Historically, these waterways have consisted of trapezoidal or rectangular concrete lined channels. More recently, these have often been modified to grass-lined trapezoidal channels, which frequently have concrete beds to expedite channel maintenance. While these channels usually perform adequately from a single-objective flood conveyance perspective; habitat, aesthetic, recreational or water quality benefits have usually been ignored.

2. *A "Preserved" Existing Channel* has recently been often resorted to to respond to regulatory resource concerns. Urban development is set back, usually 50 to 200 feet from the "preserved" channel, but there is no consistency in specifying setback distances among regulatory agencies or jurisdictions in California. Development, including any channel modification, is precluded within the "preserved" corridor. While motives for enforcing these Preserves are valid (i.e. to prevent further degradation of the channel and its associated habitat), the "preserved" channels invariably experience severe stress from modified hydrology and water quality. Before hydro-modification planning became a requirement for stormwater permitting, degradation of the channel was exacerbated due to urban development adjacent to the channel. The quality of water flows into the channels also deteriorated due to introduced nutrients from "nuisance" flows (particularly summer garden and lawn irrigation). The resulting altered hydrology and increased nutrient supply preferentially benefits infestation of these waters by non-native plants and animals.

Multiple-objective Drainage Corridors as an Alternative Approach to Traditional Stormwater Channel Management – We propose an alternative to either traditional stormwater channel construction or strict preservation of existing drainageways. The choice of appropriate drainage approach within a particular urban environment requires a clear understanding of the geomorphology of the existing drainageway. There are essentially three different types of drainageways:

1. *Unimpacted channels*, while relatively rare, occasionally exist in their original, natural, pristine condition. Generally, levels of channel degradation or incisions are minimal. Hydromodification due to existing land uses such as grazing, logging, other agricultural practices, or upstream development is negligible. Under this scenario it may be appropriate to "protect" the existing channel by setting back urban development based on quantitative, transparent, rigorous, riparian buffer sizing tools, and managing runoff from urban development very carefully using hydromodification mitigation measures, such as flow duration control basins or low impact development source control activities.

2. *Relatively impacted, degraded, and incised channels* are a more common situation in California. Many existing channels are heavily degraded and actively incised and widened through bank erosion, resulting from hydromodification impacts of urban development or other anthropogenic

factors, such as grazing and agriculture. It may not be appropriate to protect or preserve the existing creek channel under this scenario, as further stresses from urban development will only exacerbate channel degradation. In this case, the channel should be modified, stabilized, rehabilitated and re-contoured to function more resiliently under urbanized conditions. This should include rehabilitation of floodplain terraces, construction of grade control structures and bank treatments to stabilize the channel for future hydromodified flow regimes.

3. *Channels responding to a new equilibrium* should be considered after many decades of anthropogenic impacts have altered historic landscapes to the extent that preservation of a functional system would be difficult and unlikely under a regime of continuing and anticipated, future urbanization. In these cases, historic drainages have already evolved into different systems through a revised hydrology and sediment transport regime and channels have substantially incised and widened to form new floodplain terraces within the degraded channel cross sections. This relatively new condition, or alternative channel type, may be more resilient to hydromodification impacts of urban development and require different management approaches to those outlined in 1 and 2, above. A combination of strategies should be applied to: (1) effectively manage this new hydrologic condition, and (2) respond to multiple-use objectives along these drainage corridors.

In the case of the ESP Area, the existing, degraded system of channels and swales can be best categorized under scenario 3 (above) and therefore should be modified, stabilized, rehabilitated, and re-contoured in order to function more resiliently under future urbanized conditions and hydrology. The corridors can be designed and constructed incorporating hydromodification measures of the stormwater management system, such as flow duration control basins and low impact design (source control) features. However, manipulation of the existing channels to form multiple-objective drainage corridors will not only provide additional stability and resiliency for the channel system, but also improved water quality, habitat, recreational, and aesthetic function.

- Inset floodplain terraces will improve floodplain-to-channel connectivity. The floodplain terrace elevation would be set at approximately the 1.5- to 2.0-year flood elevation and provide: (1) inundated floodplain terrestrial and aquatic habitat with some topographic diversity to encourage habitat heterogeneity; (2) reduced flood-flow scouring velocities, increased flood flow conveyance, and improved water quality through bio-filtration of inundating flows; and (3) accommodation of recreational trails.

- Drainage corridors should be planted with a palette of native vegetation, including riparian tree species that provide canopy cover over the channel to support aquatic fish species and reduced infestation of non-native submerged aquatic vegetation (SAV); and could also include side-channel or “oxbow” aquatic features. New plantings would be irrigated for a period to ensure establishment, and non-native invasive species would be regularly removed to prevent competition with native species.

- Multiple-objective drainage corridors would be designed to appropriately respond to the modified hydrology of the region. The historically ephemeral swales at the project site would become intermittent and eventually perennial after project buildout. Summer “nuisance” and irrigation flows would increase and vegetation along the drainages should be resilient to this revised hydrology and provide some filtering of nutrient-concentrated flows. In-line ponds or pools should be included to provide additional flow attenuation, water quality improvement, and aquatic habitat.

- Drainage channels may need to be re-profiled, depending on the project-induced hydromodification. Swales throughout the Study Area have already been anthropogenically modified over time, resulting in a straightened and channelized system, which has increased the hydraulic channel gradients and contributed to ongoing channel degradation through scour, incision and bank erosion. The new drainage corridors may need to be re-contoured and graded to stable channel design parameters, established through hydrodynamic and sediment transport modeling design. Hydraulic grade control features may be required to provide the appropriate stable channel slope, or it may be possible to introduce sinuousity to provide a reduction in channel slope.

- Existing low function and value wetland habitats in the Elverta Specific Plan Area would be replaced under this new scenario with either enhanced or new wetland habitats having greater ecological, hydrologic, and geochemical functions and values. This will be achieved by replacing most of the hydrologically reductive and ecologically depauperate wetland types - including low-quality seasonal wetlands, swales, channels, stock ponds, and some vernal pools – with more robust, ecologically diverse vegetative assemblages within a mosaic of habitat types within defined, intermittent drainage corridors. Proposed wetland habitat types include seasonal wetlands, freshwater emergent marsh, riparian woodland, riparian willow scrub, and vernal pools; upland habitat types include Central Valley prairie and valley oak woodland/savanna.

The following are proposed habitat creation and/or enhancement of existing habitats within the Specific Plan Area that contain representative plant assemblages recognized in the literature as alliances or associates expected to occur with these various California plant communities.

Seasonal Wetlands – Created seasonal wetlands within the Specific Plan Area will consist of shallow concave features of varying depth and surface area that will function as part of a larger complex of wetland types along the three proposed perennial stream corridors and will likely be sited in various configurations on low terraces above the stream channel(s). These features will not only intercept sheetflow runoff from surrounding uplands, but will also intercept bank overflows from the perennial stream channels during high precipitation events during the rainy season. Success criteria for hydrologic regimes for this wetland type should be developed as part of a longer-term mitigation monitoring plan, and should include, at a minimum, at least 60 days of continuous saturation and/or inundation during the rainy season.

Dominant hydrophytic plant species in the planting palette could include a high percentage of graminoids such as common rush (*Juncus effusus*), Baltic rush (*Juncus balticus*), iris-leaved rush (*Juncus xiphioides*), meadow barley (*Hordeum brachyantherum*), common spikerush (*Eleocharis macrostachya*), and California oat grass (*Danthonia californica*); broad-leaved plants could include coyote thistle (*Eryngium* spp.) narrow-leaved milkweed (*Asclepias fascicularis*), and common spikeweed (*Centromadia pungens*). These, along with other appropriate native species, could be part of the planting palettes for recreating this community type throughout the Specific Plan Area.

Success criteria for establishment of hydrophytic associates for this (and others that follow) wetland type should be developed as part of a longer-term mitigation monitoring plan[16], but should include,

[16] Conversely, contingency plans for replacement of failed transplant stock, cuttings, etc. should also be incorporated into any mitigation monitoring plans.

at a minimum, 50% cover of hydrophytic species (i.e., FAC or greater) after the end of the second growing season, with 60% of the aggregate total comprised of native hydrophytic species (i.e., FAC or greater)

Freshwater Emergent Marsh – Dominant hydrophytes should consist of robust monocots including cattail (*Typha* spp.) and tule (*Schoenoplectus acutus* var. *occidentalis*), along with other graminoids including common rush, Baltic rush, Santa Barbara sedge (*Carex barbarae*), Nebraska sedge (*Carex nebrascensis*), tall flatsedge (*Cyperus eragrostis*), and rice cutgrass (*Leersia oryzoides*); broad-leaved plants could include western goldenrod (*Euthamia occidentalis*), burhead (*Echinodorus berteroi*), seep monkeyflower (*Mimulus guttatus*), willow dock (*Rumex salicifolius*), and rigid hedge-nettle (*Stachys ajugoides* var. *rigida*). These, along with other appropriate native species, could be part of the planting palettes for recreating this community type throughout the Specific Plan Area. Species such as water cress (*Rorippa nasturtium-aquaticum*) and yellow water primrose (*Ludwigia peploides*) would likely become established through natural recruitment via various dispersal mechanisms (e.g., wind, water, animals) from local populations in close proximity to the Specific Plan Area.

Riparian Woodland – Dominant tree species would include valley oak (*Quercus lobata*), Fremont's cottonwood (*Populus fremontii*), Oregon ash (*Fraxinus latifolia*), California black walnut (*Juglans californica*), and western sycamore (*Platanus racemosa*). A liana/shrub layer of California wild grape (*Vitis californica*), pipestems (*Clematis* sp.), California man-root (*Marah fabaceus*), blue elderberry (*Sambucus mexicana*), woodbine (*Parthenocissus vitacea*), American licorice (*Glycyrrhiza lepidota*), California wild rose (*Rosa californica*), and California blackberry (*Rubus ursinus*); herbaceous species in the understory could consist of Santa Barbara sedge, deer grass (*Muhlenbergia rigens*), and mugwort (*Artemisia douglasiana*). These, along with other appropriate native species, could be part of the planting palettes for recreating this community type throughout the Specific Plan Area.

Riparian Willow Scrub – This habitat type would consist of plantings of various species of willow (Salix spp.), box-elder (*Acer negundo* var. *californicum*), buttonbush (*Cephalanthus occidentalis*), California wild rose, California blackberry, mugwort, California aster (*Aster chilensis*), bee-plant (*Scrophularia californica*), and meadow-rue (*Thalictrum fendleri*). These, along with other appropriate native species, could be part of the planting palettes for recreating this community type throughout the Specific Plan Area.

Vernal Pools – Vernal pools are typically dominated by a high percentage of dwarfish annual plants including common spikerush, annual hairgrass (*Deschampsia danthanioides*) and various species of forbs including coyote thistle, goldfields (*Lasthenia* spp.), downingia (*Downingia* spp.), meadowfoam (*Limnanthes* spp.), navarretia (*Navarretia* spp.), popcornflower (*Plagiobothrys* spp.), and white-tip clover (*Trifolium variegatum*). Swale complexes should be incorporated into the overall design elements of any created/enhanced vernal pools within the Specific Plan Area and would include many of the same species found in vernal pool habitats, along with the following species: American pillwort (*Pilularia americana*), western rush (*Juncus occidentalis*), and tidy-tips (*Layia platyglossa*). These, along with other appropriate native species, could be part of the planting palettes for recreating this community type throughout the Specific Plan Area.

Central Valley Prairie – While bunchgrasses such as purple needlegrass (*Nasella pulchra*) are recognized as important components of this community type, there is increasing evidence[17] that many of the treeless, upland pre-settlement communities throughout the Great Central Valley and surrounding foothills were likely dominated by a high percentage of native annual and long-lived perennial forbs including vinegarweed (*Trichostema lanceolatum*), turkey mullein (*Croton setigerus*), California poppy (*Eschscholzia californica* and *E. lobbii*), lupines (*Lupinus* spp.), purple owl's clover

[17] Minnich, R.A. 2008. California's fading wildflowers: lost legacy and biological invasions. University of California Press, Berkeley, CA

(*Castilleja exserta*), madia (*Madia* spp.), mules ears (), tomcat clover (), gumplant (*Grindelia* spp.), and a high percentage of geophytes (including various species of blue dicks (*Dichlostemma* spp.), brodiaea (*Brodiaea* spp.), soap plant (*Chlorogalum* spp.), mariposa lily (*Calochortus* spp.), and triteleia (*Triteleia* spp.). These, along with other appropriate native species, could be part of the planting palettes for recreating this community type throughout the Specific Plan Area and would be an essential component in recreating suitable upland habitat adjacent to vernal pools. Species such as fiddleneck (*Amsinckia menziesii* var. *intermedia*), annual fireweed (*Epilobium brachycarpum*), and pitgland targweed (*Holocarpha virgata*) would likely become established through natural recruitment via various dispersal mechanisms (e.g., wind, animals) from populations near the Specific Plan Area.
Valley Oak Woodland/Savanna – Valley oak would be the dominant woody overstory species in this community type; sub-dominant tree species could include interior live oak (*Quercus wislizeni*), blue oak (*Quercus douglasii*), and California buckeye (*Aesculus californica*). The shrub layer could consist of California coffeeberry (*Rhamnus californica*) and toyon (*Heteromeles arbutifolia*). The herbaceous groundlayer would consist of blue dicks, soap plant, meadow barley, deer grass, creeping wild-rye (*Leymus triticoides*), blue wild-rye (*Elymus glaucus*), western ragweed (*Ambrosia psilostachya*), elegant clarkia (*Clarkia unguiculata*), baby blue-eyes (*Nemophila menziesii*), California buttercup (*Ranunculus californicus*), milkweed (*Asclepias* spp.) and other appropriate native species. There would be no need to intentionally plant poison oak (*Toxicodendron diversilobum*), as this species will likely be established along the perennial stream corridor plantings through natural recruitment from dispersal mechanisms (primarily by animals).

IMPACTS OF THE PROPOSED PROJECT ON EXISTING ESP WETLANDS

A total of 84.4 acres of Corps-jurisdictional wetlands and “other waters of the U.S.” have been identified within the 1745-acre ESP Area, with 14.2 acres within the 686.4-acre Phase I residential development parcels and 13.1 acres within the 253.5-acre infrastructure improvement areas (roads, drainage corridors). The remaining 57.1 acres occur within the 805 acres of the ESP not included in the Phase I development project and are therefore not addressed in this current 404 bundled permit application package.

