RAMONA VERNAL POOL CONSERVATION STUDY
RAMONA, CALIFORNIA

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January 2005

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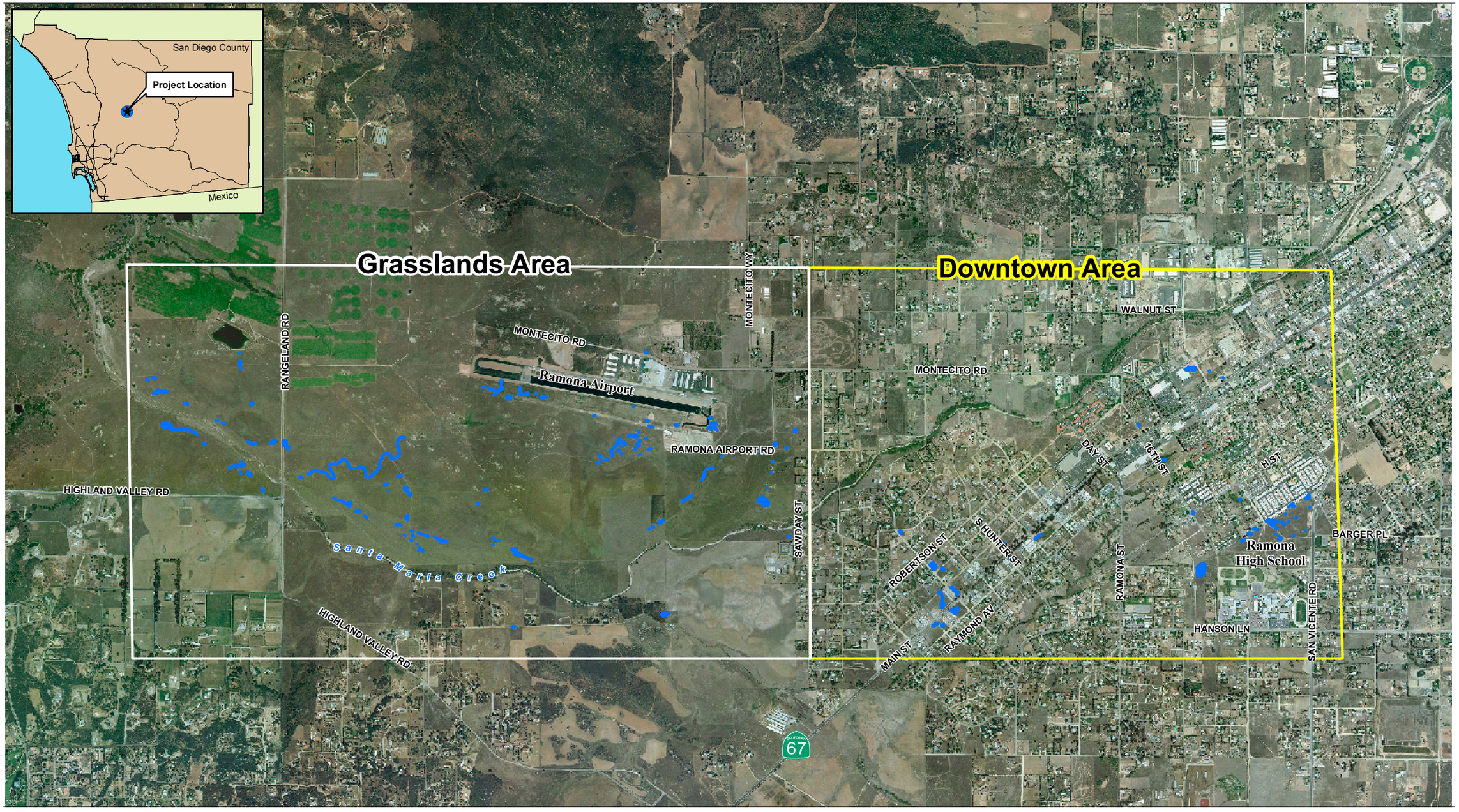
INTRODUCTION

This Ramona Vernal Pool Study report illustrates the approach, results, and recommendations for the vernal pool conservation study performed as part of the North County Multiple Species Conservation Program (MSCP) Plan (North County MSCP) currently in preparation by the County of San Diego (County). Vernal pool habitats are ephemeral (temporary and seasonal) wetland habitats with significantly different management requirements than other habitats and ecological resources found in San Diego County and are therefore being analyzed separately from the North County MSCP. However, the results of this study will be incorporated into the North County MSCP planning effort. Because vernal pools represent one of San Diego County's fastest declining and historically impacted habitat types, inclusion of high-quality vernal pool complexes within the North County MSCP preserve boundaries would provide this sensitive habitat additional protection not guaranteed through the existing regulatory process.

Vernal pool habitats exist frequently throughout the Ramona study area (Figure 1), and while about half of the existing vernal pools are conserved by The Nature Conservancy (TNC) and other entities, the remaining pools are often found on private properties. Of significance is vernal pool habitat in the Ramona town center along both sides of Main Street and the adjacent urbanizing areas. The Ramona area has been subject to small parcel land subdivisions over the past 80 to 100 years, resulting in small lot residential and commercial development within the town center. However, within the past few decades, it has become apparent that the development has been placed in an area of historic and current vernal pool habitat. Furthermore, the endangered San Diego fairy shrimp and rare species of plants have been found in many of these pools. As a result, many ponded areas, some of which support federally listed endangered species, occur in the yards of residences and adjacent to small commercial developments.

GOALS AND OBJECTIVES

The goal of the project is to create a vernal pool conservation plan for Ramona, San Diego County. The plan will facilitate protection of biologically valuable areas of vernal pools while accepting that some vernal pools of low quality may be permitted for loss with appropriate and adequate mitigation. The objective of this project is to generate a detailed plan that provides maps with an assessment of the function and general integrity of the vernal pools, with identification of the most sensitive and viable pools, as well as creating a process for addressing land use proposals that may affect them. In addition, this plan will also attempt to identify historical vernal pools, which may have lost function over time due to habitat degradation. The modeling process in this plan was developed to evaluate vernal pools. It analyzes the biological



Source: Eagle Aerial 2002, .5m color; SANDAG, SanGIS.

2000 1000 0 2000 Feet

Scale: 1 : 24,000; 1 inch = 2000 feet

Figure 1
Ramona Vernal Pool Study
Overview

functions of Ramona vernal pool basins and associated watersheds (individual vernal pools and vernal pool complexes). This biological suitability model will be integrated into the larger North County MSCP to identify conservation priorities consistent with the North County MSCP.

STUDY AREA

The study area (Figure 1) is limited to the parts of the unincorporated area of Ramona, California that do, or potentially could, support vernal pools. Ramona is located in San Diego County, approximately 30 miles northeast of the city of San Diego and about 25 miles east of the Pacific Ocean.

VERNAL POOL ECOLOGY

Vernal pools and swales are seasonal biological communities that support an unusual flora and fauna. Several topographic and soil conditions are prerequisites for the occurrence of vernal pools and swales. The topography is typically a series of microdepressions (vernal pools) but also can arise as a drainage pattern that flows during high rainfall and forms distinct ponded areas during the drying phase (vernal swales). Vernal pools and vernal swales are treated together here and are simply referred to by the term "vernal pools." The depressions collect water from precipitation and runoff from the surrounding mounds or upstream watershed. The important soil requirement is either a subsoil of hardpan or claypan, which prevents the draining of water from these pools through downward percolation. The unique flora and fauna of Ramona vernal pools include several indicator plant species such as woolly marbles (*Psilocarphus brevissimus*), water starwort (*Callitriche marginita*), pygmy crassula (*Crassula aquatica*), quillwort (*Isoetes* sp.), toothed downingia (*Downingia cuspidata*), little mouse tail (*Myosurus minimus* ssp. *apus;* former federal candidate C2 and CNPS List 3), spreading navarretia (*Navarretia fossalis;* federally listed as threatened), and San Diego button-celery (*Eryngium aristulatum* ssp. *parishii;* federally and state listed as endangered).

The County of San Diego (1991) and the California Department of Fish and Game (CDFG) (Holland 1986) consider vernal pools sensitive because of the unique character of this habitat and the sensitive plant and animal species found only in or around vernal pools. Throughout San Diego County, urbanization has resulted in losses of habitat estimated to be as high as 96 percent in 1990 (Oberbauer 1990). More pools have been lost since then. Vernal pools have also been degraded by off-road vehicle (OHV) activity, agricultural practices, and draining of lands.

In Ramona, vernal pools were originally described by Beauchamp and Cass (1979), and then Balko (1979) and Bauder (1986). In these reports, only the vernal pool complex southeast of the Ramona Airport (Airport) on the Cumming Ranch property was identified; this complex was labeled as pool group T1-5 in the Bauder report. Additional vernal pools along Main Street, near Ramona High School, and throughout the Santa Maria Valley have been subsequently identified in a variety of studies, the most comprehensive of which was a general survey of the status and condition of vernal pools in the Ramona area (Sproul 1989). In addition to vernal pools, the Ramona vernal pool ecosystem also includes vernal swales that exhibit seasonal flows and, due to underlying clay soils, display seasonal ponds that contain vernal pool plant and animal species.

Although not considered true vernal pools, a group of alkali playas/meadows exist within the study area. This habitat consists of a series of small barren alkaline openings surrounded by grasslands. A few true vernal pools occur nearby, some of which are underlain by different soils. The playas occur as part of a subtle, low gradient swale on the north side and parallel to Santa Maria Creek on Cagney Ranch, currently owned by TNC. They are associated with Visalia sandy loam, 0 to 2 percent slopes, which is derived from granitic alluvium and may have pockets of an underlying calcareous layer (USDA 1973). During surveys conducted by EDAW in 2001, the alkali playas were dominated by the annual Parish's brittlescale (*Atriplex parishii*; formerly proposed endangered, CNPS List 1B). Associated species found in this habitat are Coulter's saltbush *(Atriplex* cf. *coulteri;* CNPS List 1B), dwarf peppergrass (*Lepidium latipes),* vernal pool plantain *(Plantago bigelovii*), alkali barley (*Hordeum depressum),* and southern tarplant (*Centromadia parryi* ssp. *australis*; CNPS List 1B).

STUDY METHODS

The Ramona Vernal Pool Study was mainly funded by a grant from the U.S. Environmental Protection Agency (EPA). In summary, data compilation for this study consisted of aerial photo analysis, literature review, field data collection, and constraints modeling. The dataset for the Ramona vernal pool conservation model consists of a combination of previously collected data for a variety of projects unrelated to the Ramona Vernal Pool Study, and the stratified dataset collected for this study.

Vernal Pool Selection Criteria

The criterion for including a vernal pool landscape feature in this study was the presence of at least one indicator species according to the Bauder vernal pool species list (Bauder 1993a)

(Appendix A). "Road pools" were surveyed and included only when found within vernal pool complexes that contained vegetated vernal pools. For the purpose of this study, vernal pools were classified and vernal pool indicator species were defined according to a combination of definitions and criteria published by the following references:

1. U.S. Army Corps of Engineers (1997): contains a limited list of vernal pool plant species and fairy shrimp species to be used as vernal pool indicators;
2. Ellen Bauder, San Diego State University (1993a): contains a comprehensive list of vernal pool indicator plant species;
3. City of San Diego (1993): contains the requirement that at least one indicator must be present to qualify as vernal pool.

All vernal pools identified during the field reconnaissance effort of this study exhibited at least one of the conditions or indicator species mentioned in any one of the above references. All vernal pools identified in this study contained at least one plant species from the Bauder list, or fairy shrimp.

Record Collection

Historical records were compiled for vernal pool locations and natural resources (i.e., plant and animal species, soils, physical features, etc.) associated with vernal pools. These records included aerial photographs, records from County surveys, California Natural Diversity Database records of vernal pool species, biological survey reports from development projects, 10(a) permit reports submitted to the U.S. Fish and Wildlife Service (USFWS), and other official documents. When multiple years of data were available for a vernal pool or a pool complex, these data were combined into a master data sheet to accurately represent all known attributes for this area. A black and white historical aerial photograph from 1929 was analyzed to identify possible locations of historical vernal pools. In addition, aerial color-infrared photographs were taken on March 8, 2003, during the winter aquatic phase, which clearly displayed ponded areas, including vernal pools. This aerial photograph, in combination with field surveys, was also used to locate and map vernal pools not previously recorded. In addition, it also assisted in the identification of previously recorded vernal pools and vernal swales that no longer exist. We identified vernal pool types based on Bailey's state-ecoregions (1995) and Miles and Goudey's California's ecoregions (1997) modified by Thomas Oberbauer for San Diego County to include more detailed subdivisions based on flora and fauna. U.S. Department of Agriculture soil survey of the San Diego Area, California (1973) soil maps were also consulted to verify vernal pool-associated soils. However, these maps were generated for agricultural purposes and are not

suitable for small-scale analyses necessary to identify vernal pools. Detailed soils analysis was not conducted for this study, but may be necessary to identify compatible restoration or mitigation sites for vernal pools.