Implementation of the proposed ESP development plan includes some re-routing and significant enhancement of existing, ephemeral drainages within the Study Area to accommodate anticipated flood flows through the area. While resulting in an initial loss of approximately 10.9 acres of wetland swale habitat within these three existing corridors, it will ultimately create and enhance approximately 19 acres of wetlands and “other waters of the U.S.” within the proposed, multiple-use corridors and up to ~35 additional acres of transitional wetland habitats (e.g. cottonwood/ oak/willow riparian and riparian grassland) that would depend on year-to-year rainfall fluctuations or an increase in total water conveyance within the corridors. Consequently, there could be a net gain of up to 54 acres of wetlands and waters associated with the creation of the proposed drainage corridors, including a creation of new seasonal wetlands; freshwater marsh; willow, cottonwood, and oak riparian; and perennial grassland habitats where none currently exist.

The table below shows the total acreages of existing wetland features within the Phase I ESP development area:

ESP Phase I Existing Wetlands and “other Waters of the U.S.”

Wetland Type	Pre-Project (acres)
Other Waters of the U.S.	0.3
Seasonal Wetlands	1.7
Vernal Pools	11.1

Swales	10.0
Ditches	0.4
Pond	3.8
Total	27.3

The preferred project proposes an initial loss of 27.3 acres of existing vernal pools, seasonal wetlands and swales within the Phase I ESP, but an ultimate net gain of up to 53.8 acres of wetland and transitional wetland habitats within the three proposed drainage corridors, as well as enhancement of an additional 21.4 acres of upland (perennial) grasslands shown in the following table:

ESP Phase I Drainage Corridor Proposed Habitats

Drainage Corridors B & C & D	Participating Phase I Properties	Non-Participating Properties	Combined Habitat Total
Wetlands and "other waters of the U.S." (low-flow channe, channel wet-edge, freshwater marsh, seasonal wetland)	*18.87*	*14.92*	*33.79*
Lower transitional wetlands (willow riparian, riparian grassland)**	*10.40*	*17.48*	*27.88*
Upper transitional wetlands (oak & cottonwood riparian, lower 1/4 corridor bank)**	*24.52*	*9.09*	*33.61*
Enhanced upland habitats (upper 3/4 corridor bank, upland grassland buffer)	*21.40*	*18.50*	*39.89*
Total	*75.18*	*59.99*	*135.17*

* = *upland habitat*
** = *transitional wetland habitat (dependent upon annual rainfall fluctuations and water conveyance within corridors)*
- lower transitional wetlands are more likely to be inundated on a yearly basis

COMPARISON OF DRAINAGE CORRIDOR WETLANDS TO SIMILAR REGIONAL (REFERENCE) WETLANDS

The selection of reference wetlands for the ESP proposed condition (i.e. drainage corridors) included a consideration of biodiversity, as well as physical, chemical, and biological characteristics of the “comparison” wetlands and their surrounding landscape. The Empire Ranch wetlands (located in Folsom; eastern Sacramento County) were determined to be suitable, as they contain biotic and hydrogeomorphic attributes that approximate the conceptual goals of establishing permanent drainage corridors within the Elverta Specific Plan area. Reference wetlands should represent the range of variation that results from both natural processes (e.g., succession, channel migration, erosion, and sedimentation) and anthropogenic disturbance. Generally, the minimum number of reference wetlands recommended for this type of assessment is in the range of 15 to 25 sites. However, due to budgetary constraints, it was not possible to evaluate so many sites, especially as we conducted a significant CRAM analysis of the ESP, Empire Ranch, and Orchard Creek sites for quantitative comparison.

EMPIRE RANCH IN FOLSOM, CALIFORNIA – The Empire Ranch residential development incorporates open space elements into a greater greenbelt complex that supports a mosaic of valley prairie grassland, oak woodland, riparian, vernal pool, seasonal wetland, and freshwater emergent marsh habitats along seasonal and perennial stream corridors (*Willow Creek* is the primary intermittent blue line feature on the Clarksville USGS topographic quadrangle) and engineered stormwater detention basins. We believe that the existing upland and wetland features at Empire Ranch serve as suitable comparative models for the conceptual creation of permanent drainage corridors proposed within the Elverta Specific Plan area.

We conducted a field survey of the Empire Ranch reference wetlands on January 16, 2009 and chose comparative Wetland Assessment Areas (AAs) to the Elverta Specific Plan features (FIGURE 8), recording a list of plant species observed within each feature, and establishing photo-points for visual reference of the various wetland habitats assessed (Appendix B).

Riparian Willow Scrub – Riparian willow scrub appears to be the dominant habitat type within the Empire Ranch WAA. This habitat is important to a number of local and transient wildlife species for foraging, feeding/drinking, thermal and escape cover, nesting and breeding, migration, and as dispersal corridors (including shade and cover habitat for fish and other aquatic species). In California, over 225 species of birds, mammals, reptiles, and amphibians depend on riparian habitats for their survival. The most diverse bird communities in the arid and semi-arid regions of the Western United States occur within riparian ecosystems[18].

Dominant woody shrubs and trees within this willow riparian scrub include shining willow (*Salix lucida*), sandbar willow (*Salix exigua*), Goodding's willow (*Salix gooddingii*), Fremont's cottonwood (*Populus fremontii*), and discontinuous bands of subdominant shrubs, such as Himalayan blackberry (*Rubus discolor*), coyote brush (*Baccharis pilularis*), blue elderberry (*Sambucus mexicana*), and California wild rose (*Rosa californica*). Plantings of valley oak (*Quercus lobata*) occur on slightly elevated terraces above the stream corridors throughout portions of the greater greenbelt. Herbaceous broad-leaved plants within the stream channel and edges of the saturation zone include broad-leaved cattail (*Typha latifolia*), curly dock (*Rumex crispus*), fiddle dock (*Rumex pulcher*), prickly sow-thistle (*Sonchus oleraceus*), prickly lettuce (*Lactuca serriola*), willow herb (*Epilobium ciliatum*), annual fireweed (*Epilobium brachycarpum*), water cress (*Rorippa nasturtium-aquaticum*), horseweed (*Conyza canadensis*), California mugwort (*Artemisia douglasiana*), Muhlenberg's centaury (*Centaurium muehlenbergii*), and smartweed (*Polygonum* sp.). Graminoids (i.e., grasses and grass-like plants) include deer grass (*Muhlenbergia rigens*), creeping wild-rye (*Leymus triticoides*), tall flatsedge (*Cyperus eragrostis*), Baltic rush (*Juncus balticus*), iris-leaved rush (*Juncus xiphioides*), and *Carex* sp. (likely *C. praegracilis*).

Wildlife

Wildlife species using these habitats include the: white-crowned sparrow (*Zonotrichia leucophrys*), northern mockingbird (*Mimus polyglottos*), red-winged blackbird (*Agelaius phoeniceus*), snowy egret (*Egretta thula*), great blue heron (*Ardea herodias*), American coot (*Fulica americana*), bufflehead (*Bucephala albeola*), mallard (*Anas platyrhynchos*), Canada goose (*Branta canadensis*), red-shouldered hawk (*Buteo lineatus*), white-tailed kite (*Elanus leucurus*), northern harrier (*Circus cyaneus*), river otter (*Lutra canadensis*), beaver (*Castor canadensis*), raccoon (*Procyon lotor*- tracks), and coyote (*Canis latrans*).

ORCHARD CREEK IN PLACER COUNTY, CALIFORNIA – This WAA along Orchard Creek in southern Placer County is a city-owned parcel north of the Lincoln Wastewater Treatment Facility, northwest of the Wildlands Orchard Creek Conservation Bank, and east of the *Moore Ranch Wetland Preserve*.

[18] Barbour, M.G., T. Keeler-Wolf, and A.A. Schoenherr. 2007. Terrestrial vegetation of California. University of California Press.

The ±200-acre site supports significant natural areas, including valley oak riparian woodland along the perennial channel of Orchard Creek, freshwater emergent marsh, and a mosaic of vernal pool, swale, and seasonal wetland complexes. We believe that existing wetland features at this Orchard Creek site can serve as possible reference models for drainage corridor enhancement proposed as part of the ESP development.

We conducted a field survey of the Orchard Creek reference wetlands on April 13, 2009, where recorded a list of plant species observed within, and took representative photographs of the selected creekside riparian WAA. The following discusses the existing perennial stream corridor of Orchard Creek and how it could also serve as an appropriate model for the proposed Specific Plan.

Valley Oak Riparian Woodland – A nearly continuous band of riparian woodland dominated by valley oak (*Quercus lobata*) occurred along the mainstem channel of Orchard Creek. The western half contained younger-age classes ranging from saplings to trees approximately eight inches in diameter at breast height (dbh) with an open, herbaceous understory. Native herbaceous broad-leaved plant species observed closest to the edge of the channel included western goldenrod (*Euthamia occidentalis*); graminoids included common rush (*Juncus effusus*), clustered field sedge (*Carex praegracilis*), foothill sedge (*Carex tumulicola*), creeping wildrye (*Leymus triticoides*), and meadow barley (*Hordeum brachyantherum*). Species observed slightly upslope along the edge of the riparian ecotone included white brodiaea (*Triteleia hyacinthina*), soap plant (*Chlorogalum pomeridianum*), and purple needlegrass (*Nasella pulchra*). Within the north-central portion of the Orchard Creek parcel, this community type consisted of an even-aged stand of larger trees, with a discontinuous shrub layer of poison oak (*Toxicodendron diversilobum*).

Orchard Creek is a meandering, low-gradient stream representative of those along the eastern edge of the Sacramento Valley. Open oak and mixed riparian woodland along low terraces above the channel is the dominant vegetative woody cover. The bankwidth varies along its course, and in the case of Orchard Creek, hydrogeomorphology is influenced by beaver activity, resulting in ponded open water habitats fringed by freshwater emergent marsh habitat.

ANTICIPATED WETLAND FUNCTIONS & VALUES OF THE PROPOSED PROJECT IN THE ELVERTA SPECIFIC PLAN STUDY AREA

The following items address improvements to overall wetlands functions and values within the Specific Plan Area through implementation of the proposed Plan. The proposed, multiple-use drainage corridors will be designed to:

- More robustly respond to impacts from long-term hydromodification (i.e., erosion);
- Result in improved geomorphic, hydrologic, and ecologic functions;
- Increase the types and diversity of functional wetland and upland habitats within the development area; and

- Improve water quality, create passive recreational opportunities, enhance wildlife habitat, and provide significant aesthetic value;

Red flag features — *"Red flags are features of a wetland or its surrounding landscape to which special recognition or protection has been assigned on the basis of objective criteria. The recognition or protection may be at a national, State, regional, or local level and may be official or unofficial. Screening for red flags is not directly related to the assessment of wetland functions. Rather, it is a proactive attempt to determine if a wetland will require special consideration or attention that will preempt the assessment of functions. The public interest review process in 404 already includes some form of red flag screening. However, it is often narrow in scope and limited to a few of the more common, nationally recognized red flag features such as threatened or endangered species. The initial screen for red flags is made by determining whether the project area falls under the jurisdiction of a pertinent regulatory program or law or are important at the regional or local level."*

Potential red flag features associated with the proposed Elverta Specific Plan include:

1. *Floodplains, floodways, or flood prone areas* – Implementation of the Elverta Specific Plan proposes improvements in hydrologic function within the proposed drainage corridors.

2. *Areas of high public use* – Urban build-out (resulting from increased population densities within the Specific Plan area) will occur with the implementation of the proposed Specific Plan.

3. *Areas supporting rare or unique communities* – 2.52 acres of occupied vernal pool branchiopod (i.e. vernal pool fairy shrimp – *Branchinecta lynchi*) habitat occur within the Phase I ESP area[19].

SUMMARY

Extant habitats within the proposed Elverta Specific Plan area can be generally distinguished as isolated wetland habitats, such as vernal pools and swales within larger upland habitats – predominantly ruderal grass-dominated areas and agricultural fields. The functions and values of these wetland and upland habitats do not differ markedly except for the larger (artificial) ponds and areas of degraded, but relatively undisturbed valley prairie habitat – primarily in the northern portion of the Study Area near the Sacramento-Placer County line – containing embedded remnants of vernal pool and swale complexes.

After 80+ years of anthropogenic changes to the biogeochemical integrity of wetlands within the Elverta Specific Plan area, the following is a summary of why existing wetland functions and values are currently low:

- Remnant vernal pools are presently disconnected and isolated, with the smaller pools and majority of historic swale drainage patterns extirpated by a long history of anthropogenic land use changes. Based on a qualitative analysis of detected plant species during the various surveys conducted for this project, the quality of existing habitats within the Specific Plan area is low. Extant plant communities are highly degraded;
- Existing network of drainage ditches, artificial ponds, and highway infrastructure (e.g., roads,

[19] Helm, B. 2005-2011. Wet- and Dry-season sampling for federally-listed large branchiopods on the Elverta Specific Plan properties. Helm Biological Consulting, LLC. Lincoln, CA

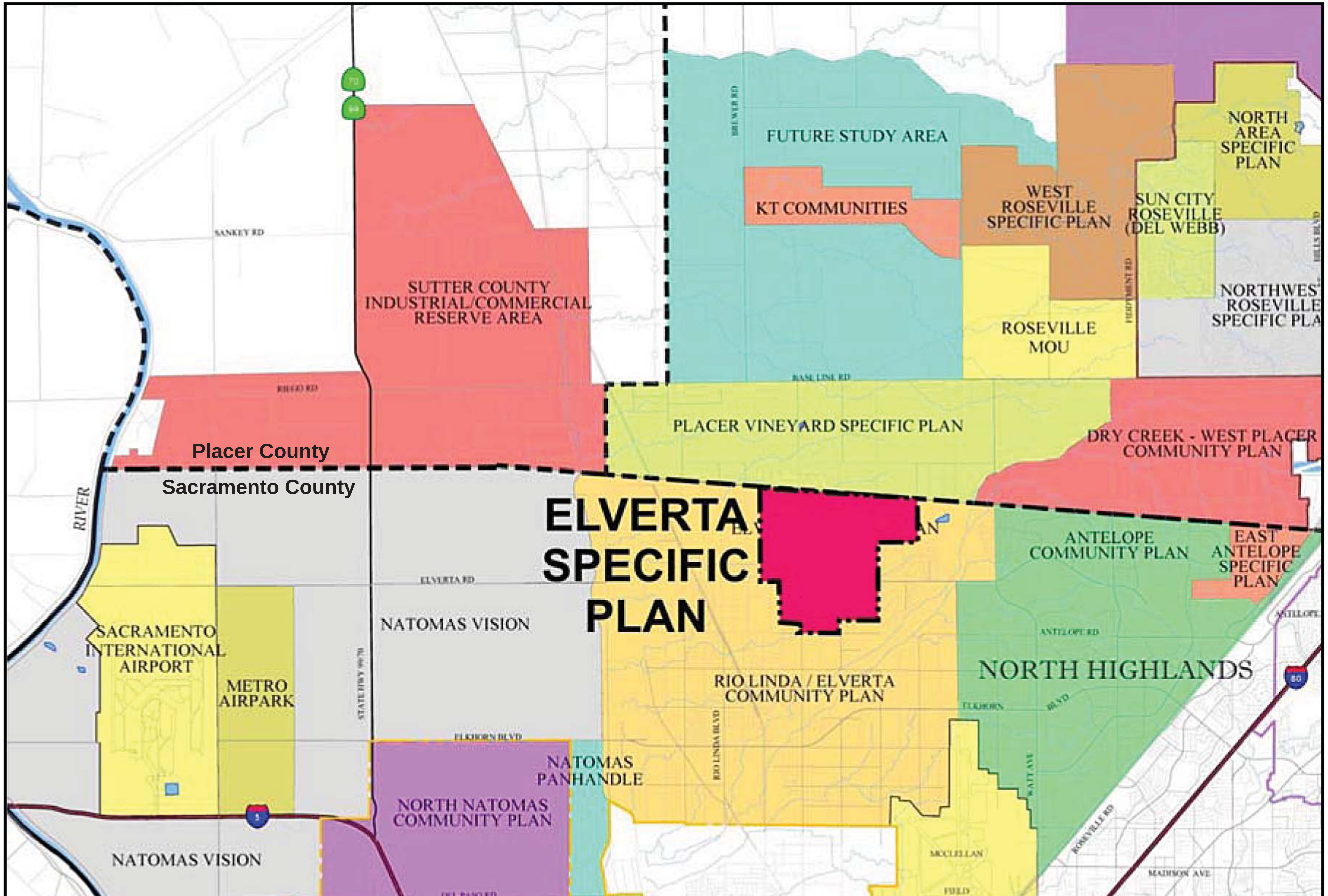
culverts) has substantially modified hydraulic connectivity and increased drainage efficiency;

- The alteration of the pre-settlement hydrologic regime has resulted in significant impacts to the historic ecological conditions of the surrounding environment in terms of frequency, duration, timing, and depth of surface water hydrologic connectivity;
- Alteration of historic surface drainage patterns (including the elimination of historic vernal pools and swales and the creation of man-made ditches, channels, and ponds) has led to a decrease in species richness and biotic diversity;
- The creation of artificial features (i.e., ditches, channels, and ponds) and increases in disturbed habitat over the past 80+ years has led to a marked change in the biology and botany of the general area by eliminating critical habitat for a number of resident and migratory native species dependent upon the pre-settlement vernal pool, prairie, and valley oak woodland habitats that previously occurred within the Specific Plan area – some level of ecological reconstruction of these community types will be implemented through the proposed plan;
- The societal values provided by the aggregate total of wetland features within the Study Area is extremely limited, as the wetlands (as they currently exist within their landscape setting) are isolated in terms of the aesthetic, cultural, recreational, and commercial contributions they may provide to society; and
- Ecosystem-level hydrologic and biochemical processes, such as surface and subsurface water storage, moderation of groundwater flow, nutrient cycling, and elemental import/export processes, are currently functioning at a relatively low level and, over time, increasing build-out of, and surrounding the Study Area will continue to isolate and degrade already constrained and compromised ecological systems within the larger landscape setting.

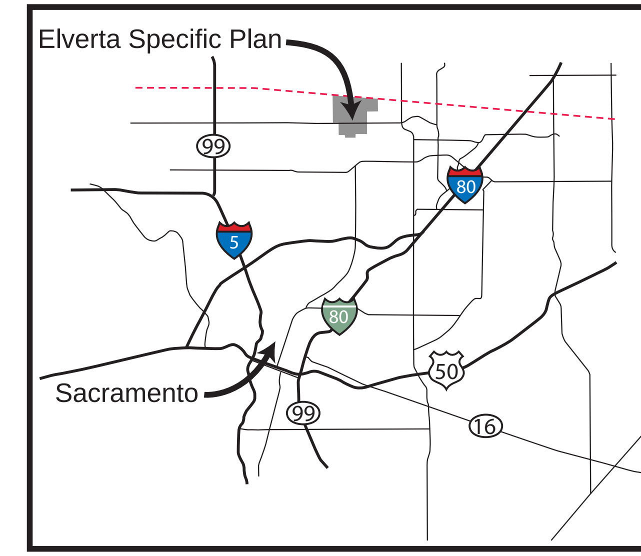
Extant wetland features within the Phase I ESP do serve some minimal, local hydrologic, biogeochemical, and ecological functions, including:

- recharging groundwater;
- providing hydrologic input to the Sacramento River watershed (via the Natomas East Main Drainage Canal);
- transforming and cycling of elements;
- retaining and removing dissolved substances;
- accumulating and retaining inorganic sediments;
- maintaining plant communities; and
- maintaining some level of energy flow within the system.

These services are extremely limited as a result of the impacts of historic anthropogenic changes to the surrounding landscape, including the complete extirpation of pre-settlement natural communities via land-use (e.g. agricultural) conversion, alteration and/or truncation of natural drainage patterns and hydrologic regime, and elimination of critical species habitat for a number of plant and wildlife species. While the proposed Phase I ESP area is not small, increasing urban build-out will eventually result in even more fragmentation of remaining wildlife habitat, contributing to the overall decline of native biodiversity within the area. By implementing the proposed habitat creation within the three perennial drainage corridors within the framework of the greater Elverta Specific Plan, some of these impacts to local and regional wildlife resources can be mitigated to a great extent by the creation of more ecologically complex and diverse habitats than presently exist.



PROJECT SITE & CONTEXT MAP



PROJECT VICINITY MAP

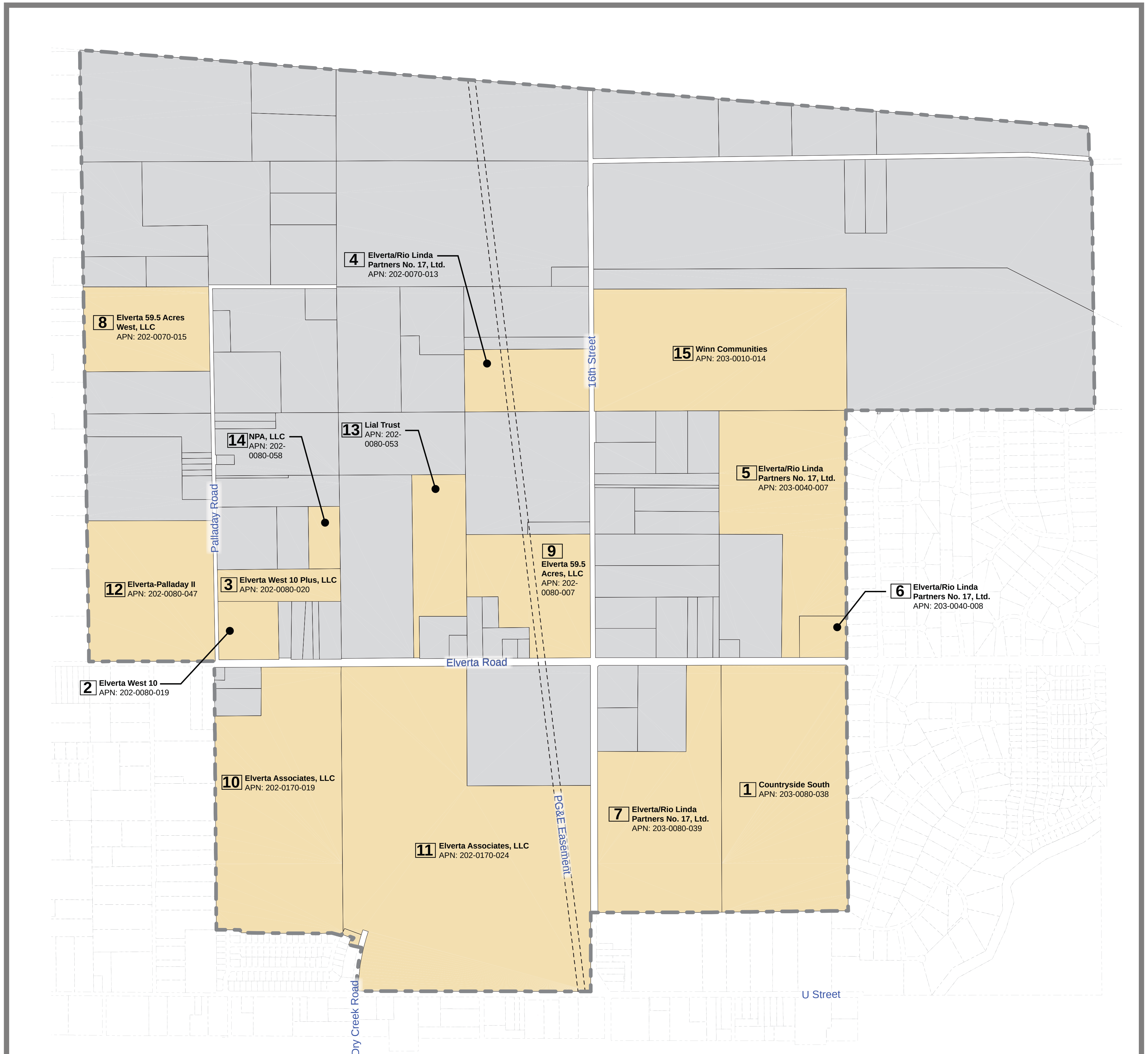
FIGURE 1: PROJECT SITE, CONTEXT, & VICINITY

ELVERTA PLANNING AREA • SACRAMENTO COUNTY, CALIFORNIA

N

Date: March 23, 2011
Plan Scale: Not To Scale

BARNETT ENVIRONMENTAL



Parcel / Land Use Legend

- Phase 1 Development Participant Parcels
- Build-out Development Parcels
- Adjacent Parcels (Not in Specific Plan Area)
- Specific Plan Boundary
- Existing Parcel Lines
- PG&E Easement

EXISTING PHASE I DEVELOPMENT PARCELS				
#	Name	APN	Acres	%
1	Towne/Countryside South	203-0080-038	77.70	11.3%
2	Elverta West 10, LLC	202-0080-019	10.00	1.5%
3	Elverta West 10 Plus, LLC	202-0080-020	10.00	1.5%
4	Elverta Rio Linda Partners No. 17, LLC	202-0070-013	20.00	2.9%
5		203-0040-007	54.70	8.0%
6		203-0040-008	5.20	0.8%
7		203-0080-039	56.40	8.2%
8	Elverta 59.5 Acres West, LLC	202-0080-007	32.50	4.7%
9	Elverta 59.5 Acres, LLC	202-0070-015	26.60	3.9%
10	Elverta Associates, LLC	202-0170-019	79.80	11.6%
11		202-0170-024	165.70	24.1%
12	Elverta Palladay II	202-0080-047	45.00	6.6%
13	Lial Trust	202-0080-053	20.00	2.9%
14	NPA	202-0080-058	5.00	0.7%
15	Winn Communities	203-0010-014	77.83	11.3%
	Total		686.43	100.0%