We adapted Bainbridge's (2002) vernal pool conservation model to conditions of vernal pools found in the Ramona area. Refining the Bainbridge model with professional expertise specific to Ramona vernal pools a conservation model was devised for the Ramona study area.

Data sheets (Appendix B) for vernal pool inventory and functional analysis were as comprehensive as possible for using a quick visual assessment method and were tailored to the conditions and criteria important in San Diego County vernal pools. The criteria used for the inventory and functional analysis also utilized information gathered from the vernal pool model established by Bainbridge (2002) for the San Joaquin Valley, and from preliminary data sheets devised by Ellen Bauder and Marie Simovich (pers. comm. 2003) as part of their EPA-funded hydro-geomorphological (HGM) vernal pool model. Bauder (pers. comm. 2003) and Simovich (pers. comm. 2003) also provided expert input on vernal pool functions and fairy shrimp accounts in Ramona. All field data were collected according to the criteria established on the data sheets. Reports were analyzed using the same criteria; however, many reports did not contain the level of detail desired for this type of data analysis.

The literature review consisted of studies performed by researchers and consultants in Ramona (see references). Information from these reports was entered into the data sheets, although most reports were not detailed enough to provide the entire set of information needed for the conservation modeling effort. A total of 41 pools, a subset of all reported pools, were surveyed as part of this study to obtain data necessary for the model that were not contained in the previous reports. Vernal pool locations were also available from most reports and were either transferred as Geographic Information System (GIS) shapefiles, where available, or digitized into the GIS database from report maps or using aerial photographs. New vernal pools identified during this study were mapped using submeter Global Positioning System (GPS) technology and incorporated into the GIS database.

Field Data Collection

Due to the large sample size, we chose to collect data on a subset of all vernal pools known in the Ramona area based on accessibility of properties and similarity of vernal pools (i.e., of two similar pools in a pool complex only a quantifiable dataset from one pool was collected). In addition, only pools to which landowners granted the County access were surveyed from March

to July 2003 for presence/absence of plants and animals, water quality, physical characteristics of the pool, hydrological and ecological function, and surrounding land condition and uses. Pool bbb_5_5 in Downtown Ramona (Kalbaugh and La Brea), however, was fenced and not accessible, and thus was not surveyed, although permission to survey was granted. Where feasible, field surveys were conducted to fill data gaps from previous reports. In October 2003, dry-season surveys were conducted according to USFWS protocols on a subset of vernal pools for the presence of fairy shrimp.

The following data were analyzed for vernal pool complexes (vernal pool basins and associated watersheds) and individual vernal pools, to devise the conservation model:

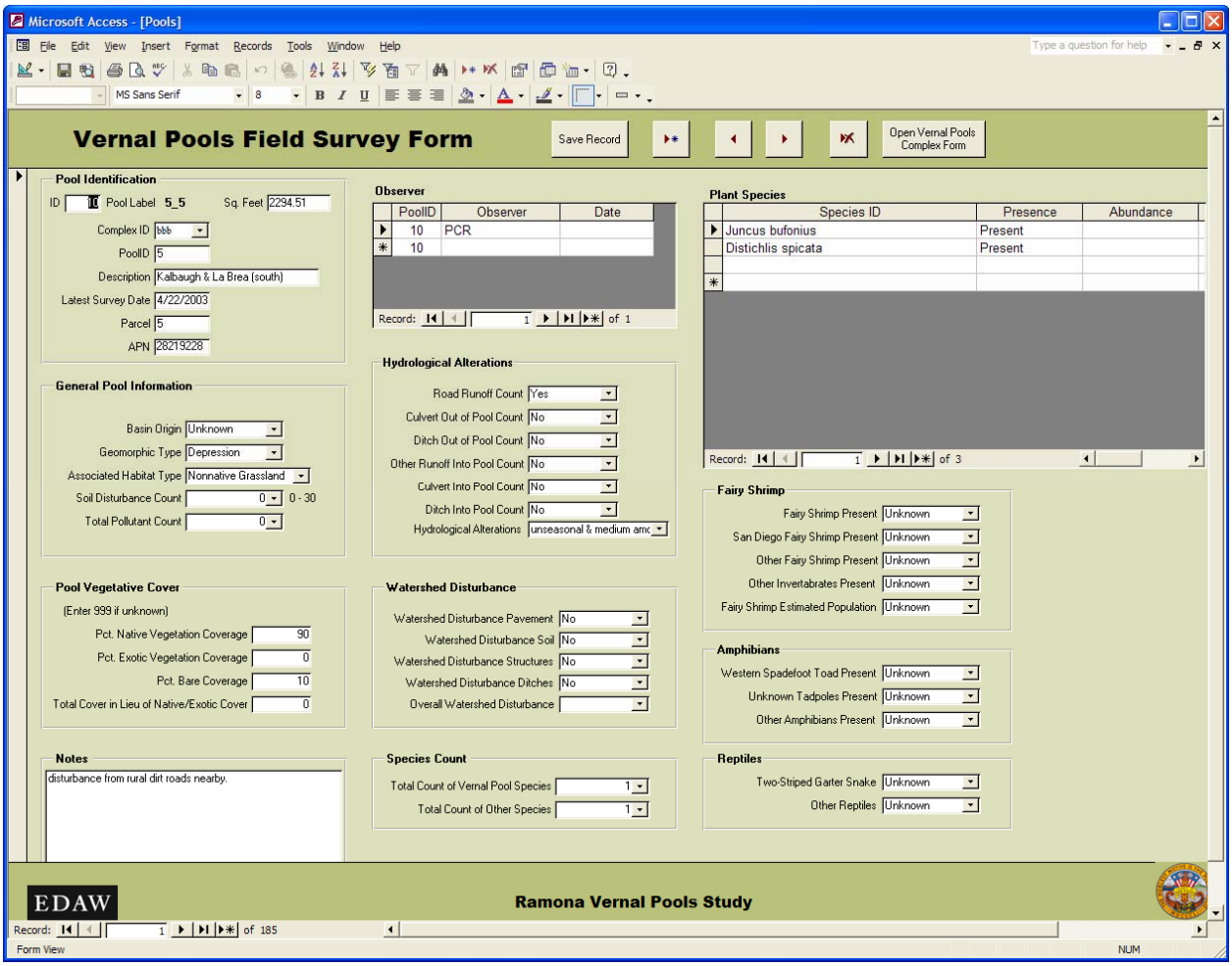
- Pool/Complex size
- Soils associated with vernal pools
- Plant species composition (native and nonnative plants)
- Animal species composition (mainly focusing on fairy shrimp)
- Presence/absence of vernal pool indicator species (plants and animals)
- Presence/absence of sensitive species (federal/state lists and MSCP covered species list)
- Watershed vegetation community
- Watershed hydrology
- Closeness to other pools/complexes
- Site connectivity and continuity
- Site fragmentation
- Edge effect (surrounding land uses).

Due to contract schedule, all vernal pool identification under this contract was performed during the dry season from April-July 2003. Surveys were conducted on property with explicit access permits only.

Computer Model

A database was designed using Microsoft Access to store the previously listed data. Additional spatial data were linked into the Access database. Spatial data included proximity to development, associated soils, and size and density. All data from literature review and field surveys were entered into the database using the form pictured in Figure 2 below.

Figure 2 Sample screen of vernal pool database



Quality indices for each surveyed pool were derived based on survey data, which gave an indication of the relative functionality and integrity of pools. For example, pool complexes (more than one pool) in a natural setting were considered of higher quality, and therefore more

regionally sensitive, than isolated pools in an urban setting due to the urban edge effects. Plant species composition, similarly, was used to give pools with higher proportions of native species more weight in the data analysis than pools with predominantly nonnative vegetation cover. Pools with sensitive and/or listed species (plant or animal) were given the greatest weight in the analysis as these species are regulated by the resource agencies due to the rarity of their occurrence. The majority of background literature did not report wildlife species other than the presence or absence of fairy shrimp; therefore, the model evaluated fairy shrimp exclusively, while the database contains information on other animal species if available. Vernal pool depths were not available in most background literature and were therefore not evaluated. Vernal pool size, while ranked, was not given a high weight as most vernal pools in the study area are sized relatively homogeneously. Also, size does not seem to contribute a significantly higher biological value in this study, as both the smallest and largest pools contain vernal pool indicator species, including threatened and endangered species.

After finalizing the spatial and survey data, a resource sensitivity model was developed based upon the available data. Certain data within the database were assigned a weight, with all data categories accounting for a value of 100. Therefore, the maximum value that any pool could receive would be 100. Those categories deemed more significant or unique were given a higher weight. The categories and weights used were as follows:

Category	Weight
Plant Species	20
Fairy Shrimp Population	15
Vegetation Coverage	10
Exotic Vegetation Coverage	10
Soils	10
Hydrological Alterations	10
Watershed Disturbance	10
Pool Complex Density	5
Pool Size	5
Proximity to Development	5

All pools within the study area were compared against each other using a decision-tree model based on biological data and geographical information. The resource value was assigned on a curve based on the pool's overall ecological function and value as measured against other pools. Those pools with the maximum resource value in a category across all pools were given the

maximum weight. Those pools with a lower resource value in a category were given a lower value based on its value as a percentage of the maximum value of all pools. For example, if a pool had 100 percent vegetation coverage it would get the maximum weight for that category and receive 10 points. However, if a pool had a value of 50 percent vegetation coverage it would only receive half of the weight for a value of 5 points. In another example, if the maximum value for pool size was 0.8 acres, all other pools for this category are ranked relative to this value, so a pool that is 0.2 acres would receive a score of 2.25. Those pools with the most significant or unique resources would be assigned the most points and therefore have a higher resource value.

Categories and weights were based on Bainbridge's (2002) model, professional judgment and expert experience. The input data (biological, hydrological, physical, and land use data) were ranked using a similar approach as identified in Bainbridge (2002) and altered to fit the Ramona conditions. Scores were assigned according to the sensitivity of a pool and the opportunities for vernal pool conservation. Although the potential exists, not many vernal pools in Ramona harbor threatened and endangered (T&E) plant species. Based on our field observations and historic information available on a few Ramona vernal pools, it was determined that the presence of T&E plant species in pools exhibited one of the most important characteristics for pool conservation, followed by the presence of vernal pool indicator plant species (as defined above). The presence of fairy shrimp, specifically the endangered San Diego fairy shrimp (*Branchinecta sandiegonensis*), was also ranked very highly throughout due to its limited distribution and occurrence. A ranking distinction by fairy shrimp quantities per pool was not applied because the population density in any given pool varies from year to year and accurate data are not available for all pools based on climatic (drought versus wet year), environmental (pool conditions suitable for shrimp development), and biological (population dynamics suitable for cyst development) factors (Erikson and Belk 1999).

Overall, soils were valued as an important vernal pool indicator (Placentia soils were most important; all other vernal pool associated soils were secondary). In addition, each vernal pool was ranked according to its location in the landscape regarding fragmentation, connectivity, and edge effect by calculating the distance between each pool within a complex, identifying isolated pools, and evaluating the distance of a pool/complex to the nearest development. In addition, the quality of the watershed was ranked by evaluating hydrological conditions and obstacles impeding or altering connectivity and surface flows, such as fences, roads, berms, and development. The presence of native versus nonnative vegetation in the field also contributed to the evaluation of vernal pools and vernal pool watersheds. The presence of nonnative vegetation was ranked low as it generally deteriorates vernal pool quality. Nonnative vegetation was ranked

above 0 (with the exception of invasive plant species that are difficult to remove, see below) if it can be removed to improve vernal pool function (Bauder 2003, pers. comm.). If a pool was occupied by an aggressive invasive species such as annual ryegrass (*Lolium multiflorum)* and bermuda grass (*Cynodon dactylon*), which are very difficult to eradicate successfully in vernal pools, the pool was assigned a negative value due to the reduced likelihood that the pool would ever achieve optimal function without permanent intensive management.
The weights were selected based on these inputs' functions to sustain vernal pools over time. The resulting categories were quartiled based on the mathematical distribution of these functions. Based on these quartiles, the resource value model then identified the conservation of selected pools as having very high, high, moderate, or low priority.