FIGURE 2: ELVERTA SPECIFIC PLAN & PHASE 1 DEVELOPMENT PROPERTIES

ELVERTA PLANNING AREA • SACRAMENTO COUNTY, CALIFORNIA

Plan Scale: 1" = 500' @ 42x30 Sheet Size

Date: April 4, 2010

Figure 3: History of the Project Area – Land Use

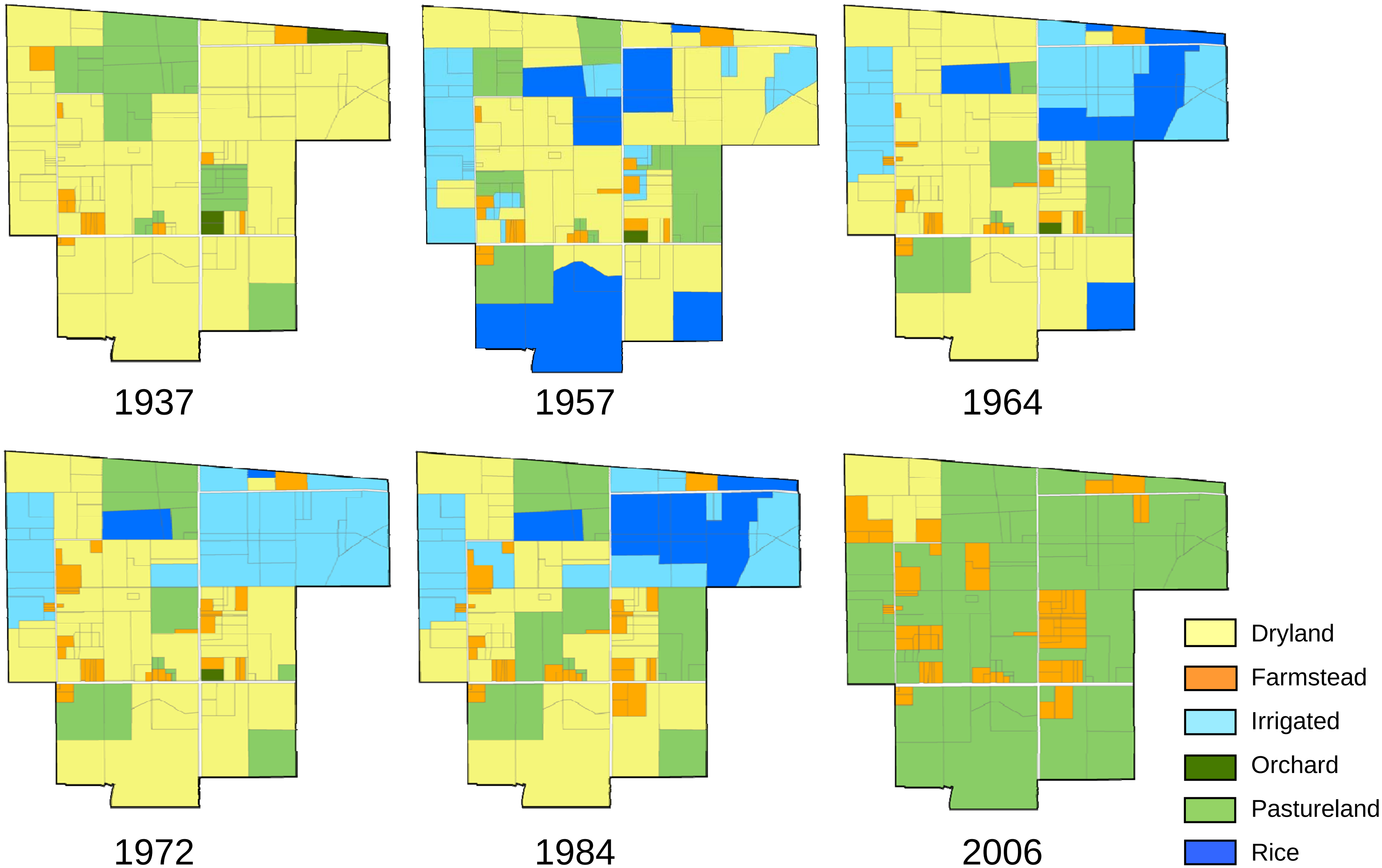


Figure 4: History of the Project Area – Wetlands

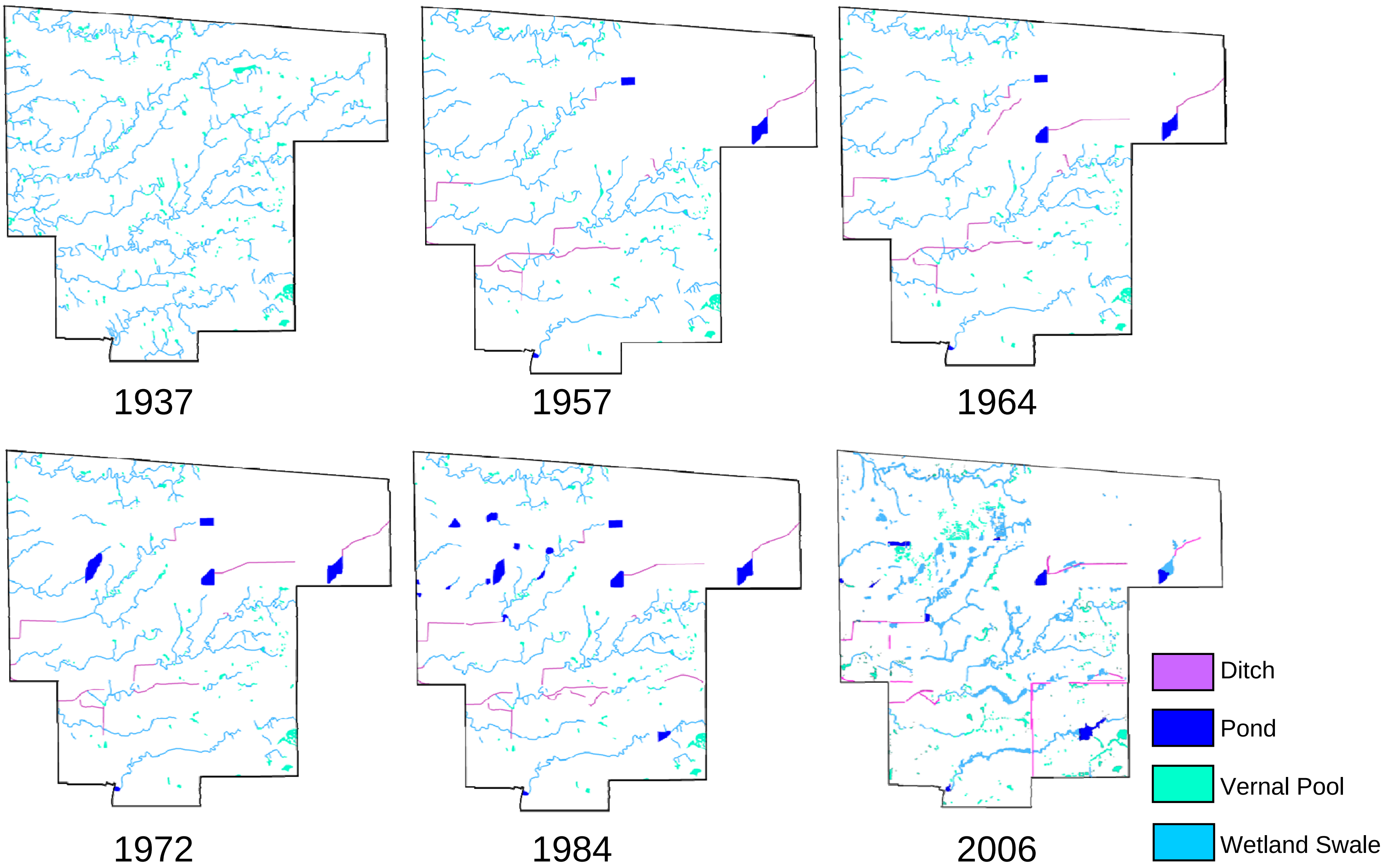
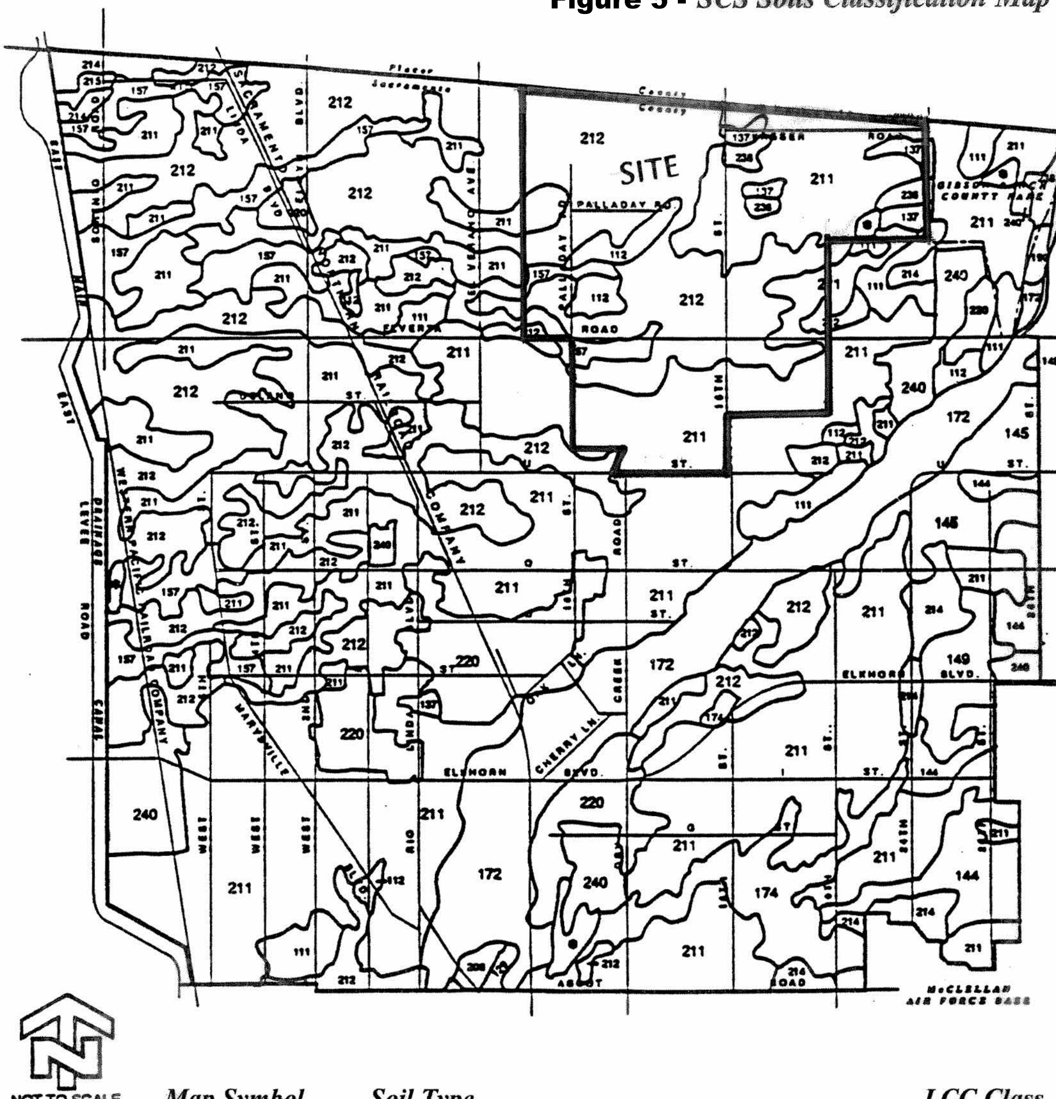


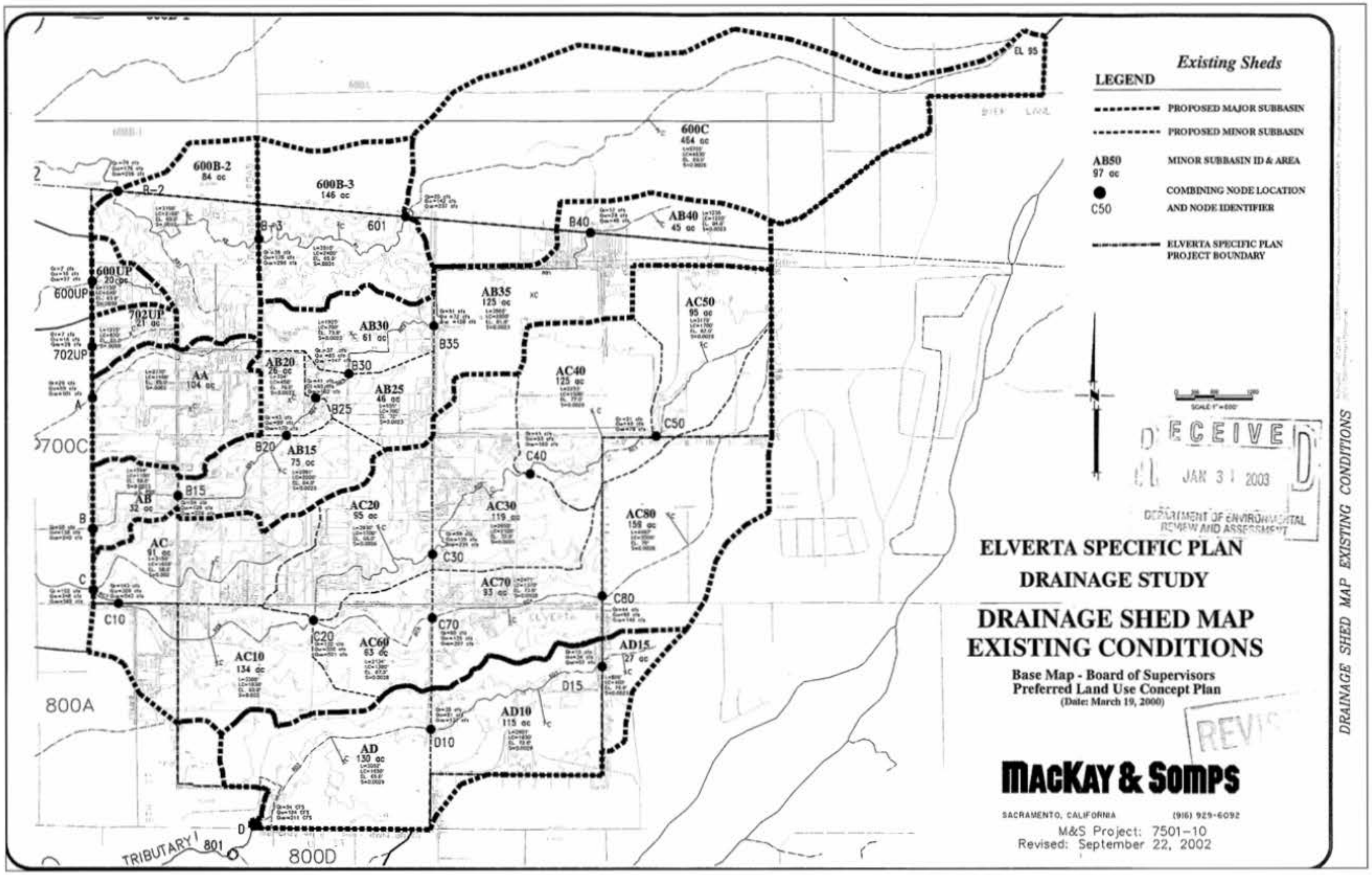
Figure 5 - ***SCS Soils Classification Map***

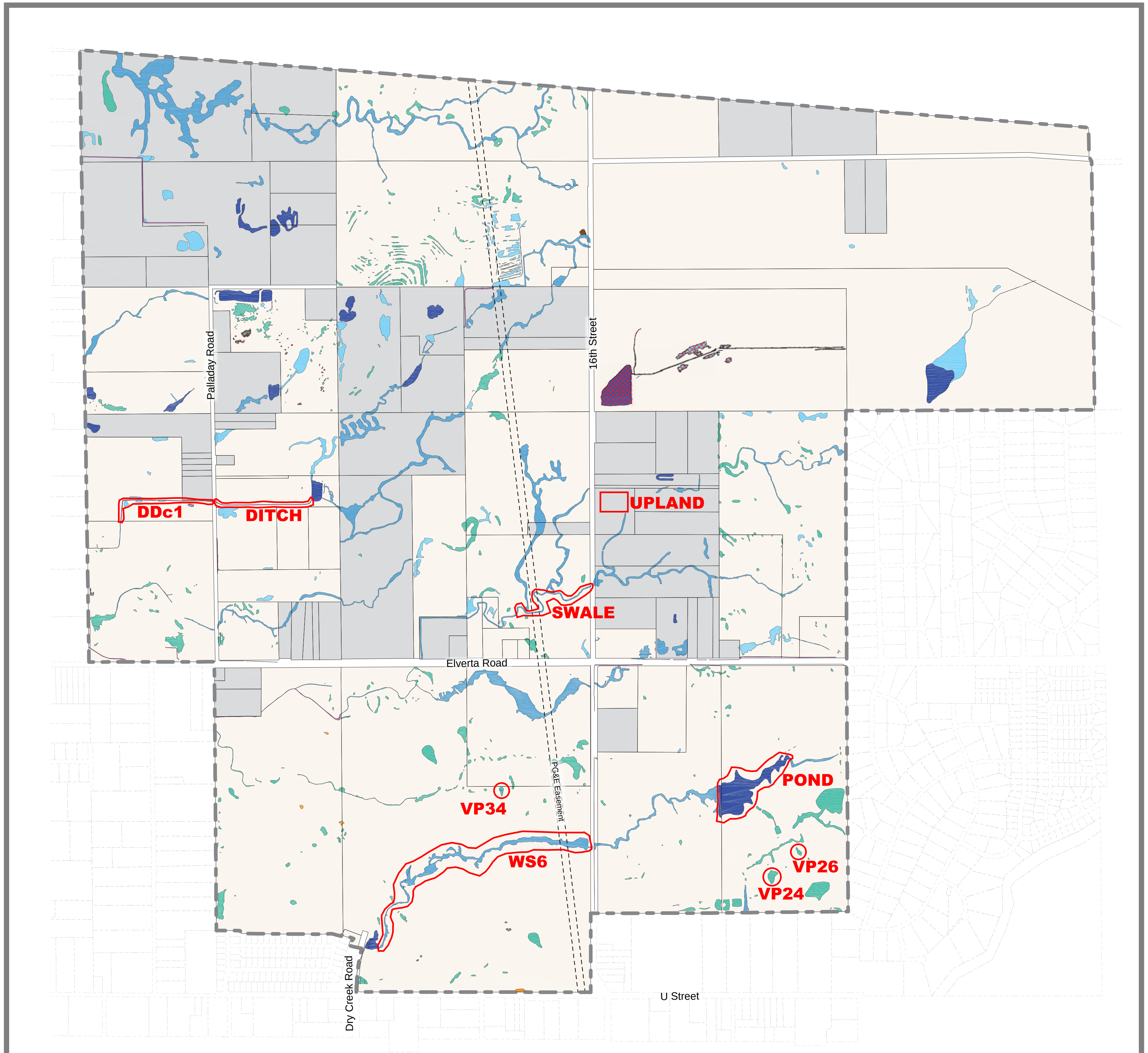


Map Symbol	***Soil Type***	***LCC Class***
112	*Bruella sandy loam 0-2% slope*	*II*
137	*Durixeralfs 0-1% slope*	*IV*
157	*Hedge loam 0-2% slope*	*III*
211	*San Joaquin fine sandy loam 0-3% slope*	*III*
212	*San Joaquin fine sandy loam 3-8% slope*	*III*
238	*Xerarents – San Joaquin complex 0-1%*	*III*

(Source: Soil Survey of Sacramento County, Soil Conservation Service)

Figure 6 - Existing Drainage Shed Map





Existing Wetlands, Other U.S. Waters, and Additional Endangered Species Habitat

Resource Category	Channel (=Ditch)	Ditch	Pond	Seasonal Wetland	Seep	Vernal Pool	Wetland Swale	Total
Delineated Jurisdictional Wetlands	0.606	0.521	7.953	9.337	0.069	19.110	19.903	**57.499**
Photo-Interpreted Wetlands (Not Delineated, Assumed From Aerial Imagery)	0.000	0.588	3.762	2.826	0.000	1.088	18.683	**26.947**
Delineated Non-Jurisdictional Wetlands	0.000	0.261	2.284	0.781	0.000	0.300	0.000	**3.627**
Additional Fairy Shrimp Habitat Depressions (Identified During Endangered Species Sampling)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	**0.130**
Total	**0.606**	**1.370**	**13.999**	**12.944**	**0.069**	**20.498**	**38.586**	**88.203**

Wetlands Legend

- Channel (= Ditch)
- Ditch
- Pond
- Seasonal Wetland
- Seep
- Vernal Pool
- Wetland Swale
- Non-Jurisdictional / Isolated
- Additional Fairy Shrimp Habitat Depression

Parcel / Land Use Legend

- Verified USACE Delineation
- Photo-Interpreted Wetland Assessment
- Adjacent Parcels (Not in Specific Plan Area)
- Specific Plan Boundary
- Existing Parcel Lines
- PG&E Easement

Notes:
1. Delineated wetlands have been verified by USACE and determined to be jurisdictional waters of the U.S., or non-jurisdictional (Isolated). Isolated wetlands may still be regulated under threatened/endangered species laws by the U.S. Fish & Wildlife Service.

2. Photo-interpreted wetland assessments have been included on non-participating properties to estimate the total impact of development in the Elverta Specific Plan. At such time when these properties proceed with development, verified delineations will be needed to confirm these acreages.

3. Additional fairy shrimp habitat depressions, which were not considered to be wetland features, have been included as existing resources. These depressions were identified in dry and/or wet-season sampling reports and were confirmed to house either adult fairy shrimp, or cysts.

FIGURE 7: EXISTING WETLANDS, U.S. WATERS, AND OTHER FEATURES

ELVERTA PLANNING AREA • SACRAMENTO COUNTY, CALIFORNIA

Plan Scale: 1" = 500' @ 42x30 Sheet Size

0' 250' 500' 1000' 2000'

N

Date: March 23, 2010

BARNETT ENVIRONMENTAL

Figure 8: Empire Ranch - Wetland Assessment Areas

Legend

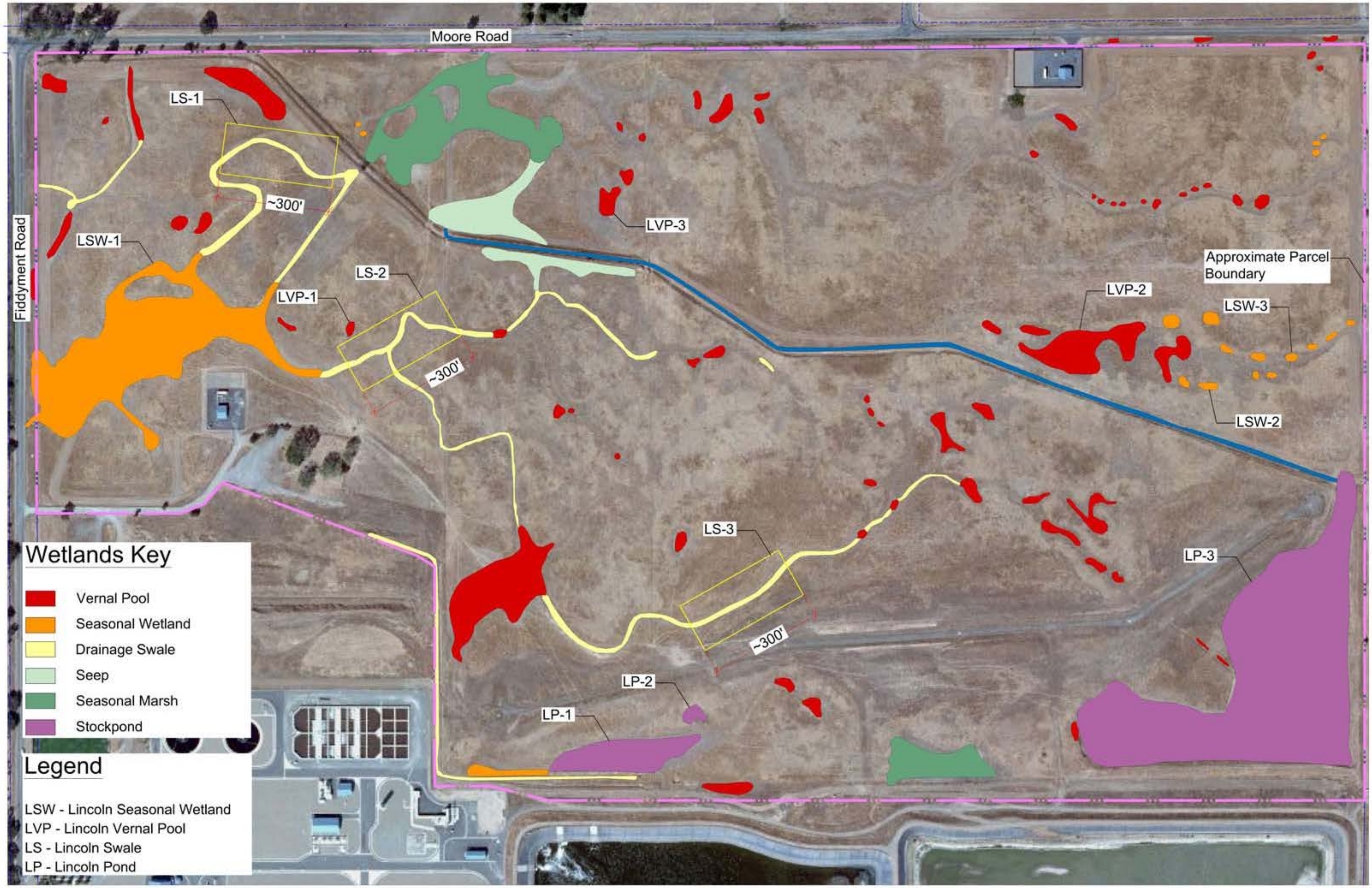
ERDW - Empire Ranch Depressional Wetland

ERR - Empire Ranch Riverine

Assessment Area Boundary

Not To Scale

N



Extracted from South Lincoln Regional Sewer Plan, Public Works Department

Figure 9: South Lincoln WWTF Wetlands

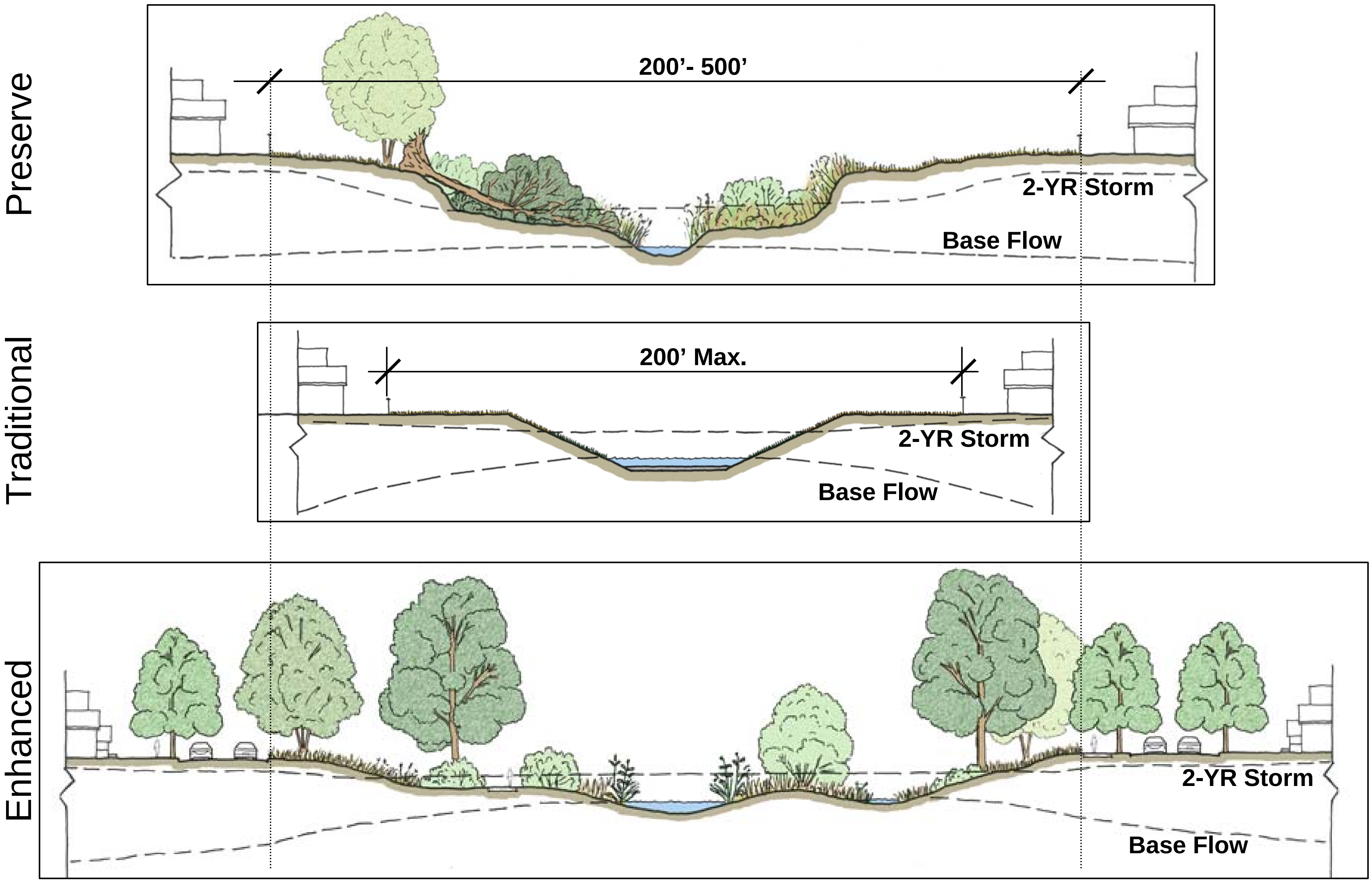
City of Lincoln, CA

Scale: 1" = 100' @ 42"x30"

September 15th, 2009

0 100' 400' 50' 200'

Figure 10: Approaches to Stormwater Management



Appendix M
California Rapid Assessment Method

Elverta Specific Plan Project
Summary Report of CRAM Application, Sampling, Data Interpretation, and Quality Assurance

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28 June 2010
Revised 12 July 2010

1.0 Introduction

In order to assist the Sacramento District of the U.S. Army Corps of Engineers (USACE) in achieving CWA Section 404 permits for the proposed Elverta Specific Plan, a "CRAM Sampling Plan" (Elverta Specific Plan CRAM Draft Task Outline, 16 Nov 09) was proposed and accepted. In essence the plan proposed to utilize the California Rapid Assessment Method (hereafter CRAM) to identify existing wetland conditions at: (1) the proposed Elverta Specific Plan project site, where development would be associated with conversions of existing wetland conditions (the subject of the Section 404 application, characterized elsewhere); (2) the Orchard Creek reference site (the Wildlands Inc. Orchard Creek Conservation Bank), which is functionally a preservation site for existing vernal pool wetlands, with some restoration and enhancement, in southwestern Placer County; and (3) the Empire Ranch reference site, a development project in Folsom, in easternmost Sacramento County, at which detention basins and stream courses are managed as elements in the site's stormwater system in ways that allow enhanced wetland conditions. The Empire Ranch reference site has been identified by the applicants as approximating conditions on the Elverta project site following the implementation of the project.