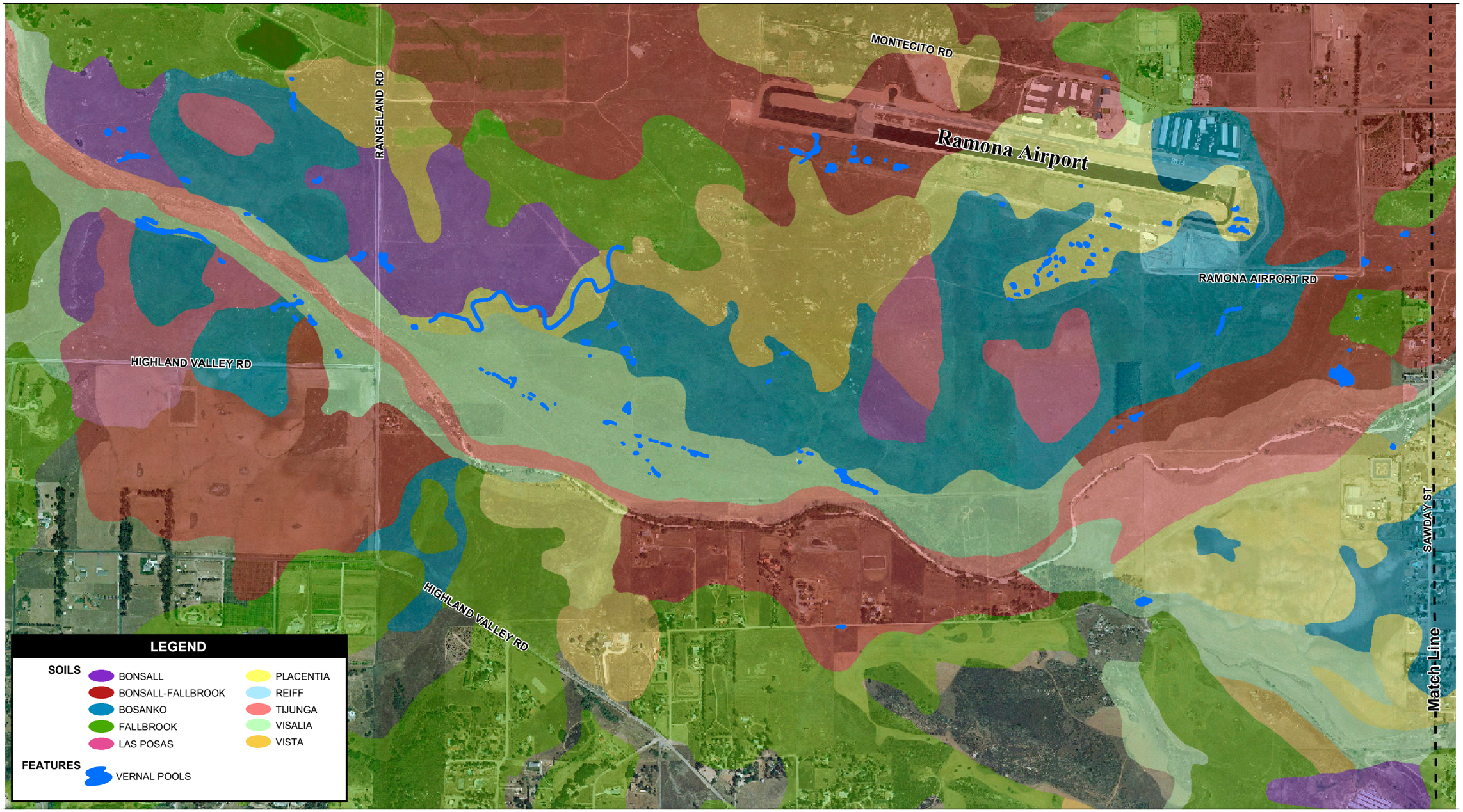
Conservation strategies and priorities were developed based on professional experience, expert opinion (Bauder and Simovich 2003, pers. comm.), and a variety of background resources (e.g., USFWS 1998; Bauder and Wier 1990; RECON 2001; Bainbridge 2002).

RESULTS

We identified and mapped a total of 188 vernal pools, either within vernal pool complexes or as isolated pools, based on our vernal pool identification criteria as defined above. This does not represent the total number of vernal pools in the study area. Only those properties were surveyed for which we had access permission, and which we were able to detect from aerial photos and then positively identify during field.

The majority of vernal pools identified for this study included vegetated vernal pools. Unvegetated (road) pools were only included in the dataset if present in a vernal pool complex that also contained vegetated vernal pools.

The two major vernal pool areas in the Ramona area are separated by Santa Maria Creek: the Ramona Grasslands vernal pools, which extend mainly north of the creek, and the Downtown vernal pools south of the creek. Both systems contain a similar distribution of vernal pool-associated soils (USDA 1973), including Placentia, which is a soil type most often associated with vernal pools, and the following other vernal pool associated soils: Bosanko clay, Bonsall, and Bonsall-Fallbrook (Figures 3 and 4). Alkali playas appear to be exclusively associated with the Visalia soil series (Figure 3). While the Downtown area displays the largest expanse of Placentia soils, vernal pools historically associated with this soils series in this location have largely been lost to development (Figure 4). Vernal pools associated with the Bonsall-Fallbrook



Source: Eagle Aerial 2002, .5m color; SANDAG, SanGIS.

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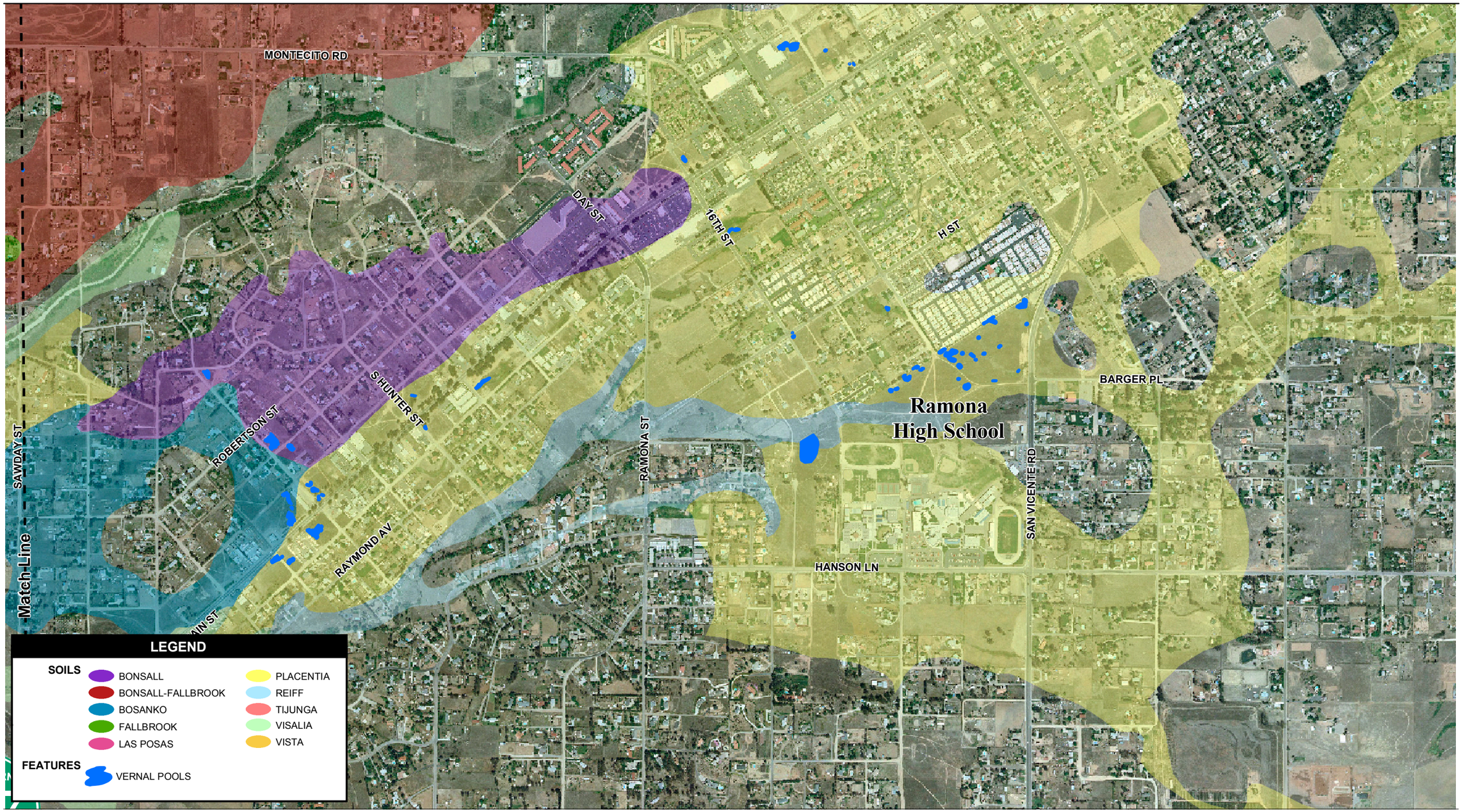
NORTH

Scale: 1 : 12,000; 1 inch = 1000 feet

Figure 3
Vernal Pool Soils associated with
Ramona Grasslands Vernal Pools



Source: Eagle Aerial 2002, .5m color; SANDAG, SanGIS.

1000 500 0 1000 Feet

Scale: 1 : 12,000; 1 inch = 1000 feet

Figure 4
Vernal Pool Soils associated with Downtown Vernal Pools

and Bosanko soils seem to be lacking in the Downtown area, which is in part due to intensive agricultural practices on this soil type. Five different pool types were identified in the study:

- true vernal pools on Placentia soils,
- true vernal pools on other vernal pool-associated soils,
- road pools (unvegetated pools),
- swale pools (vernal swales), and
- alkali playas.

Most Ramona vernal pools represent grassland pools rather than the mesa top mima mound pools typical in the San Diego area. However, pools with shallow mima mound topography are present, particularly on Placentia soils, such as vernal pool complex "f" in the northeastern area of the former Cagney Ranch and the "n" complex north of Ramona High School.

Sensitive plant species were found to have certain affinities for specific soil types in this study. All current and historic locations of spreading navarretia in Ramona are associated with the Bonsall-Fallbrook series and Placentia series. The one known location of San Diego button-celery in the study area is on the Bonsall series. Little mousetail is found on Bonsall-Fallbrook and Visalia soil series. Parish's brittlescale and Coulter's saltbush are associated with the Visalia soil series in alkali playa habitat.

Ramona Grasslands

The Ramona Grasslands area is located in the Santa Maria Valley primarily north of Santa Maria Creek and encompasses a series of large land holdings, some portion of which will likely be preserved. The Santa Maria Valley is a small valley lying approximately 1,400 feet above mean sea level (AMSL) with low, rocky hills of between 2,000- and 3,000-foot AMSL elevations surrounding the valley. The area extends across the valley floor and is generally flat to gently sloping with numerous rock outcrops scattered across the site. The general topography consists of low rises (10 to 20 feet) around these outcrops of granitic boulders separated by swales and flats. Some tributaries of Santa Maria Creek support vernal swales. Preservation of large land holdings will is proposed through a combination of acquisition of lands for conservation, conservation easements granted through the planning process, hardline negotiations through the North County MSCP process, or maintenance of current, low-intensity land use practices.

A portion of the proposed Oak Country Estates development, east of Rangeland Road, and Cumming Ranch, south of Ramona Airport Road, will likely be preserved through the planning and North County MSCP processes, while residential developments are planned for the remaining portions of those properties. The former Cagney Family Trust property is currently owned and preserved (hard-line preserve) by TNC; small portions were acquired by the County as mitigation for the Airport runway extension.

Soils in the northern portion of this area are primarily Bonsall-Fallbrook sandy loams (2 to 5 percent slopes) to the west and east of the Airport runway, and Placentia sandy loams (2 to 9 percent slopes) to the south of the runway. The areas mapped as Placentia sandy loams are heavier soils with a sandy clay subsoil that are most associated with vernal pools in Ramona. This soil type is associated with the vernal swale in the western part of the TNC Cagney Ranch property, and the vernal pool complex southeast of the runway. Bosanko clay (2 to 9 percent slopes) occurs in the southern portion of the Ramona Grasslands area (USDA 1973). In the Bonsall-Fallbrook soil in the runway extension area, Bonsall soils occupy the swales and flats, and the Fallbrook soils make up the mounds and ridges surrounding the boulder piles. Both soils have a thin, sandy topsoil layer over heavier clay subsoils. In addition, the southern portion of TNC's Cagney Ranch includes a series of alkali playas associated with Visalia sandy loam soils. These playas exist in low-lying flat areas that inundate less frequently and for a shorter duration than vernal pools. Due to these hydrological conditions and the saline soils, this habitat is comprised of unique flora and fauna.

The Ramona Grasslands consist mainly of undeveloped pastures, which support cattle and are dominated by nonnative grass species. All grazing activities have been discontinued in some areas, such as the eastern portion of the Airport (since spring of 2002), and the northern portion of Cumming Ranch. Portions of the western quarter of the Ramona Grasslands are used as effluent spray fields by Ramona Municipal Water District and therefore support denser, greener ground cover than other areas. Similarly, areas fenced to keep livestock out of Airport facilities support somewhat denser vegetation, with a higher proportion of grasses to annual forbs than grazed areas.

The majority of the Ramona Grasslands area consists of nonnative grassland vegetation community with disturbed and remnant patches of native grassland. The areas that are currently moderately to heavily grazed form a very open association of filaree (*Erodium* spp.) and scattered nonnative grasses and forbs, such as wild oat (*Avena fatua*), rip-gut brome (*Bromus diandrus*), vinegar weed (*Trichostemma lanceolatum*), and ragweed (*Ambrosia* sp.). Nonnative grasses form a dense canopy where grazing has been discontinued. Bosanko clay soils in the

eastern portion of the grasslands area contain dense communities of tarweed (*Deinandra fasciculata).* An open to dense cover of saltgrass (*Distichlis spicata*), alkali barley (*Hordeum depressum),* and southern tarplant occurs on swales and lower areas (alkali meadow and playa) specifically in the south of the Ramona Grasslands area. Bermuda grass has invaded portions of this alkali meadow community and the vernal swale on the TNC Cagney Ranch property. Coastal sage scrub dominated by flat-topped buckwheat (*Eriogonum fasciculatum*) is the primary vegetation community of the low, rocky hills to the north. Freshwater marsh and sparse stands of willow riparian forest occupy the banks of Santa Maria Creek.

Portions of the Ramona Grasslands are occupied by two federally endangered species: Stephens' kangaroo rat (*Dipodomys stephensi*) and San Diego fairy shrimp. In addition, two state species of special concern, the western burrowing owl (*Athene cunicularia hypugaea*) and golden eagle (*Aquila chrysaetos*), occupy the grasslands, among other raptor species. One juvenile bald eagle (*Haliaeetus leucocephalus*) was potentially sighted by EDAW biologists at the Airport mitigation pools on TNC Cagney Ranch property (formerly the northeastern portion of the Cagney property) in June 2003.

Ramona Downtown

The Ramona Downtown vernal pool area comprises all pools in the downtown Ramona area, including vernal pools on property owned by the Ramona School District north of Ramona High School, and Olive Pierce Middle School. Historically, this entire downtown area was probably characterized mostly by grasslands and sage scrub interspersed with vernal pools on Placentia and other vernal pool-associated soils. However, most pools have gradually been developed. The majority of parcels in the Ramona Downtown area are disturbed or vegetated with nonnative grasses and exotic herbaceous vegetation. Ephemeral wetlands and swales are abundant, most of which are wetlands under the jurisdictions of the U.S. Army Corps of Engineers or CDFG. However, some of these wetlands, specifically the ones on vernal pool-associated soils, display seasonal depressions with vernal pool properties (i.e., vernal pool plant indicator species or San Diego fairy shrimp).

Study Deficiencies

As indicated above, vernal pools that were not accessible during the study or for which we did not receive study results are not included in this study, and are not shown on the study figures and in the database. Historical information is included in the database if this information was provided by a credible source (see references). For example, some pools contained historical populations of certain vernal pool species that were not rediscovered during recent surveys. However, due to recent droughts, these species may have not germinated, but could still be present in the seed bank. Therefore, they were included in the database.

Exact calculations on the population size and dynamics of fairy shrimp cannot be made at this time for the following reasons: (1) no population viability analysis (PVA) is available on this species in Ramona; (2) the sample size in this study is very small because fairy shrimp data for many Ramona vernal pools were not available at the time of this study. Therefore, fairy shrimp results presented in this study and associated recommendations are inconclusive.

CONSERVATION PRIORITIES

Conservation priorities for the Ramona Vernal Pool study area are based on the principles that vernal pools are interconnected (vernal pool complex) and subject to proper watershed function. Viable vernal pool conservation must focus on the landscape scale, including appropriate watershed size, surrounding land use and property ownership to allow for perpetual conservation. However, individual pools exhibiting unique vernal pool habitat components (e.g., soils, flora and fauna) and rare and sensitive species, should be conserved and long-term management guaranteed. Appropriate vernal pool conservation should include the following elements:

- Functioning contiguous preserve systems
- Long-term monitoring
- Appropriate long-term management, and enforcement thereof
- Public education.

Restoration and enhancement may also become a necessary component of a vernal pool conservation plan due to the edge effects of pools in the downtown area, past land uses, and poor quality of certain pools that are important for conservation of certain species. Restoration of vernal pools is not intended to be relied upon for preservation of vernal pools in the Ramona area, although many pools may benefit from restoration to enhance and repair their functionality. Most, if not all, vernal pools will significantly benefit from such management as exotic species

removal, specifically in the watershed, and often in the vernal pool basin. Many pools remain self-sustaining with normal stewardship and adaptive management; however, some pools will need more intense management to maintain the biological resources found there.

Ramona Grasslands

Biological Suitability Model

The majority of vernal pools that display moderate to high vernal pool functions and biological quality are located within the Santa Maria Valley in the Ramona Grasslands area north of Santa Maria Creek. The high biological value of these vernal pools is attributed to a combination of biological, physical, and landscape conditions, such as:

- Abundance of vernal pool indicator plant species
- Presence of sensitive species, including San Diego fairy shrimp
- Abundance of native plant species
- Lower amount of nonnative or invasive species
- Suitable soil formations
- Suitable physical parameters such as size, depth, water quality, hydrological conditions, etc.
- Appropriate watershed size and quality
- Lower level of landscape fragmentation
- Lower edge effect (located in a larger context of open space and preserves)
- Ongoing habitat management
- Land uses compatible with vernal pool management
- Opportunities for enhancement and restoration

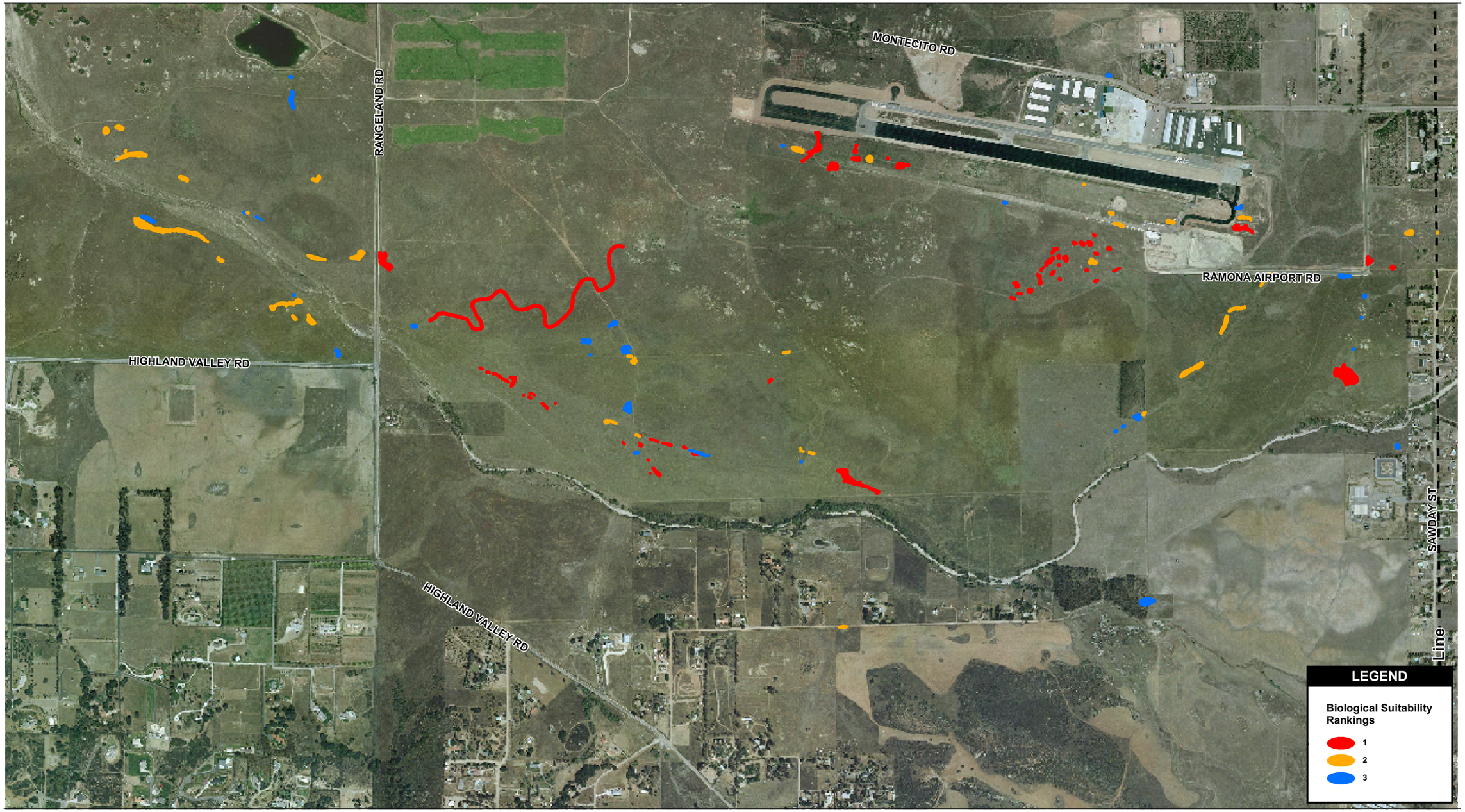
With the exception of San Diego button-celery, all known vernal pool species found in Ramona and all habitat types, including soil types, are represented in the Ramona Grasslands vernal pool system. Of the 188 vernal pools mapped in the study area, 133 occur within the Ramona Grasslands area.

Most of the 133 pools are or will likely be preserved as follows:

- 48 pools are currently preserved by TNC
- 23 alkali playas are currently preserved by TNC
- 13 pools (listed below as preserved) will be preserved by the County (Ramona Airport)
- 13 pools are currently preserved by the proposed Cumming Ranch mitigation (Area C)
- 4 pools may optionally be preserved by the proposed Cumming Ranch mitigation (Area B) and Hardy Ranch
- 22 pools will likely be preserved by the proposed Oak Country Estates mitigation

Biological and Conservation Values

The suitability and conservation values of the Ramona Grasslands pools are depicted on Figure 5. On TNC Cagney Ranch property, 100 percent of all vernal pools will be conserved and are included in the current draft North County MSCP hard line preserve boundary. In the entire Ramona Grasslands area, most mapped vernal pools are proposed to be preserved and included in the current draft of the North County MSCP as either hard or soft line preserves or through hardline negotiations with property owners. This includes vernal pools in the Oak Country Estates Open Space Area, the Hardy Ranch (currently in negotiation for purchase and preservation by the County) and Cumming Ranch (a portion of which will most likely be donated to the County for conservation). The eastern portion of Area C of Cumming Ranch contains vernal pools already preserved through conservation easements. Some of this area was formerly managed by The Environmental Trust and is currently managed by the property owner. The western vernal pools in Area C, including the vernal pools already preserved through a conservation easement, are located within a vernal swale system. This area is proposed to be preserved to form a contiguous preserve as part of the Ramona Grasslands. The land owner has applied to the County for a subdivision of the Cumming Ranch property. He has indicated a willingness to donate the entire Area C to the County for the conservation of vernal pools and other sensitive biological and cultural resources as part of his project. The majority of vernal pools located on the Airport property will be preserved as mitigation for the Ramona Airport Improvement (hard line preserve: dd_142_c3w, -c19a, -c20, -c21, -c21a, and d_142_k3, -k2, and d_142_c2e, -c3e and g_142_k2 and nn_144_r24; and soft line preserve: dd_142_c19a, -r5). An additional two pools are located within an existing conservation easement for mitigation of