The specific goals for sampling in these three sites are described more fully in the CRAM Sampling Plan; these goals are not directly germane to reporting the results of the CRAM application, which is the subject of this summary report. The application of CRAM for this project is intended, at the present time, solely to document the existing condition of wetlands

[1] For disclosure purposes it should be noted that Dr. Roberts is a member of the CRAM Development Team and the L2 Committee of the California Wetland Monitoring Workgroup.

within the project site and at the two identified reference sites, expressly to assist the USACE and other agencies in identifying existing wetland conditions on the three sites (see CWMW 2009 for additional considerations).

This report does not include a thorough description of the California Rapid Assessment Method; this information may be obtained from the CRAM website (www.cramwetlands.org), including information about the development, application, and implementation of CRAM. In general, however, it is important for present purposes to emphasize that CRAM is an assessment method for wetland condition; CRAM is not a wetland identification/delineation methodology or a methodology for assessing wetland functions. The rationale for, application of, and description of internal reference conditions on which CRAM is based are fully described in the CRAM Manual (Collins et al 2008). It should be noted that CRAM utilizes a wetland classification that is derived from the functional classification included in the "Hydrogeomorphic Method" (Brinson 1993), modified by the California experiences of the CRAM development team (hereafter PI team).

This approach is implemented through a series of CRAM "modules" that are focused on characterizing the following attributes for each wetland class: (1) Buffer and Landscape Context, (2) Hydrology, (3) Physical Structure, and (4) Biotic Structure. All CRAM modules assess these same four attributes, although the metrics used in the modules vary to address wetland class-specific relationships. In all modules, the CRAM "Index Score" is calculated as the average of the four attribute scores. The CRAM development team emphasizes that interpreting the results of CRAM's application requires a consideration of the attribute scores (or even metric scores in some applications).

Pursuant to requests from reviewing agency staff, this report summarizes: (i) the qualifications of the CRAM team members for the study, (ii) the application of the CRAM methodology for the study, (iii) the essential results of applying the methodology, (iv) considerations for interpreting the resulting data, and (v) considerations for the further development of the methodology as a consequence of ambiguities or uncertainties that emerged from the study.

2.0 CRAM Study Organization for the Elverta Project

The Elverta Specific Plan CRAM Project was organized under the direction of Dr. Bruce Barnett, while most organizational details for the study were addressed by Mr. Chris Bronny. In summary, the following individuals were involved in the field aspects of this study.

Terry Adelsbach	U.S. Fish and Wildlife Service
Bruce Barnett	Bruce D. Barnett, Ph.D., LLC
Jinnah Benn	U.S. Army Corps of Engineers, Sacramento District
Chris Bowles (one day)	CBEC, Inc. Eco Engineering
Chris Bronny	Independent botanical and wetland consultant
Melanie Carr	CBEC, Inc. Eco Engineering
Cara Clark	Moss Landing Marine Laboratories; CRAM PI Team

Sam Diaz (one day)	CBEC, Inc. Eco Engineering
Paul Jones	U.S. Environmental Protection Agency, San Francisco
Chad Roberts	Roberts Environmental and Conservation Planning LLC (independent consultant); CRAM PI Team
John Stofleth	CBEC, Inc. Eco Engineering

The individuals identified above composed the various CRAM assessment teams who carried out the fieldwork for the proposed project. Team composition varied, although two requirements were addressed throughout:

1. Every team included at least one individual trained in conducting CRAM assessments using the modules being applied for this study. Not all team members were CRAM-trained. Therefore, at least one of the following CRAM-trained personnel was included in the team for each assessment: Adelsbach (specifically for vernal pool modules), Bronny, Clark, Roberts.
2. Applying the CRAM vernal pool modules requires specialized knowledge of "vernal pool plant species." For this study the following individuals were identified as qualified to identify these specialized plants: Adelsbach, Benn, Bronny. Therefore, at least one of these individuals was included in any team carrying out a vernal pool assessment, either for a single pool or a vernal pool system.

In CRAM the conditions attributed to wetland areas in a site or region are based on the conditions sampled in "assessment areas" (AAs) chosen to represent the wetlands within the site or region. The assessment areas at all three sites covered by this report were identified initially by Mr. Bronny, working in concert with Dr. Barnett and with Mr. Cox. A field packet was provided for each prospective AA, including maps at several map scales, each showing a preliminary boundary for each AA, as well as a field book with necessary text and work tables for conducting the assessments. The preliminary AA identifications were reviewed in the field during the week prior to the team assessments by Barnett, Bronny, and Roberts. At that time, some initial AAs were dropped, other AAs were added, and some boundaries were modified.

Field assessments at the Elverta, Orchard Creek, and Empire Ranch sites were carried out by the teams described above during the period 19th through 22nd April, 2010. Generally the mid-spring season in 2010 was cool and relatively wet. Many of the AAs demonstrated substantial wetness, and the growth and flowering periods of vernal pool plants appeared to be generally "late."

Assessment Areas are identified in this report according to location and CRAM module type. Each AA is identified as occurring at the Elverta project site (initial letter in AA identifier code is "E;" see Figure 1), the Orchard Creek reference site (letters "OC;" see Figure 2), or the Empire Ranch reference site (initial letters "ER;" see Figure 3). Each AA is also identified as being a depressional wetland (the name includes "DW"), a riverine wetland (the name includes "R"), a single vernal pool wetland (the name includes "VP"), or a vernal pool systems wetland (the name includes "VPS").[2] In addition, each AA includes a unique number. For example, the AA

[2] The Empire Ranch reference site does not include any vernal pool systems, and the category "ERVPS" is not used.

identified as OCVPS2 is the second vernal pool system assessed at the Orchard Creek reference site.

During the week of fieldwork, at the request of agency personnel and members of the CRAM PI team, several additional assessment areas were added to those initially identified, in order to more fully address wetland conditions that were thought to be underrepresented in the initial AA list. Additional assessments included both new AAs as well as conducting a second assessment at some existing AAs using a different module (see Discussion).

As required by CRAM, each assessment team was authorized to modify AA boundaries during the CRAM fieldwork to better reflect the conditions present in the assessment areas at the time of the fieldwork. Data were not collected regarding the frequency at which preliminary AA boundaries were adjusted; however, many AA boundaries were altered to some degree by field teams. The results reported herein reflect assessment areas and field conditions as identified by the field teams at the times the assessments were carried out.

Following the completion of fieldwork, the scoring results were entered by Mr. Bronny into an Excel workbook. This workbook was reviewed by Dr. Roberts and compared with the field scoring sheets for quality-assurance purposes, particularly for data-entry or computational errors. In addition, Dr. Roberts reviewed the plotted assessment area boundaries (as identified by Mr. Cox) in order to validate either the acceptance of the preliminary AA boundaries or the incorporation of any field changes made by assessment teams.[3] The Excel workbook is the basis for this summary report. Both the workbook and the original field data forms are available to agency staff for review purposes. In addition, the boundary maps, scoring sheets, stressor checklists, and site photographs for each assessment area are reported in a technical document under separate cover [California Rapid Assessment Method (CRAM) Technical Appendix for the Elverta Specific Plan, Bruce D. Barnett, PhD., LLC, June 2010].

3.0 Results

The CRAM results are categorized according to four "wetland types" present on the three sites as reflected in four CRAM assessment modules: (1) the Depressional Wetland Module, (2) the Riverine Wetland Module, (3) the Single Vernal Pool Wetland Module, and (4) the Vernal Pool Systems Wetland Module.[4] The following summaries are based on comparisons among the three sites of the results under each module; i.e., results for depressional wetlands at the Elverta site are compared with results for depressional wetlands at the Orchard Creek site and the Empire Ranch site, and similar within-type comparisons are made for the other three modules.

[3] The photopoint locations and bearings were not reviewed as part of the QA process.

[4] The CRAM development team (now included within the "L2 Committee" of the Wetland Monitoring Workgroup; http://www.waterboards.ca.gov/water_issues/programs/monitoring_council/wetland_workgroup/index.shtml) has determined that after the current field season the two vernal pool modules will be treated as "sub-modules" of a single Vernal Pool Module. However, that will not affect any ongoing monitoring for vernal pools, as the sub-modules will maintain the approaches and contents of the two current modules.

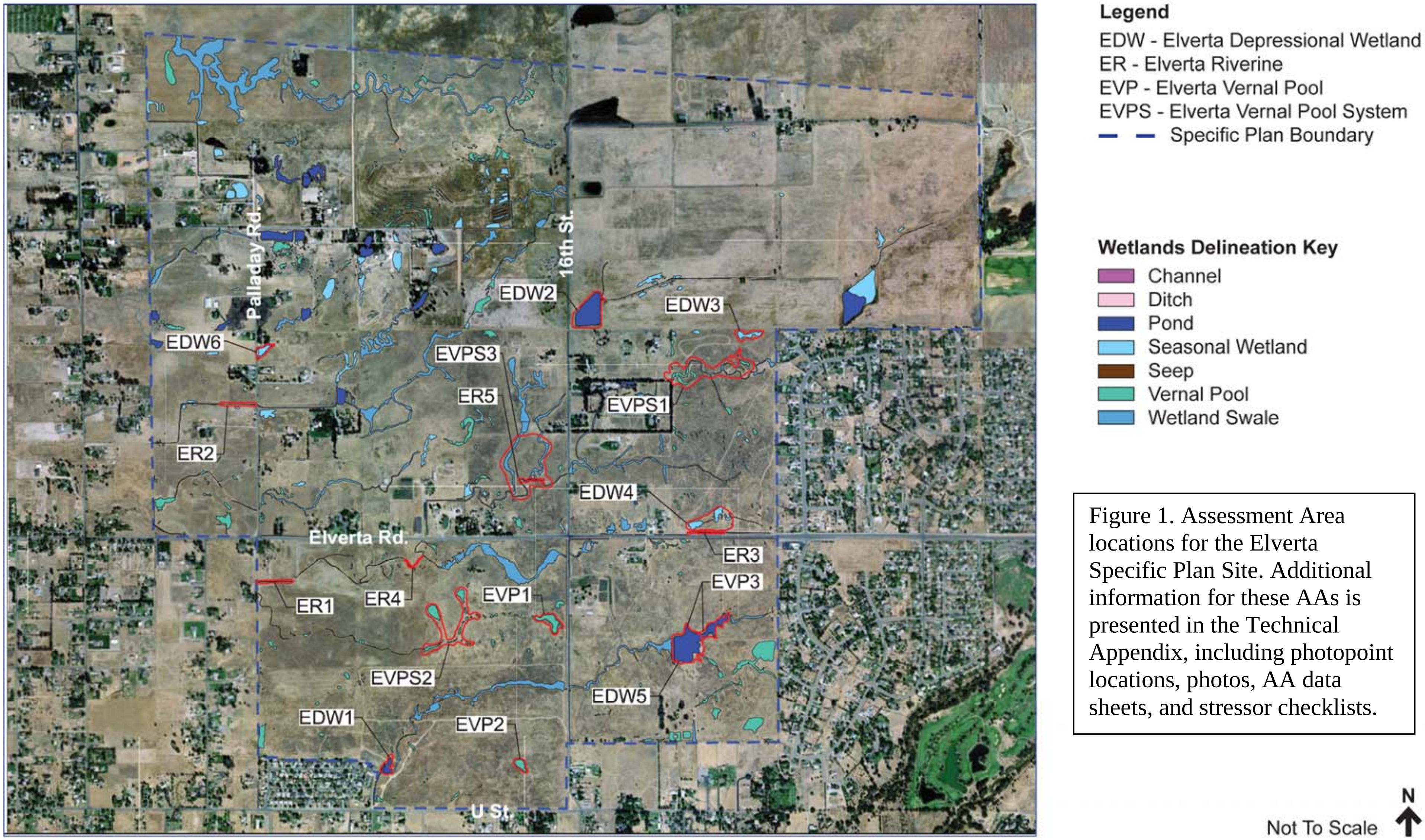

Figure 1. Assessment Area locations for the Elverta Specific Plan Site. Additional information for these AAs is presented in the Technical Appendix, including photopoint locations, photos, AA data sheets, and stressor checklists.