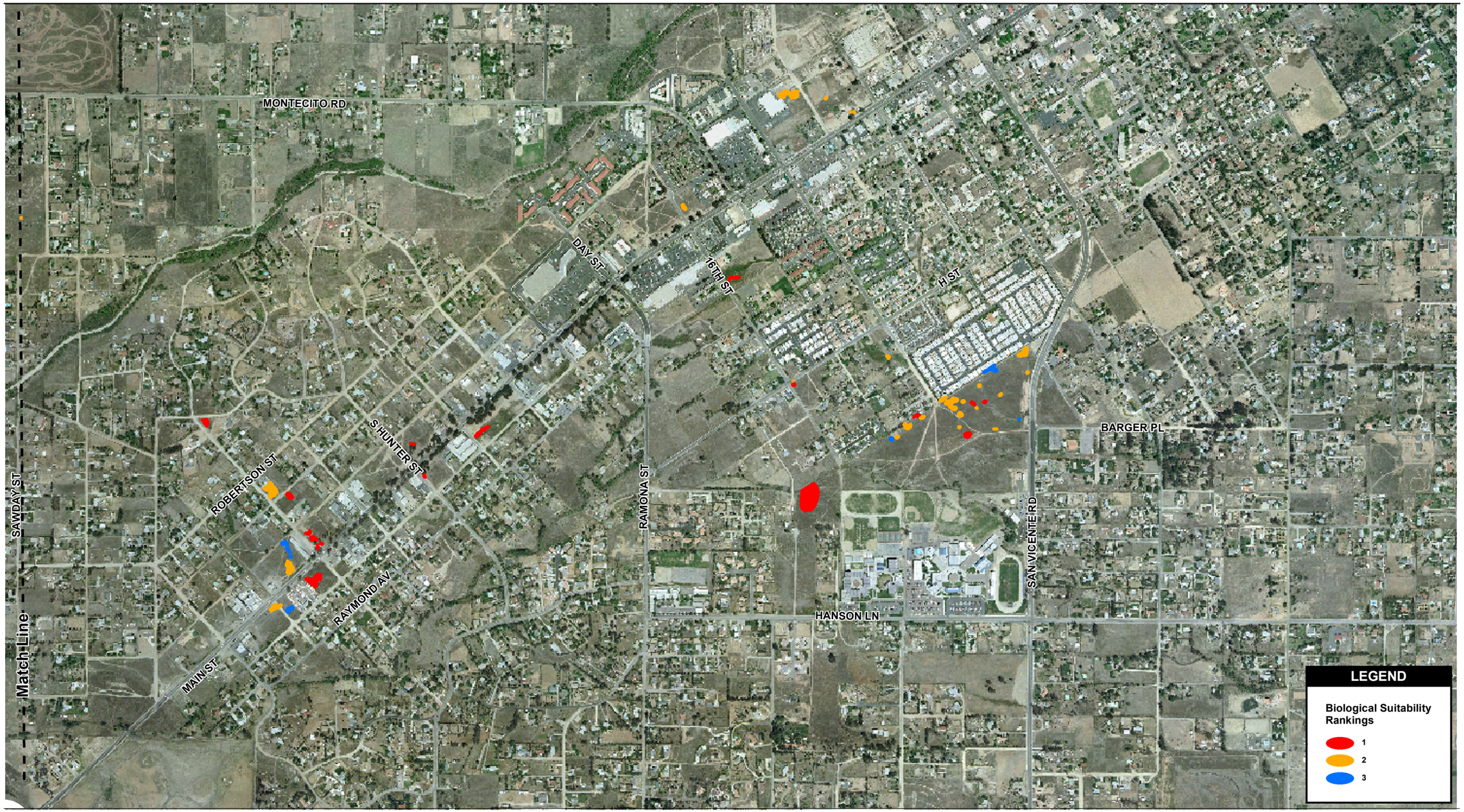
Source: Eagle Aerial 2002, .5m color; SANDAG, SanGIS.

1000 500 0 1000 Feet

NORTH

Scale: 1 : 12,000; 1 inch = 1000 feet

Figure 5
Grasslands Area
Biological Suitability Rankings



Source: Eagle Aerial 2002, .5m color; SANDAG, SanGIS.

1000 500 0 1000 Feet

Scale: 1 : 12,000; 1 inch = 1000 feet

Figure 6
Downtown Area
Biological Suitability Rankings

vernal pool impacts at Gillespie field (dd_142_c18, c19). The remainder of the pools, while not formally preserved, will most likely not be developed in the future due to the limitation in building around airports runways. About 50 percent of vernal pools on the Airport property will be conserved.

Therefore, of all mapped vernal pool basins and swales in the Ramona Grasslands area, almost all pools will be conserved through a combination of hard and soft line preserves. The majority of these pools exist on Bonsall, Bonsall-Fallbrook and Bosanko soils, with the alkali playas exclusively associated with Visalia soils. Two Placentia-associated vernal pool complexes exist in the Ramona Grasslands area (vernal pool complexes f and ee). With appropriate management, all of these pools could potentially be very high-quality vernal pools as the factors influencing vernal pool quality in this area are mainly affected by the amount of cattle grazing, nonnative species control (specifically bermuda grass), and hydrological and soils disturbances.

Ramona Downtown

Biological Suitability Model

Due to the high level of development, the majority of vernal pools on Placentia soils have been lost. The majority of downtown vernal pools exist along a swale system along Main Street and on the Ramona School District property. One pool on Kalbaugh Street contains the only currently known Ramona population of the federally endangered San Diego button-celery. This site is a fenced mitigation site. A Declaration of Restrictions has been recorded for this property to protect vernal pool resources and is therefore considered to be 100 percent conserved; however, management obligations for this vernal pool remain unclear. The compromised quality of the Ramona Downtown vernal pools is due to development pressures such as increased edge effects, landscape fragmentation, absence or reduced size and quality of surrounding watersheds, low water quality, absence of appropriate management, and the resulting lack of biological resources associated with vernal pools.

Most Downtown vernal pools are associated with Placentia soils. Although many of these pools contain vernal pool indicator species, specifically fairy shrimp, most of these pools are moderately to heavily degraded. In addition, the Downtown area exhibits a large number of unvegetated pools, which were not mapped for this study. Many of these pools persist in dirt roads or on undeveloped parcels. Overall in this study, 31 pools were categorized as having an artificial origin, of which 15 were verified as having fairy shrimp. (Artificial pools, in this case, are defined as those pools clearly having a man-made origin through alteration of soil. This

distinction is not always clear as some "road rut pools" may simply be altered natural vernal pools, in which case historical photographs could be used to determine the historical presence of natural vernal pools.)

Biological and Conservation Values

The Downtown vernal pools are unique in their continued presence of Downingia in relative abundance when most Downingia populations seem to have been severely diminished in the Ramona Grasslands area. Downingia was recorded in the 1990's in many vernal pools (approximately 25) on the Ramona Airport property, Cummings Ranch, and Cagney Ranch (RECON 1996, 1998; The Environmental Trust 1993). It was rediscovered in only five vernal pools during surveys in the early 2000's (pools e_142_c3w and c21 in EDAW 2003; p_98_e5 in Ecological Ventures 2003; f_147_e46 and e53 in this 2004 study). These findings indicate a decline in Downingia populations in the Grasslands area given that spring surveys were conducted by EDAW each year for the last five consecutive years on the Ramona Airport and for multiple years on adjacent properties. Downingia is a locally important species given its strict adherence to vernal pool habitat. In a study of the genus, Weiler (1962) suggested the possibility of local races or varieties of *Downingia cuspidata*. Bauder (1993b) suggested that there may be genetic differentiation between the coastal and foothill populations of this species in San Diego County. She found that seed collected from Ramona germinated under different conditions than Downingia seed from the coast or *Downingia concolor* from Cuyamaca. If all of the remaining downtown Ramona vernal pools were to be lost, the five pools in the grasslands area known to have extant populations may not be enough to preserve a possible local race or variety of this species.

Most vernal pools, with the exception of vernal pools on the Ramona School District property, are located on small, isolated private properties surrounded by development. Therefore, the conservation and long-term management of these pools are subject to the property owner's conservation commitment and cannot be guaranteed in perpetuity unless the properties were acquired for conservation purposes. In addition, edge effects from adjacent land use such as urban runoff, trespassing, invasion of exotic plant species, and watershed disturbance are unavoidable, and the perpetual function of these pools is compromised. With the exception of the already preserved vernal pool containing *Eryngium* (bbb_5_5) on Kalbaugh Street, only pools with sensitive species (including fairy shrimp) or abundant populations of *Eryngium*, *Myosurus* (e.g., ggg_471_1), and *Downingia* (e.g., ww_25_25), or those donated by the property owners for conservation, restoration and enhancement should be conserved in perpetuity (Figure 6) to preserve their unique ecological value. Due to the high level of fragmentation and

isolation, conservation of the remaining fragmented vernal pools on private property would be very management intensive and difficult, if not impossible, to maintain in perpetuity within a Downtown Ramona vernal pool ecosystem.

The Ramona School District vernal pools range from low to high quality. High quality pools generally contain vernal pool indicator plant species and fairy shrimp. Threats from exotic species and surrounding development reduces the overall value of these pools compared to the Ramona Grasslands vernal pools; however they exhibit relatively high vernal pool functions relative to other Downtown pools. The Ramona School District pools persist on Placentia soils as a contiguous vernal pool complex on 40.8 acres, with much of their watershed undeveloped. This contributes to their high restoration potential provided that exotic species removal and intensive management would continue on the site in perpetuity. This site would be considered a highly valuable mitigation site (mitigation bank) for vernal pools lost to development in the Ramona area; however, the County of San Diego does not have land use jurisdiction over Ramona School District. In a recent Program Environmental Impact Report, the school district evaluated several alternative designs for reconstruction and expansion of Olive Pierce Middle School and Ramona High School (Mooney & Associates, 2003). All alternatives show some level of vernal pool preservation on this site.

Placentia soils once supported the majority of vernal pool habitats in the Ramona area, but most have been developed. Vernal pools on the remaining vernal pool-associated soils will be conserved within the Ramona Grasslands vernal pool preserves; however, only two small Placentia associated vernal pool complexes exist in this area (vernal pool complexes "f" and "ee"). Therefore, the conservation and restoration of the Ramona School District vernal pools and the other Downtown pools recommended for conservation is crucial to the preservation of the appropriate representation of Placentia-associated vernal pools in the Ramona area (Figure 6).

Sensitive Species Coverage

The larger Ramona area contains the only remaining viable vernal pool habitat within the study boundaries of the North County MSCP. Most vernal pools in the study area coincide with grassland vegetation communities. Grassland communities are considered important for sensitive plants and wildlife in the North County MSCP Habitat Evaluation Model. The species mentioned in the following paragraphs will be covered under the North County MSCP as rare, narrow endemic and wetland obligate species.

San Diego Fairy Shrimp

No comprehensive presence and abundance data exist for San Diego fairy shrimp (*Branchinecta sandiegonensis*) in Ramona, although the majority of vernal pools in the study area are either occupied by San Diego fairy shrimp or have the potential for fairy shrimp to occur. The dataset obtained for the this study includes the results of a variety of fairy shrimp surveys performed during either the dry and wet season pursuant to USFWS 10(a) permit requirements, including (1) past data from a variety of project reports in the study area; (2) sampling conducted during the year 2003 wet season on a subset of vernal pools; and (3) dry season sampling of 25 pools in the study area during the summer of 2004. Most wet-season data do not contain information about species abundance; however, this information is generally inconclusive as wet-season data are highly variable dependent on the state of vernal pool disturbance and the climatic conditions when the samples were obtained. For example, trampling by cattle in the wet season may preclude an otherwise healthy fairy shrimp crop from hatching; equally, in a wet year a given pool may yield a high volume of shrimp, while this same pool may contain little or no shrimp during a drought year as less shrimp will hatch from the existing cyst reservoir. Dry-season data typically yield more conclusive abundance information; however, the majority of fairy shrimp data in the Ramona study area were obtained from wet season samples. Dr. Marie Simovich (from University of San Diego, Branchiopod Research Group) has collected both wet and dry season data from many pools in the study area over the years, specifically during the wet season of 2002/2003. These samples have not yet been analyzed, but this information may be available in the future if it is needed for decision-making purposes.

Although relatively abundant in Ramona vernal pools, this species is regionally declining due to the decline in vernal pool habitat. There also exists a high probability that the Ramona population of San Diego fairy shrimp, together with those found on Miramar and Mira Mesa in San Diego (clade B), may exhibit genetic differences from other San Diego fairy shrimp populations in the county, e.g., Del Mar Mesa and Otay Mesa (clade A), based on preliminary results of genetic analysis done by Dr. Bohonak (2004). This study also found that each pool may have its own uniqueness regardless of watershed connectivity. Dr. Simovich is currently analyzing DNA samples of Ramona fairy shrimp; however, conclusive results have not yet been presented and it remains to be seen how distinct from other San Diego fairy shrimp populations the Ramona populations would be.

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San Diego Button-celery

The federally endangered San Diego button-celery (*Eryngium aristulatum* var. *parishii*) is restricted to vernal pool habitats under intermittently moist conditions and on clay soils, often growing around the periphery of vernal pool basins. In the Ramona study area, this plant is currently known from only one location within the Ramona vernal pool study area, bbb_5_5 on Kalbaugh Street in Downtown Ramona. This pool is currently fenced and is a mitigation site for the construction of the U.S. Postal Service office in Ramona. The site does not appear to be managed and no habitat management plan could be located. Preservation of this pool is mandatory to achieve species coverage for this species. The U.S. Postal Service mitigation site should have a management plan for the perpetual management and conservation of this and other vernal pool associated species in this location prepared and implemented. Introduction of this species into restored vernal pools will be crucial to conserve this species in the Ramona area.

Spreading Navarretia

The federally threatened spreading navarretia (*Navarretia fossalis*) is currently only known from one pool in the study area, p_98_E5 on the Cumming Ranch property south of Ramona Airport Road. It has been preserved by a type of conservation easement as mitigation for Big Bear Markets since 1992. The Big Bear Markets (currently the Stater Brothers shopping center) pools were the only other historic location for this species in the Ramona area. This pool was previously managed by The Environmental Trust and continues to the managed by the property owner (Driscoll 2004, pers. comm.). He will manage it until such time that the entire northern portion of this property (Area C) is donated to a land management entity as part of the Ramona Grasslands conservation effort and the Cumming Ranch Development project. This pool did not fill during the wet season of 2003-2004; however, spreading navarretia was found to be present as well as most of the other vernal pool indicators previously recorded (little mousetail was not rediscovered in 2004).

This species was also reported by RECON (1995) from vernal pool d_142_c2e at the Airport. However, the species has not been rediscovered during the last three separate survey efforts since then, and is believed to be extirpated from this location.

Introduction of spreading navarretia into restored vernal pools is crucial for the conservation of this species in Ramona.

Little Mousetail

Little mousetail (*Myosurus minimus* var. *apus*) is associated with the deeper portions of vernal pools and appears immediately after the pool has dried up. This species is regionally declining. Little mousetail has historically occurred in four vernal pools within the study area, including pool p_98_E5, which is discussed above for the presence of spreading navarretia (The Environmental Trust 1993), a record from Downtown Ramona, and in two pools on Oak Country Estates (r_152_p7 and p_22) (Westec 1980 in Sproul 1989). Vernal pool p_98_E5 in the Cumming Ranch vernal pool preserve may be the only extant location of this species. However, it was not found during a reconnaissance survey in Spring 2004 (Cumming Ranch field trip including botanists from EDAW, Ecological Ventures California and the County of San Diego) in the Cumming Ranch pool, although the Downtown location near 14th & H Streets was verified by Maggie Loy 2003 (J. Buegge 2004, pers. comm.). However, it is likely to be extant in the seed bank, given the lack of adequate rainfall in the 2003-2004 wet season. It is recommended that all known historic locations of this species be conserved.

No further impacts to vernal pools containing little mousetail should be permitted, and transplanting of little mousetail into suitable restoration pools (e.g., pools on Placentia and Bonsall-Fallbrook soil series) should be encouraged, if feasible (and if this effort does not endanger extant populations of little mousetail in the study area).

Southern Tarplant

Southern tarplant (*Centromadia parryi* var. *australis*, formerly *Hemizonia parryi* var. *australis*) is an annual herb associated with valley grasslands, alkali meadows and playas, vernal pools, and freshwater wetlands. It is listed as extremely rare (list 1B) by the California Native Plant Society (CNPS). Southern tarplant occurs in the study area on the TNC Cagney Ranch property, the Ramona Airport property, and on Cumming Ranch (including both planned preserved and currently proposed development areas). The population of southern tarplant in the study area will be 100 percent conserved on the TNC Cagney property and partially preserved on the Cumming Ranch property (EIR in preparation by EDAW). No further impacts to alkali playas and grasslands in the Ramona study area containing Southern tarplant should be permitted.

Vernal Barley

Vernal barley (*Hordeum intercedens*) is an annual grass typically associated with saline flats and depressions in grasslands and within vernal pool basins. It is regionally declining and was only known in San Diego County from Otay Mesa and Camp Pendleton. This species was recently

detected in alkali meadow/playa habitat on the TNC property (Fred Sproul, personal communication 2004) and is likely to occur in other locales in the Ramona grasslands. Past botanical surveys may have overlooked this species, as it appears similar to other barley species.

Parish's Brittlescale

Two sensitive Atriplex species occur within the alkali playas north of Santa Maria Creek on TNC property. Parish's brittlescale (*Atriplex parishii)* was believed to be extinct until the 1990s when it was rediscovered in Riverside County. Prior to its rediscovery, it had been dropped from proposed status for federal listing because it was thought to be extinct. The population of Parish's brittlescale in Ramona is one of possibly only two extant locales for the species and is therefore extremely rare. No previous definite records for San Diego County can be located (Reiser 2001). It is a CNPS List 1B species. Parish's brittlescale was discovered in 2001 by EDAW in nine alkali playa pools on TNC's Cagney Ranch property. A sensitive plant survey currently underway for the Cagney Ranch Framework Management Plan will produce updated survey results. It appears as though its distribution and abundance has severely decreased from the 2001 results (personal communication with Fred Sproul 2004). It will be 100 percent conserved.

Coulter's Saltbush

The second Atriplex species, Coulter's saltbush (*Atriplex coulteri)* occurs in nine of the alkali playa pools on TNC Cagney Ranch property, of which only two pools support both species (16 pools have rare Atriplex species). The extent of this species may be confirmed as larger than mapped in 2001 by EDAW (pending sensitive plant survey results for TNC Cagney Ranch Framework Management Plan). Coulter's saltbush is a rare species (CNPS List 1B) occurring in the Channel Islands that may be nearing extirpation in mainland California (Reiser 2001). The Ramona population may be the only extant population in San Diego County.

Conservation Status of Properties

While the majority of Downtown vernal pools occur on private properties, some Ramona Grasslands vernal pool resources have been transferred to public conservation status within the recent past as a result of the Ramona Grasslands conservation efforts. The following conservation status is known about properties containing vernal pool resources in the study area (see also Figures 5 and 6):

Ramona Grasslands:

Cagney Ranch: Conserved (currently owned by TNC; ownership transfer to County of San Diego pending).

Cumming Ranch: Currently owned by 805 Properties (managed by Gene Driscoll); northern part, and potentially the central part of the property, are conditionally proposed for donation to the County of San Diego for conservation; the north-eastern portion of this area has a conservation easement overlay; the southern part is proposed for development.

Hardy Ranch: Transfer from private property ownership to the County of San Diego for conservation in progress.

Oak Country Estates: The southeastern part of the property has been proposed as mitigation and conservation for the Oak Country Estates project; the northwestern part is proposed for development.

Ramona Airport: Many vernal pools are proposed for conservation as mitigation for the Ramona Airport Improvement project; however, some of the pools, specifically those near the runway, are not preserved although they are not likely to be impacted.

Ramona Downtown:

Ramona High School: The property is proposed for development with some vernal pool-containing portions conserved as mitigation for the project. The project has not yet received permits related to impacts to wetlands and endangered species and is not regulated, with respect to land use, by the County.

14^{th} & H Street: Currently proposed for on-site mitigation of a development project.

U.S. Postal Service: The mitigation property on Kalbaugh Street is fenced and conserved, although active management is not being performed on the site.

16th & Main Street: As a result of an enforcement action on two parcels here, the property owner is planning to restore vernal pool resources; however, conservation of the property is not planned at this time.

Toub Street: Mitigation for own project with recorded conservation easement on 2 parcels.

South Julian/Letton: Five contiguous parcels along Main Street containing a vernal swale system. Previous illegal actions on some of these properties has resulted in degradation of the wetland resources.No conservation information is available; however, some property owners have expressed interest in mitigation banking efforts.

Conservation Recommendations

Extensive conservation efforts are currently underway in the Ramona Grasslands area, initiated by the conservation purchase of the Cagney Ranch property by TNC. This and many surrounding properties are proposed for conservation in the near future, and will be managed by the County of San Diego, resulting in a large contiguous open space system synonymous with conservation boundaries recommended by the North County MSCP. Much of this habitat contains the most valuable and unique vernal pools and vernal swales in the study area as well as pools exhibiting restoration potential. Conservation of this area guarantees the preservation of the full range of vernal pool biodiversity within the Ramona grasslands area, including all vernal pool associated sensitive species, and soil affinities. However, San Diego button celery is found only in the downtown area and both little mousetail and downingia have a significant proportion of their already extremely limited distribution in the downtown area (one of 2 little mousetail pools and two of 7 downingia pools).

The majority of Downtown vernal pools exist on Placentia soils on small, private parcels. Vernal pool complexes have been fragmented by development and are no longer present as large intact systems. The watershed of the majority of Downtown vernal pools has been partially paved or disturbed and most pools are highly degraded. Downtown vernal pools are constantly threatened by the side effects of development, including soil erosion, polluted run-off, exotic species contamination, and fragmentation. The only contiguous vernal pool complex exists on the Ramona High School property, which is planned for development. A secondary semi-contiguous vernal swale system exists on 5 adjoining private parcels along the south side of Main Street, between South Julian and Letton streets. Two small, fragmented vernal pool properties north of Main Street (Toub and Kalbaugh streets) are currently preserved.

Due to the tremendous threats and continuous development of the surrounding area, conservation of small, piece-meal vernal pool sites in the Downtown area is management intensive and costly. Long-term sustainability of these pool systems is questionable due to development pressures and

the associated edge effects. While restoration of some of these pools is feasible in the short term, successful long-term management will be difficult. Ecologically, the conservation of large, contiguous open space is preferred over the protection of small, fragmented habitats, mainly to preserve wildlife linkages and dispersal routes. This is also true for vernal pool complexes. For example, distances between vernal pools or vernal pool complexes exceeding one mile may prevent pollinators from traveling between vernal pool habitats (Thorp and Leong 1995). Pollinators may also be affected by surrounding land uses such as ornamental vegetation (USFWS 1998). However, due to species locales, preservation of some downtown pools is important.

The most viable approach for long-term ecological sustainability of vernal pools in Ramona would be to preserve the entire Grasslands system and an archipelago of the largest and most sensitive vernal pool areas in the Downtown region. There are several possible combinations of downtown conservation configurations that would achieve this goal. Biological suitability rankings are useful in prioritizing conservation, but the overall conservation strategy must also take into account preserve connectivity, as well as the other principles and information presented above. Resources found in individual pools may change over time as a result of plant or animal dispersal, human disturbance, prolonged drought, or other factors. In addition, preservation of certain pools may not be possible at a given time due to property ownership, availability of funds, or jurisdictional considerations. Discovery of currently unknown vernal pools may increase the number of options available. Two examples of possible conservation strategies are outlined below.

One possible strategy is to conserve the five-parcel South Julian/Letton Street vernal swale system and the Ramona High School vernal pools, in addition to the Grassland vernal pools and those already conserved in the Downtown area. The South Julian/Letton Street system is one mile to the east of the Grasslands area and one mile to the west of the Ramona High School vernal pools. This arrangement of natural areas may help to maintain the long-term genetic interchange among vernal pools in Ramona by serving as a steppingstone for pollinators. The 14th & H Street vernal pool with little mousetail is located only a few hundred feet north of the Ramona High School pools and the U.S. Postal Service pool with San Diego button celery is located mid-way between the South Julian/Letton Street area and the large contiguous Grasslands area.

Another possible strategy is to conserve vernal pool areas near 16th & Main Street, pools in the vicinity of Kalbaugh Street near the currently preserved pools (U.S. Postal Service and Toub Street pools), and the Ramona High School vernal pools. This would be in addition to the

conservation of Grassland vernal pools. This configuration would likely require greater restoration efforts than the previous option and would likely require more active management as these parcels have greater edge effects from adjacent land uses. The quality and quantity of vernal pools on the 16th & Main Street properties are also largely unknown. This could accomplish a steppingstone preserve system from the Grasslands to the Ramona High School site with no pools being isolated by more than one mile. However, the effect of the greater urbanization between potential preserve areas in this configuration makes the connections more tenuous, resulting in a need for preservation of more pools.

Conservation of the San Diego fairy shrimp within Ramona is complicated by the fragmentation of vernal pool habitat in the downtown area and the fact that the distribution of fairy shrimp in the downtown area is not well understood. Furthermore, small preserves are notoriously difficult to manage and may not make a significant contribution to the survival of this species in the wild.

The presence of vast Placentia soils and remnants of such important vernal pool plant species as downingia, little mousetail, and San Diego button celery still exist in the Downtown area. Some of the above vernal pool habitat components are currently preserved or proposed for conservation in the Grasslands area, including at least 50 percent of the little mousetail and downingia occurrences and, although to a smaller extent, Placentia soils. Placentia soils are found in the vernal pool complex south of the Ramona Airport property (mitigation for the Ramona Airport Improvement project), and the vernal swale in the southeastern portion of the TNC Cagney property. However, the ratio of conserved Placentia soil vernal pool complexes to other vernal pool associated soils is much smaller than the historical distribution of Placentia soil associated vernal pools. Vernal pools on Placentia soils used to make up the majority of vernal pool complexes in the Ramona area. It is, therefore, important to preserve the entire Ramona High School vernal pool complex, which is entirely formed on Placentia soils. Any deduction from the High School complex, including associated upland habitat, translates into a deduction or degradation of Placentia soil associated pools available for conservation in the entire study area. Preservation of the vernal pools or swales along Main Street would also contribute value to the Placentia soil associated vernal pool system. In particular, the vernal pool at the south end of the South Julian/Letton swale contained downingia on Placentia soils. The preservation of all five adjacent Main Street parcels would be specifically important to help maintain genetic interchange over longer dispersal distances (i.e., one mile) between the High School pool complex and the Grasslands area. Both the High School and Main Street properties would function well as mitigation banks to offset the potential loss of vernal pool resources, specifically fairy shrimp, elsewhere in the Downtown area.