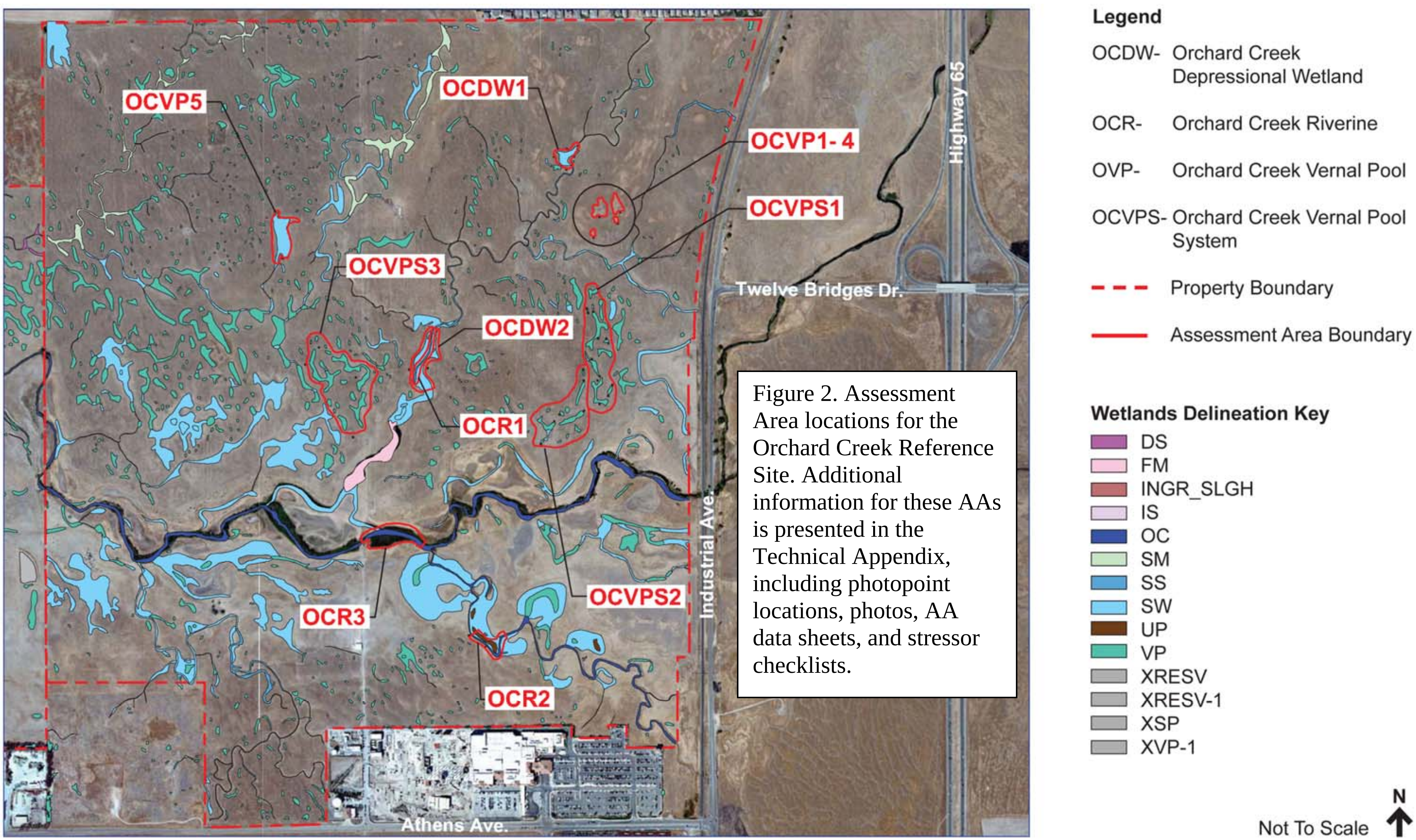

Figure 2. Assessment Area locations for the Orchard Creek Reference Site. Additional information for these AAs is presented in the Technical Appendix, including photopoint locations, photos, AA data sheets, and stressor checklists.

Legend

ERDW - Empire Ranch Depressional Wetland

ERR - Empire Ranch Riverine

Assessment Area Boundary

Figure 3. Assessment Area locations for the Empire Ranch Reference Site. Additional information for these AAs is presented in the Technical Appendix, including photopoint locations, photos, AA data sheets, and stressor checklists.

Not To Scale N

3.1 Depressional Wetlands

The index and attribute scores for the depressional wetland assessment areas for all three sites are shown in Table 1. In general, there are no substantial differences in the index scores for these AAs across sites. That is, the depressional wetlands at the Elverta site fall generally within the same range as the scores for depressional wetlands at Orchard Creek and Empire Ranch (see Discussion section regarding interpreting CRAM scores).

The CRAM attribute scores for the Elverta depressional wetland AAs (Table 1) demonstrate a mixed pattern of results for the hydrology, physical structure, and biotic structure attributes, and generally poor conditions for the buffer and landscape context attribute. In my opinion, this pattern is consistent with past and current disturbance and modification of the site by human activity. The assessment area with the highest attribute scores for the site (EDW3) is arguably the most remote AA on the site, consistent with an interpretation that disturbance is an important factor in conditions on this site.

Table 1. Index and Attribute CRAM Scores for Depressional Wetland Assessment Areas in the Elverta Specific Plan Project Site, the Orchard Creek Reference Site, and the Empire Ranch Reference Site, Spring 2010.

Depressional Wetland Assessment Area	**Index Score**	**Attribute Scores**			
		Buffer / Landscape Context	Hydrology	Physical Structure	Biotic Structure
Elverta Specific Plan Site					
EDW1	61	45	75	50	75
EDW2	60	42	83	62	50
EDW3	75	48	100	75	78
EDW4	50	45	75	25	56
EDW5 [a, b]	63	48	67	62	75
EDW6	46	40	67	25	53
Orchard Creek Reference Site					
OCDW1	71	93	92	50	47
OCDW2 [c]	67	68	100	50	53
Empire Ranch Reference Site					
ERDW1 [d]	68	81	42	62	89
ERDW2 [d]	64	73	42	62	81
ERDW3 [d]	61	34	42	88	81
Wetland Mean	*64*	*63*	*42*	*77*	*84*

Notes:
a Assessment Area EDW5 was also CRAMmed as Single Vernal Pool AA EVP3
b AA EDW5 was CRAMmed by all field personnel as a group as an initial exercise
c Assessment Area OCDW2 was also CRAMmed as Riverine AA OCR1
d AAs ERDW1, ERDW2, and ERDW3 were all located within a single wetland feature; see text

The two Orchard Creek depressional wetland AAs score high for the buffer and landscape context attribute and the hydrology attribute (a pattern demonstrated for this site for other wetland classes as well). The physical and biotic structure attributes for the two wetlands show low scores, however, a pattern that is also consistent for the riverine AA results at Orchard Creek but not for the vernal pool AAs (see below). It appears that some aspect of the site management program at Orchard Creek (perhaps grazing) adversely affects the characteristics that would yield higher scores for these structural attributes.

The Empire Ranch AAs show much higher attribute scores for the physical and biotic structure attributes and much lower hydrology attribute scores than do either of the other two sites. This result is not unexpected, given the placements and functions of the wetlands at Empire Ranch as parts of the site's stormwater management program. This management focus yields substantially altered hydrology, but allows for the development of greater physical and biotic structure. The depressional wetland scores for the buffer and landscape context attribute at Empire Ranch are problematic (see Discussion).

3.2 Riverine Wetlands

The riverine wetland assessment area scores for all three sites are presented in Table 2. The index scores clearly indicate that riverine wetlands at the Elverta site exhibit lower condition than do riverine wetlands at the Orchard Creek and Empire Ranch sites, a result that appears to be attributable to past and current modifications of the Elverta site. In general the latter two sites exhibit similar riverine wetland conditions, although the comparable index scores reflect substantially different patterns in attribute scores at the two sites, with the Orchard Creek scores reflecting high condition for buffer and landscape context and hydrology, while the Empire Ranch scores are more evidently related to higher scores for physical structure and biotic structure.

Table 2. Index and Attribute CRAM Scores for Riverine Wetland Assessment Areas in the Elverta Specific Plan Project Site, the Orchard Creek Reference Site, and the Empire Ranch Reference Site, Spring 2010.

Riverine Assessment Area	**Index Score**	**Attribute Scores**			
		Buffer / Landscape Context	Hydrology	Physical Structure	Biotic Structure
Elverta Specific Plan Site					
ER1	53	70	67	25	50
ER2	58	83	83	38	28
ER3	41	45	58	25	36
ER4	69	90	92	38	56
ER5 [a]	63	93	83	38	36
Orchard Creek Reference Site					
OCR1 [b]	69	93	92	38	53
OCR2	76	93	92	63	56

Riverine Assessment Area	Index Score	Attribute Scores			
		Buffer / Landscape Context	Hydrology	Physical Structure	Biotic Structure
OCR3	74	93	83	50	69
Empire Ranch Reference Site					
ERR1	67	42	75	75	75
ERR2	78	75	75	88	75
ERR3	74	75	83	75	64

Notes: a Assessment Area ER5 was also CRAMmed as Vernal Pool System AA EVPS3
b Assessment Area OCR1 was also CRAMmed as Depressional Wetland AA OCDW2

Within the AA scores for the Elverta site the buffer and landscape context attribute and the hydrology attribute generally show moderately high values, and it appears that the general context of the Elverta site still supports hydrological and buffer conditions favorable to maintaining the meandering swales in this landscape. However, the physical structure and biotic structure attributes reflect low condition, a result generally consistent with past and ongoing alteration of the site's surface and the surrounding area by human activity.

As was true for depressional wetlands, and probably for the same reasons, the Orchard Creek site demonstrates high condition for the hydrology attribute and the buffer and landscape context attribute, but much lower condition for the physical structure and biotic structure attributes.

The Empire Ranch riverine AAs demonstrate a pattern of relatively high scores for all attributes. It may be that this pattern results from management of the drainage system at the site for "woody riparian" vegetation and an ability to accommodate periodically elevated runoff flows. This pattern is not inconsistent with the assertion that increased wetland values could result from development, and least for some wetland types.

3.3 Single Vernal Pool Wetlands

Index and attribute scores for single vernal pool wetland AAs at all three sites are presented in Table 3. The index scores indicate that the Elverta site provides conditions for single vernal pools that are comparable to the conditions available in single vernal pools at the Empire Ranch site, while conditions on the Orchard Creek site for these wetlands are higher. These results may have been affected on all three sites by the wet spring.

The attribute scores for the Elverta site indicate low condition for the buffer and landscape context attribute, which are likely a valid reflection of altered conditions on and near this site because of both site use and the presence of nearby development. Attribute scores for hydrology are generally high, reflecting hydrological conditions in the region that still maintain these wetlands. The biotic structure attribute scores are also generally high, indicating that the Elverta site still provides value for vernal pool wetland species; as well, the elevated scores confirm the continued existence and favorable ecological dynamics of the uncommon vernal pool species on the Elverta site. The physical structure attribute scores for this site (and for the other two sites) are low, but this may be related to a methodological problem with this module (see Discussion).

Table 3. Index and Attribute CRAM Scores for Single Vernal Pool Wetland Assessment Areas in the Elverta Specific Plan Project Site, the Orchard Creek Reference Site, and the Empire Ranch Reference Site, Spring 2010.

Single Vernal Pool Assessment Area	**Index Score**	**Attribute Scores**			
		Buffer / Landscape Context	Hydrology	Physical Structure	Biotic Structure
Elverta Specific Plan Site					
EVP1	74	45	100	62	88
EVP2	69	48	100	50	79
EVP3 [a]	67	48	68	62	92
Orchard Creek Reference Site					
OCVP1	82	92	100	50	83
OCVP2	84	93	100	50	92
OCVP3	77	93	100	50	68
OCVP4	78	93	100	38	79
OCVP5	84	93	100	50	92
Empire Ranch Reference Site					
ERVP1	73	60	75	75	83
ERVP2	63	65	100	38	50
ERVP3	64	61	92	38	67

Notes: a Assessment Area EVP3 was also CRAMmed as Depressional Wetland AA EDW5

The Orchard Creek attribute scores for buffer and landscape context and for hydrology are high, as with other modules. The biotic structure attribute scores are also generally high, reflecting substantial value for vernal pool biota at the Orchard Creek site. These results are consistent with management of the Orchard Creek site to maintain high habitat values for vernal pool organisms.

Vernal pools are not widespread at the Empire Ranch site, and some of the pools are created pools. The attribute scores for the buffer and landscape context attribute and the biotic structure attribute are in the middle of the range of scores, indicating that this site does not provide substantial condition for those attributes. The hydrology attribute scores are substantially greater, which may be a result of the wet spring of 2010.

3.4 Vernal Pool Systems Wetlands

Index and attribute scores for vernal pool systems AAs are presented for the Elverta and Orchard Creek sites in Table 4 (the Empire Ranch site has no vernal pool systems). There is a substantial difference in index score values for the two sites, with the Elverta site providing substantially lower condition than does the Orchard Creek site. Nonetheless, it would be inappropriate to conclude that the Elverta site provided little value for vernal pool system organisms, even though the site appears to reflect the effects of past and ongoing disturbance and of development in the region.

Table 4. Index and Attribute CRAM Scores for Vernal Pool Systems Wetland Assessment Areas in the Elverta Specific Plan Project Site and the Orchard Creek Reference Site, Spring 2010.

Vernal Pool System Assessment Area	Index Score	Attribute Scores			
		Buffer / Landscape Context	Hydrology	Physical Structure	Biotic Structure
Elverta Specific Plan Site					
EVPS1	62	48	68	58	75
EVPS2	72	49	100	58	79
EVPS3 [a]	79	68	100	62	83
Orchard Creek Reference Site					
OCVPS1	94	93	100	92	92
OCVPS2	87	93	100	58	96
OCVPS3	91	93	100	75	96

Notes: a Assessment Area EVPS3was also CRAMmed as Riverine AA ER5

As was true for single vernal pools, the buffer and landscape context attribute scores for the Elverta site are low, presumably because of human use and development in the region. The hydrology attribute scores are relatively high, which may reflect the wet 2010 spring, but the scores confirm that the Elverta site provides hydrological conditions that support vernal pool systems. The biotic structure scores are also relatively high, indicating that the site, though modified, provides value for these wetlands and their associated biota.

The Orchard Creek attribute scores for the buffer and landscape context attribute, the hydrology attribute, and the biotic structure attribute are all very high, indicating that this site provides almost exceptional values for vernal pool wetland systems.

4.0 Discussion

4.1 Study Consistency with CRAM Requirements and Implementation Guidelines

A primary concern known to affect CRAM studies in general is deviations from the specified technical approaches identified in the CRAM modules. As a technical judgement, it’s my considered opinion that the field portion of this study was conducted pursuant to published CRAM technical requirements, and the results reported for this study stem from a valid application of CRAM.

I am aware of one instance for which adherence to methodological requirements remains incompletely resolved. This relates to the scores for the large depressional wetland at Empire Ranch (identified as three AAs, ERDW1, ERDW2, and ERDW3). This context arose because this large detention basin significantly exceeds the recommended AA size for depressional wetlands of ±2 hectares. At my request, Dr. Barnett and Mr. Bronny directed field teams to partition out three ±1-ha AAs, and the reported results reflect that approach. However, this large wetland is still only a single (if varied) wetland, rather than being three separate depressional wetlands. CRAM addresses "project" assessment with such segmented sampling (see Appendix I to CRAM Manual), but a single wetland is not a "project" and the CRAM scores for the wetland are not independent of one another. Consequently the scores for the three AAs in this wetland are averaged in Table 1, and these mean scores for one wetland cannot be considered to represent all of the depressional wetlands on the Empire Ranch site. An additional depressional wetland was assessed on the Empire Ranch site (located upstream from the Riverine AA ERR3; see Figure 3), which would have helped clarify the conditions in depressional wetlands on this site; however, the completed field data forms for that assessment have been lost.