Most vernal pools proposed for conservation in this study have been secured or are proposed either for conservation or mitigation, including some mitigation pools in the Downtown area. Hence, no further vernal pool mitigation sites exist in the study area, unless a private property owner offers his/her vernal pool resources for mitigation. Conservation of Main Street parcels and the Ramona High School site is not planned at this time, but would be necessary to develop a functioning vernal pool conservation and mitigation plan. However, due to the higher property value in the Downtown area versus outlying parcels, and the increased maintenance and management costs over time, vernal pool mitigation within the Downtown area is costly. Therefore, development of a process involving mitigation banking or in-lieu fee mitigation would be most effective for vernal pool mitigation in the Ramona area, provided there are willing sellers.

In summary: conservation of all Ramona Grasslands properties is mandatory to preserve the viability, diversity, and uniqueness of Ramona vernal pool ecosystems. However, this would not satisfy conservation of the historic ratio of Placentia versus other vernal pool-associated soils, nor the adequate preservation of San Diego button celery, little mousetail, and downingia. Therefore, it is important to conserve some combination of downtown pools – the entire Ramona High School vernal pool complex, the 14th & H Street vernal pool with little mousetail, the U.S. Postal Service pool containing San Diego button celery, and, if feasible, a combination of other parcels along Main Street.

CONSERVATION GUIDELINES

Compatible Land Uses within Vernal Pool Preserve Areas

Land uses compatible with vernal pool conservation and management will be described in the North County MSCP. Currently, the majority of land uses in vernal pool preserve areas consist of conserved open space and agriculture. Additional vernal pools exist on residential or commercial properties outside the recommended conservation areas.

The land uses within vernal pool conservation areas should mostly be limited to open space preserves, and passive recreation, such as hiking and nature study, on existing access roads and trails. Allowable and compatible agricultural uses, such as seasonally managed, moderate cattle grazing, may continue provided that strict management guidelines, as described below, are followed. Other passive land uses, such as biking and equestrian recreation, shall be discouraged in the vernal pool conservation areas. Land uses in vernal pool areas outside the conservation areas should be evaluated on a case-by-case basis.

Restoration Potential, Vernal Pool Management, and Vernal Pool Creation

Many of the pools within the study area boundary have been highly degraded by various stressors (e.g., cattle grazing and agricultural practices, off-road vehicle use, etc.). Many of these degraded pools could be restored and vernal pool functions enhanced. All pools in the study area could benefit from an invasive exotics plant removal program. Some of the lower functioning pools could be enhanced through basin recontouring and reintroduction of species historically recorded but no longer found in a particular pool. For example, spreading navarretia was known from Airport pool d_142_c2e, but has not been rediscovered in this pool in 2001, 2002, or 2003. Pool l_556_e62 on the TNC Cagney Ranch property has a high percent cover of Bermuda grass, which impairs vernal pool function, and pool s_11_11b has been impacted by off-road vehicle activity. The removal of Bermuda grass may be complicated as this highly invasive exotic co-occurs with many vernal pool indicator species. Similarly, many pools on the Cumming Ranch vernal swale are infested with rye grass, another aggressive nonnative species difficult to eradicate. A variety of experimental weed control approaches have been tested in the Central Valley, e.g. artificially filling vernal pools to drown out rye grass, and using cattle grazing to control nonnative species (Marty 2003, pers. comm., Marty 2004, in process), however, none of these techniques have yet been tested in Southern California. More aggressive restoration methods, such as salvaging vernal pool indicator species from weed infested pools, solarizing overrun pools, and subsequently re-seeding with the salvaged material, remain untested in Ramona, while they have shown limited success elsewhere in San Diego County.

Certain parcels in Downtown Ramona (e.g., Main Street and S. Kalbaugh; Main Street and Toub Street, among others) containing degraded and unvegetated pools could be considered for restoration, including the sculpting of vernal pool basins where they historically occurred, or where soil and watershed conditions are suitable. It is likely that this area along Main Street and many other areas in Downtown Ramona contained historical vernal pools that have been lost to degradation and disturbance. However, restoration of these pools will only be feasible if the disturbance factors that led to the loss of these pools can be identified and eliminated. The restoration potential of each pool must be evaluated by a qualified biologist experienced in successful restoration of vernal pool ecosystems.

Restoration and enhancement of degraded pools (including intensive weed eradication programs) should be considered as part of a long-term management program of all vernal pools preserved in the study area. Creation of vernal pools can also be considered in appropriate areas to satisfy

potential mitigation needs but is not a cost-effective means of conserving vernal pool ecosystems, nor has it been proven to be entirely successful.

Examples of Recommended Conservation Guidelines

The following vernal pool conservation guidelines are recommended for the inclusion in the North County MSCP and associated County land use and biological mitigation and management policies:

1. Permanently Conserve Ramona Vernal Pools

- Permanently conserve enough true Ramona vernal pools (vegetated vernal pools with at least one vernal pool indicator species as defined in this report) to conserve all vernal pool species found in Ramona.
- Mitigation of vernal pool impacts should occur within a larger, contiguous vernal pool preserve.
- Off-site mitigation for impacts should be at a higher ratio for pools impacted with higher resource values (more sensitive species or greater abundance of sensitive species).
- Ensure management of all vernal pool conservation sites through conservation/open space easements and appropriate guaranteed funding for long-term management.
- Coordinate management of vernal pools with efforts for management of the Ramona Grasslands.

Minimize the need to restore artificially created or dramatically altered pools that support vernal pool species, and allow take of "road ruts" or other artificially created pools supporting only fairy shrimp; dramatically altered or artificial vernal pools will not significantly contribute to conservation while demanding more management resources, thereby decreasing the effectiveness of management of all vernal pool resources.

2. Maintain Genetic Diversity

- Conserve vernal pools containing vernal pool indicator species.
- Preserve unique (relative to others in Ramona) pools (i.e., those with unique resources, on unique soils, etc.), such as vernal swales and alkali playas.

- Conserve pools on a variety of soils.
- Conserve pools with structural diversity (large and small, deep and shallow, isolated and in dense complexes).
- Do not restrict access of dispersal vectors or pollinators.
- Locate preserves, to the maximum extent possible, near adjacent open space for nesting and foraging habitat for dispersal vectors and pollinators. Where necessary, enhance upland habitat with a variety of native plants, in keeping with the natural condition of the area, to provide resources for appropriate pollinator species.
- Maintain migration routes (wetlands swales) for amphibians and other species that will allow natural genetic flow.
- For pools where impact is permitted, experienced biologists should salvage biota and use it for restoration of other pools in the conservation area. Ensure purity of the salvage material before inoculation of receptor site. This could be accomplished through live transfer (e.g., invertebrates and amphibians), artificial propagation of species, direct collection of seeds/cysts, or by sorting propagules found in soil to be used for inoculation.
- Focus mitigation of impacted vernal pools in areas with similar physical and biological characteristics. Off-site preservation should occur where soils are similar and, if possible, where vernal pools have similar species composition, distribution and density as the impact site.

3. Maintain and Restore Hydrological Integrity

- Buffer watershed from incompatible uses (using native plants only).
- Reduce edge effects around conserved vernal pools.
- Prevent fragmentation or diversion within vernal pool watersheds (e.g., fencing, trails, developments, etc.).
- Maintain hydrological integrity through exotic species removal and biomass reduction.
- Regularly clear trash and prevent dumping.
- Install fencing where appropriate (this should not limit movement of dispersal vectors or pollinators, nor should it block appropriate access for appropriate passive recreation)

- Ensure that grazing that will be allowed will be used at appropriate levels, locations, seasonality, and quantities to control biomass in the watershed and avoid the direct impacts to vernal pool basins. Experimental design for cattle exclosures may be necessary for implementation of this measure. If experimental results indicate that grazing is harmful to vernal pool species then grazing should be discontinued.
- Livestock feces should be removed from watersheds of vernal pools.

4. Allow Compatible Uses in or adjacent to Vernal Pool Preserves

- Maintain appropriate grazing regimes where it is beneficial to vernal pool ecosystems and practical for ranchers as is recommended by experts (Marty, in progress; Bauder 1996). Although no data on the exact animal units per month exist for Southern California vernal pools, recommendations have been made for vernal pools in the Central Valley (Marty, in progress), where cattle grazing increased species richness, reduced the cover of exotic species, increased relative cover of native species, and generally improved vernal pool hydrology relative to inundation duration. Experimental studies to test these preliminary data are recommended. In addition, there is inconclusive evidence that cattle may have a negative effect on vernal pool function during the aquatic phase. During a workshop for The Nature Conservancy's Cagney Ranch framework management plan (May 2004), evidence was cited for and against temporary fencing of vernal pools during the wet season to exclude cattle from vernal pool basins.
- Align trails so vernal pools can be viewed and enjoyed, but from a distance. Trampling from pedestrians around the margins or through vernal pools during the aquatic phase can be very damaging.
- Allow for compatible uses only: passive recreation activities such as hiking and nature study are considered compatible uses; equestrian use and biking are generally not considered compatible; trails for these uses should minimize encroachment into vernal pool watersheds and should never be placed within 30 feet of vernal pool basins. Trails should be constructed to avoid watershed fragmentation.

5. Respect Use of Private Lands

- Only purchase lands from willing sellers at fair market value.

- Request voluntary participation in management efforts. This should be at no or low cost to the landowner, or should be compensated, at their request, for time and materials with funds from mitigation settlements specified for that vernal pool.
- Respect landowners' request if they do not wish to participate in management of pools on their lands.

6. Continue Academic and Public Education

- Continue to refine knowledge of natural resource distribution and abundance in Ramona vernal pools.
- Require studies for discretionary projects for vernal pool resources if data do not previously exist, or if existing data are inadequate.
- Encourage and/or participate in requests for funding of genetic studies, studies of management through grazing, and other vernal pool-associated research.
- Educate the public about the value of vernal pools.

Vernal pool management must be maintained in perpetuity and undertaken by a qualified entity experienced in vernal pool and grasslands management. Mitigation banks may help make this process more efficient.

Conservation Strategies and Policies

The County should consider reviewing all land use proposals on properties containing vernal pools. This will allow proponents of land altering projects to be protected under the Endangered Species Act by obtaining "incidental take" permits from the County once the North County MSCP Plan is implemented. Until the North County MSCP Plan is implemented, project proponents will need to obtain "incidental take" permits from U.S. Fish & Wildlife Service and/or California Department of Fish & Game if endangered species are present.

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APPENDIX A
Vernal Pool Indicator Plant Species
Bauder (1993)

COASTAL SD VERNAL POOL SPECIES LIST Compiled by E.T. Bauder, SDSU (6/93)

SPECIES	INDICATOR CATEGORYΔ	HABITAT DESCRIPTION (CITATION)
		PLANTS THAT IN COASTAL SAN DIEGO COUNTY OCCUR PRIMARILY IN VERNAL POOLS
Agrostis microphylla	FACW	vp (B); sometimes vp (J); vp (M); beds & margins of vp, around seepy places (W); common near vp, usually not in basin (Z)
Alopecurus howellii	FACW+	about drying mud flats (B); wet places, drying mud flats (M); wet ground (MA); vp (P); vernally wet pools & marshes (*T); grassy openings (W); vp (Z)
Anagallis minimus	FACW	moist places (A); vp & other moist spots (B); vp, moist places (J); vp & other moist spots (M) & (M&K); vp (P); vernally wet pools & marshes (T); moist or muddy habitats (W); vp (Z)
Boisduvalia glabella	OBL	vp & other ephemeral ponds (B); floodlands & beds of former vp (MA); mudflats & vp (M); vernally wet pools & marshes (*T); beds of vp on mesas, clay soil in valleys, wet sands of arroyos (W); vp (Z)
Brodiaea orcuttii	OBL	heavy adobe soil on mountains/mesas of SD (A); grass, near v streams & pools (B); grassland near streams, vp (J); streams, vp, seeps (M); vp but not restricted to (P); margins & beds of vp, margins of cienegas (W); vp & adjacent habitats (Z)
Callitriche marginata	OBL	borders of vp in mud or submerged shallow water (A); often vp (J); moist cool places, terrestrial (MA); drying mud of vp (M); vernally wet pools & marshes (*T); muddy margins of vp (W); vp (Z)
Callitriche longipedunculata	OBL	bottom of desiccated winter pools (A); vp (B); rooted aq (MA); water of vp & later on mud (M); vernally wet pools & marshes (*T); vp (Z)
Crassula aquatica	OBL	vp, other moist places (B); salt marshes, vp, mudflats, ponds (J); wet ground or vp (MA); dry mud flats (M) vernally wet pools & marshes (T); vp (Z)
Deschampsia danthonioides	FACW	mud flats, vp (B); moist to drying open sites, meadows, streambanks, temporary ponds (J); vp, moist to wet meadows (MA); moist places (M); vp (P); grassy areas (W); vp (T); vp (Z)
Downingia cuspidata	OBL	vp (B); vp, lake margins, meadows (J); vp & wet soil (MA); vp (M); vernally wet pools & marshes (T*); margins of vp (W); vp (Z)
Elatine brachysperma	FACW	vp (B); muddy shores, shallow pools (J); shallow water or muddy shores of vp, ponds or ditches (MA); many plant communities (M); vp (P); vernally wet pools & marshes (T*); vp (Z)
Elatine californica	OBL	lake marg, vp (B); pools, ponds, stream banks (J); ponds, vp, rice fields, & margins of streams & ditches (MA); water borders, mudflats (M); vp (P)
Eryngium aristulatum ssp. parishii	OBL	vp (B); vp (H); vp, marshes (J); vp & salt marshes (MA); vp (M); vp (P); vernally wet pools & marshes (*T); playas & beds of vp (W); vp (Z)
Isoetes howellii	OBL	vp (B); vp, lake margins (J); ponds, streams or vp (MA); in water & on mud (M) & (M&K); vp (P); vernally wet pools & marshes (*T); along streams & in shallow pools (W); vp (Z)
Isoetes orcuttii	OBL	vp, ephemeral ponds (B); vp (J); margins of pools or along streams (MA); water of vp & on mud (M); water of vp (M&K);