An additional issue exists for this wetland in the differences in the Buffer/Landscape Context attribute scores among the three AAs within this wetland. The range of scores clearly represents varying interpretations of the metrics contributing to this attribute among the three CRAM teams. In general, highly developed areas (such as Empire Ranch) do not often support high metric scores for landscape context and buffer condition, and I would have expected the mean attribute score for this wetland to be less than the observed 63. This unusual variation should have been, but was not, identified at the time of the fieldwork, and the three teams should have resolved and coordinated interpretations for this single wetland. This didn't happen at the time and it's likely impossible to rectify the issue subsequently. This issue may be important for the federal reviewing agencies' concerns because depressional wetlands such as this detention basin are expected to be a significant element in the proposed Elverta project.

4.2 Representativeness of Sampled Assessment Areas

Appendix I to the CRAM Manual (Collins et al 2008) includes a recommend procedure for sampling "projects." The Manual's recommended Appendix I process is, in my opinion, inapplicable to the kind of large-scale site sampling required for this study, where the majority of each site in <u>not</u> wetland, and was appropriately not implemented for this study. Therefore a reasonable question is whether or not the AAs that were sampled adequately represent the range of wetland conditions on the three sites.

In my opinion there is no way to answer the question quantitatively/statistically at the present time, and the answer is therefore a matter of judgement.[5] It appears that two elements need to be considered practically in developing a sampling plan for large, heterogeneous sites, the range of conditions to be sampled and the numbers of samples for each condition. For this study, the range of conditions to be sampled is determined by the types of CRAM modules that apply to the three sites (i.e., four). The question therefore resolves primarily as whether or not a sufficiently large sampling framework was implemented to adequately address the range of variability in the three sites using the four modules.

In general, it appears to me that, with two exceptions, the sampling "design" developed for this study adequately captured the range of wetland conditions on the three sites, and the reported results largely reflect real differences among the wetland classes and sites sampled.

[5] A more appropriate sampling theory exists for "ambient surveys" of wetlands when the areas and locations of the wetlands are adequately known to allow the required area-weighted sampling design to be developed. However, the underlying conditions required to implement this process do not appear to work effectively at a project scale (which is the reason Appendix I was developed).

- One exception to the above conclusion is the single depressional wetland sampled on the Empire Ranch site (also discussed further below).
- The second possible exception regards the combination of depressional wetlands and "riverine" seasonal swales on the Elverta site. It appears likely that the Elverta site sampling adequately addressed the vernal pool wetlands. The range of variability present in swales and emergent seasonal wetlands within the Elverta site may also have been adequately captured within the 11 AAs that addressed these wetland types. Nonetheless, the Elverta site map (Figure 1) clearly shows substantial areas of swales and depressions in the northern half of the site that were not sampled, and it is uncertain whether the variability in condition within these two wetland classes present in the Elverta site was fully captured.

On the whole it appears that the sampling for this study was adequately broadly based and that the results reflect conditions on the three sites. One measure of the effectiveness of the sampling process is the demonstrated capture of a wide range of variation in CRAM index and attribute scores. Attribute scores reported for this study ranged from the minimum possible score of 25 to the maximum possible score of 100, indicating (to me) that the range of variation that exists in the wetlands on the three sites was fully sampled. In a practical sense, the attribute scores for most wetland classes in most locations demonstrated a separation of high-condition and low-condition AAs. Even if the AA selection was somewhat *ad hoc* I conclude that the results largely reflect real conditions.

4.3 Using CRAM to Interpret Differences Among Sites

CRAM is an assessment methodology for wetland condition, based upon internalized comparisons of metrics that are observed at assessment sites to the expected characteristics of those metrics in undisturbed wetlands of the same class (Collins et al 2008; also see Stein et al 2009). CRAM can be used to infer relative differences in wetland condition among sites, and this capability can assist reviewing agencies in considering contexts such as those raised for the proposed Elverta project.

As with all sampling processes, CRAM data are affected by two kinds of variability: (i) variation that reflects actual differences in the sampled conditions; and (ii) variation that results from individual observer characteristics, random variation (i.e., sampling "noise"), and other sources. Unfortunately the statistical effects on CRAM scores of the second kind of variability cannot currently be characterized. The CRAM methodology has been developed to remove the effect of some of the inter-observer variation by the requirement that studies be conducted by people who are adequately trained in implementing the methodology, together with the requirement that studies include adequate quality assurance. These conditions were met for the Elverta project.

As a practical matter, it has been demonstrated that higher CRAM scores are associated with better wetland condition, and lower scores with poorer condition. In prior large-scale CRAM studies (e.g., Sutula et al 2008) these differences have been considered in terms of the amount of difference between scores for sub-samples that should be accepted as indicating a real difference between the wetlands the sub-samples represent. In those studies the CRAM data were collected in a more controlled process than were the Elverta project CRAM data, but in my opinion the Elverta project sampling was not inconsistent with the CRAM protocols, and as a result it is not unlikely that a similar inference can be drawn about the degree of difference in wetland conditions that are indicated by differences in CRAM scores for this study.

For the purposes of this report, I recommend that a difference of 10 or more points in mean index and attribute scores between wetlands of the same class at different sites should be accepted as indicating real differences in the conditions in those wetlands. The mean index and attribute scores for the four wetland classes at the three sites included in this study are indicated in Table 5.

Table 5. Mean Index and Attribute CRAM Scores for Wetland Assessment Areas in the Elverta Specific Plan Project Site, the Orchard Creek Reference Site, and the Empire Ranch Reference Site, Spring 2010.

Location	**Mean Index Score**	**Mean Attribute Scores**			
		Buffer / Landscape Context	Hydrology	Physical Structure	Biotic Structure
Depressional Wetlands					
Elverta Specific Plan Site	59	45	78	50	64
Orchard Creek Reference Site	69	80	96	50	50
Empire Ranch Reference Site	64	63	42	71	84
Riverine Wetlands					
Elverta Specific Plan Site	57	76	77	63	41
Orchard Creek Reference Site	73	93	89	50	59
Empire Ranch Reference Site	73	64	78	79	71
Single Vernal Pool Wetlands					
Elverta Specific Plan Site	70	47	89	58	86
Orchard Creek Reference Site	81	93	100	48	83
Empire Ranch Reference Site	67	62	89	50	67
Vernal Pool Systems Wetlands					
Elverta Specific Plan Site	71	55	89	59	79
Orchard Creek Reference Site	91	93	100	75	95

What these data suggest to me about the overall wetland conditions on the three sites can be summarized:

- The Orchard Creek reference site (as noted under Results above) appears to provide better conditions for vernal pools than do the Elverta and Empire Ranch sites, particularly in terms of buffer and landscape context and hydrology. It's noteworthy, however, that the biotic attribute scores for the Orchard Creek site and the Elverta site do not appear to differ significantly for individual vernal pools.

  The Orchard Creek site also appears to provide better overall conditions for both depressional and riverine wetlands than does the Elverta site, particularly in terms of buffer and landscape context and hydrology, although the physical and biotic structure conditions for these wetlands do not indicate that either site is clearly advantageous.

The Orchard Creek site appears to provide less desirable conditions for physical and biotic structure for both depressional and riverine wetlands than does the Empire Ranch site.

In general, these results appear to be consistent with a management focus at the Orchard Creek site on providing high values for vernal pool wetlands, as well as providing suitable conditions for other wetland types to the extent that the site's primary focus results in favorable conditions for the other types.

- The Empire Ranch reference site provides generally lower condition scores for individual vernal pools (this site lacks vernal pool systems) than does the Orchard Creek site. The mean vernal pool index scores for Elverta and Empire Ranch do not appear to be substantially different, but the Elverta site supports better biotic structure than does the Empire Ranch site, even though the Elverta site provides less-good conditions for buffer and landscape context than does the Empire Ranch site.

  The Empire Ranch scores for depressional and riverine wetlands indicate that this site provides better physical and biotic structure conditions than do the other two sites. However, the conditions for buffer and landscape context for depressional and riverine wetlands for the Empire Ranch site are substantially lower than are those of the other two sites. The average hydrology attribute score at Empire Ranch is lower for both wetland types than the scores at Orchard Creek, but while the mean hydrology attribute for depressional wetlands is lower at Empire Ranch than at Elverta,[6] the hydrology attribute for Empire Ranch is not lower for riverine wetlands.

  In general, the results for Empire Ranch site are consistent with a management focus for these wetlands on maintaining water quality, discharge limitation, and habitat in depressional and riverine ("riparian") wetlands in a development area. The presence of relatively dense development in the watershed(s) of these wetlands affects their setting and functioning, and the observed high scores for some attributes suggest both a good design and active management to maintain desirable wetland conditions.

- Salient results for the Elverta project site are included in the synopses above. In general, the Elverta site shows condition losses consistent with past land (particularly agricultural) uses and a current lack of management protection for wetland conditions, but the site does still provide conditions that support all of the wetland types evaluated in this study. The Elverta site appears to provide its best conditions in terms of the vernal pool modules, while conditions for depressional and riverine wetlands are relatively more degraded when contrasted with the values provided by the two reference sites.

4.4 CRAM Design Questions to be Addressed Further

Adapting the CRAM application to agency uses is still relatively new, and it appears to me to be useful to indicate how results from this project will be used to further improve the methodology. Three substantive questions about CRAM's application in the region that includes the three sites addressed in this study have been identified for further attention by the CRAM PI Team. The

[6] Note that this may be an artifact of the Empire Ranch score being based on a single wetland.

first concerns the possible need for modifications in the depressional wetland and/or riverine modules with respect to seasonal swales in the foothills of the Sierra Nevada. The second concerns the widespread application of the vernal pool modules to the exclusion of other (possibly more appropriate) modules. The third question relates to guidance for project-based sampling for sites such as the Elverta site.

- One result of this application of CRAM has been the recognition that existing modules do not adequately address conditions in the seasonal swales and related features that comprise many wetlands in the lower Sierra Nevada foothills, including specifically both the Elverta site and the Orchard Creek site. These features exhibit characteristics of both depressional wetlands and streams. However, the results of this study indicate that neither of the existing modules adequately captures all of the conditions in these features.[7] These swales are linear drainage features that are currently evaluated in CRAM using the Riverine module (as in this project). The Sierra foothill seasonal swales observed in this study, however, almost universally lack the dynamic sediment and hydrologic flow regimes typical of streams, as well as the woody "riparian" vegetation that is necessary for high biotic structure attribute scores in this module (Josh Collins, pers. comm.).

  One illustrative example is the AA on the Orchard Creek site that was "double-CRAMmed" as both a riverine AA (OCR1) and a depressional wetland AA (OCDW2). This swale is intermediate in condition between a "typical" depressional wetland and a "typical" streamcourse, and while elements of both modules apply, other elements do not work well (e.g., lack of variation in vegetation layering and dominance by relatively few species typically lead to low scores for biotic structure). The swale produced essentially identical index scores for both modules, and the attribute scores were also similar, but it is unknown how broadly such results occur. Such features occur in hundreds or even thousands of square miles of the Sierra Nevada foothills, and the need to address this issue is clear.

- A different (but related) question affects use of the vernal pool modules. At the present time the vernal pool modules reflect a high degree of development, and these modules appear to function well in characterizing conditions in vernal pool wetlands. These modules were "split off" from the depressional module when it became evident that the more generalized module did not adequately address a subcategory of depressional wetlands in which the biotic structure was critically important. The work carried out for this project has indicated that two concerns remain with the current modules that need additional consideration. First, as noted previously the existing vernal pool modules do not work very well with respect to the "physical structure" attribute, and the Vernal Pool subgroup of the PI Team already intends to address this concern. Second, the existing CRAM module-selection process is ambiguous with respect to the application of modules other than vernal pool modules when there are varying degrees of dominance by plant species generally considered characteristic of vernal pools (a number of which occur in many wetland contexts and are not restricted to vernal pools) in what is otherwise clearly another wetland type. This is particularly a concern for landscapes with abundant depressions and seasonal swales, such as the Elverta and Orchard Creek sites.

[7] The CRAM PI Team has identified the need for further refinement of the depressional wetland module as a high priority for future CRAM development; this may include a sub-module for "seasonal depressional swales."

The second vernal pool concern is well illustrated in this study by an AA on the Elverta site that was intermediate between a depressional wetland (EDW5) and a large single vernal pool (EVP3). This wetland was also "double-CRAMmed" as part of this study (Tables 1 and 3). While the wetland showed little difference in scores for the buffer and landscape context, hydrology, and physical structure attributes, the presence of "vernal pool plants" (many of which are not restricted to vernal pools) was associated with a substantially higher score on the biotic structure attribute in the vernal pool module. It's unclear whether such a result is desirable, particularly given the seasonal restriction on conducting vernal pool assessments to months during the year when most vernal pool plant species can be identified. Too broad an application of this seasonal restriction may prove to be undesirable from the perspective of CRAM's implementation and use. In any event this will be considered further by the PI Team/L2 Committee.

- Finally, the CRAM Development Team needs to address a sampling procedure for project sites that are not all wetland areas. Appendix I in the CRAM Manual is inapplicable when many or most of the AAs that result hold no wetlands. Project sites like the Elverta site present sampling questions more akin to the issues raised in ambient assessments: (i) identify and map wetlands in the site, (ii) develop a sampling approach that statistically or proportionally selects point locations for a wetland type based on the area or distribution of the type, and (iii) extend this sampling approach across all wetland types on the site.

  The CRAM PI Team has considered how to best apply the methodology to large, largely non-wetland project sites previously, but a recommendation has not been reached. The numbers of points that should be sampled within such project sites for each wetland type is a question that has recently emerged as important for the elaboration of the CRAM methodology for energy projects proposed for development in the California desert (Cliff Harvey, L2 Committee, pers. comm.). These concerns are clearly ripe for attention from the CRAM PI Team/L2 Committee.

Resolving these issues will further increase the applicability and usefulness of CRAM for the Central Valley. The results reported above clearly indicate that the existing modules already are useful in differentiating wetland conditions that are relevant for agency decision-making processes.

5.0 References

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