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		vp on mesas & plateaus (W); vp (Z)
Juncus triformis	FACW	vp, ephemeral ponds (B); vp, granitic seeps (J); moist open places (M); vp (P); vp (T*); vp & other aquatic, marsh, or
		seepage areas (Z)
Lepidium latipes	OBL	ephemeral ponds (B); alkaline soils, fields, vp, grasslands (J); former beds of alkaline pools (MA); alkaline flats & beds of
		winter pools (M); vernally wet pools & marshes (*T); vp & adjacent habitats (Z)
Lilaea scilloides	OBL	shallow ponds, slow streams, vp (B); vp, ditches, streams, ponds, lake margins < 1700 m (J); wet soil around ponds, lakes,
		streams (MA); muddy & marshy places (M); vp (P); vp (T); mud around lakes, ponds & vp (W); vp (Z)
Lythrum hyssopifolia	FACW	vp, other moist places (B); marshes, drying pond edges (J); wet soil in marshes & at margins of streams
		& ponds (MA); moist places (M); vp (P); vernally wet pools & marshes (*T); vp (Z)
Marsilea vestita	OBL	ponds & reservoirs (B); creek beds, flood basins, vp (J); muddy banks, edges of ponds, esp about vp (M); ponds & ditches
		(MA); vernally wet pools & marshes (T); vp (Z)
Mimulus latidens	OBL	vp (B); vernally wet depressions < 900 m (J); drying mud flats in heavy soil (M); wet adobe & clay soil, margins of vp (W);
		vp (Z)
Myosurus minimus var.	OBL	vp (B); vp (H); wet places, vp, marshes (#J); vp & alkaline marshes (MA); vp (M); vp (P); vernally wet pools & marshes (#T);
apus		vp (#Z)
Myosurus minimus var.	OBL	vp (B); vp (H); wet places, vp, marshes (#J); vp & vernally wet meadows (MA); vp (M); vp (P); vernally wet pools &
filiformis		marshes (#T); grassy hillsides (W); vp (#Z)
Navarretia fossalis		vp & ditches (B); vp (H); vp & ditches (J); vernally wet pools & marshes (*T); vp & man-made depressions & pools (W);
		vp & adjacent habitats (Z)
Navarretia intertexta	OBL	wet meadows & muddy shorelines (B); open wet areas, meadows, vp (J); vps & moist places (M) & (M&K);
		drying vp (W); common near vp, usually not in basin (Z)
Navarretia prostrata	OBL	Kearny Mesa (B); alkaline floodplains, vp (J); vp & low places (MA); vp & moist places (M); vp (Z)
Orcuttia californica	OBL	vp & slump ponds (B); vp (H); vp (J); vp & mud flats (MA); drying mud flats (M); vernally wet pools & marshes (*T);
		drying beds of vp (W); vp (Z)
Phalaris lemmonii	FACW-	mud flats, vp (B); moist areas, shrublands, woodlands (J); low wet places, dried mud flats (MA); moist places < 2000 ft (M);
		vp (P); vernally wet pools & marshes (*T); creosote bush scrub (W); vp (Z)
Pilularia americana	OBL	vp, ephemeral ponds (B); vp, mud flats, lake margins, reservoirs (J); margins of ponds & vp (MA); occasional in heavy soil,
		largely of vp (M); vp (P); vernally wet pools & marshes (T); in water on mesas (W); vp (Z)
Plagiobothrys acanthocarpus	OBL	mesas & vp (B); vp, moist clay soils (J); vp & adobe flats (MA); moist flats, winter pools (M); vernally wet pools &
		marshes (*T); vp (Z)
Plagiobothrys bracteatus	OBL	vernally moist places (B); vp, wet places in grassland (J); wet places (MA); moist places or dried ditches (M); moist
		places or beds of pools & ditches, <5000 ft (M&K); vp (P); vp (Z)
Plagiobothrys undulatus		vp near Ramona (B); moist places & beds of vp (MA); mud flats, < 1200 ft (M&K); vp (Z)
Plantago bigelovii	OBL	vp (B); saline & alkaline places, beaches, vp (J); saline & alkaline places (M); vp (P); vp & adjacent habitat (Z)

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Pogogyne abramsii	OBL	vp (B); vp (H); vp coastal terraces (J); beds of dried pools (M) & (M&K); vernally wet pools & marshes (*T); vp (Z)
Pogogyne nudiuscula	OBL	vp (B); vp (H); vp (J); beds of vp (MA); moist flats (M) & (M&K); dry beds of vp (W); vp (Z)
Psilocarphus brevissimus	OBL	ponds (B); vp & flats (J); dried beds of vp (MA) & (M); vp (P); dried beds of vp (W); vernally wet pools &
		marshes (*T); vp (Z)
Psilocarphus tenellus	FAC	dried vp & dry open places (A); shores of drying ponds (B); dry disturbed soil, rarely vp (J); drier habitats (MA); dried
		vp (M) & (M&K); vp (P); foothills & mesas (W); vp (Z)
Sibara virginica	OBL*	ephemeral ponds (B); borders of vp, streambanks, open ground (J); about drying pools (M); vp (Z)
		PLANTS THAT ARE COMMON IN COASTAL SAN DIEGO VERNAL POOLS, BUT NOT RESTRICTED TO POOLS
Bergia texana	OBL	moist, disturbed soils, sand bars along rivers, margins of pools (J); margins of pools or floodplains (MA); occasional on mud
		flats (M); at margins of pools & on seeps (W)
Brodiaea jolonensis		grass (B); grassland, foothill woodland on clay (J); clay depressions (M); depressions in clay soil (W); vp & adjacent
		habitats (Z)
Cotula coronopifolia	FACW+	wet places (B); saline & freshwater marshes (J); marshy, often almost aquatic; freq salt marshes (MA); mud & moist banks,
		salt marshes (M); vp (P); wet places & water margins (W); vp & other aquatic, marsh & seepage areas (Z)
Cressa truxillensis	FACW	alkaline areas (B); saline & alkaline soils (J); lowland alkaline areas (MA); saline & alkaline places (M);
		alkaline or moderately saline soils (W); vp & other aquatic, marsh & seepage areas (Z)
Eleocharis acicularis	OBL	moist habitats (B); muddy river banks, meadows, vp & marshes (MA); marshes, meadows, riverbankds, vp (J); muddy banks,
		meadows, vp & marshes (M) & (M&K); widespread (W); vp & other aquatic, marsh & seepage areas (Z)
Eleocharis macrostachya	OBL	wet places (B); marshes, pond margins, vp, ditches (J); marshes, vp, ditches, flooded lands (MA); marshes & wet places (M);
		vp (P); along pools & intermittent streams (W); vp & other aquatic, marsh & seepage areas (Z)
Gastridium ventricosum	FACU	weed (B); open, generally dry, disturbed sites (J); dry ground, along streams, vp (MA); weed (M); around vp, on grassy
		slopes (W); vp & adjacent habitats (Z)
Juncus bufonius	FACW+	wet habitats (B); moist (sometimes saline) open or disturbed places (J); along streams or in dried pools (MA); moist,
		open places (M); vp but not restricted to (P); vp & other aquatic, marsh & seepage areas (Z)
Juncus dubius	FACW*	wet places < 1100 ft (B); wet places (J); moist places (M); wet places (M&K); vp (P); stream banks (W)
Lepidium nitidum		open places (B); meadows, alkaline flats, vp, < 1500 m (J); open places (M); vp but not restricted to (P); open grassy
		plains & hillsides (W); vp & adjacent habitats (Z)
Lolium perenne	FAC*	weed (B); disturbed sites, abandoned fields, lawns (J); scattered (M); weed (W); vp & adjacent habitats (Z)
Montia fontana	OBL	shaded slopes, pool margins, montane (B); ponds, streams, vp, seeps, ditches, <3200 m (J); muddy stream margins, pools
		(MA); rain pools (M); muddy stream margins, floating in pools (MA); vp & other aquatic, marsh & seepage areas (Z)
Nama stenocarpum	OBL	muddy shore of ponds & lakes, < 300 m (B); intermittently wet areas (J); occasional, muddy places < 1000 ft (M); moist
		sand in arroyos, canyons & valley floors, basins of vp, deltas (W)

ATTACHMENT A

Navarretia hamata		coastal sage scrub, chaparral (B); dry, sandy, rocky places (J); dry, rocky places (M) vp but not restricted to (P);
		dry hillsides & ridges (W); near, but usually not in vp (Z)
Ophioglossum californicum	FACW	moist stony mesas (A); grass, around vp (B); vp (H); grassy pastures, chaparral, vp margins (J); vp (M) & (M&K);
		moist habitats, often margins of vp (W); near but not usually in vp (Z)
Plantago erecta		around vp (B); vp (P); dry open places (M) & (M&K); grassy hillsides (W); vp & adjacent habitats (Z)
Polypogon monspeliensis	FACW+	weed moist places (B); moist places, along streams, ditches (J); moist places (MA); weed low places (M); disturbed soil
		& other grassy areas (W); vp & other aquatic, marsh & seepage areas (Z)
Rotala ramosior	OBL	irrigated fields, lake & pond margins, streams (J); wet places, < 4000 ft (MA)
Trifolium amplectans		grass (B); wet meadows, ditches, grasslands, roadsides, open spring-moist heavy soils (J); grassy places (M); grassy areas
		(W); vp & adjacent habitats (Z)
Verbena bracteata	FACW	wet places, < 150 m (B); open, disturbed places, pond or lake margins (J); near water in marshes, floodlands (MA);
		occasional in waste places, < 5000 ft (M); waste areas (W)
Veronica peregrina	OBL	not given (B); moist places < 3100 m (J); wet places on margins of ditches & ponds (MA); moist places (M); vp (P);
		moist habitats (W); vp & other aquatic, marsh & seepage areas (Z)
Citations: A= Abrams (1960), B= Beauchamp (1986), H= Holland (1986), J= Jepson (1993), MA= Mason (1957), M= Munz (1974),		
M & K= Munz & Keck (1968), P= Purer (1937), T= Thorne (1976), W= Wiggins (1980) and Z= Zedler (1987)		
Δ US Fish and Wildlife Service (1988)		
*T when Thorne (76) gives genus only; # when no subspecies is given		

APPENDIX B
Field Data Forms

RAMONA VERNAL POOL FIELD SURVEY FORM

Pool Complex Location_____ _____ Parcel ID _____ Pool ID _____
Survey Date _____ Biologists _____ PSBS # _____

Basin Origin: Natural _____ Artificial _____ Unknown _____
Comments _____
Adjacent natural pools _____ Within historical pool complex _____

Geomorphic Type: Depression _____ Swale _____ Drainage _____ Playa _____
Comments _____

Associated Habitat Type: Grassland _____ Ruderal _____ Disturbed(>50%bare) _____
(record % of watershed) CSS _____ Chaparral _____ Eucalyptus _____
Riparian _____ Dist. Wet. _____ Other _____
Comments _____

Pool Vegetative Cover: % veg cover _____ % exotic veg cover _____ % bare _____
(record % of pool)
Comments _____

Pool Soil Disturance: _____ Grading _____ recent _____ historic _____
(record % of pool) Plowing _____ recent _____ historic _____
Road _____ Trail _____ ORV damage _____
Vehicle tracks _____ Scrape _____ Fill _____
Comments _____

Pollutants: _____ Trash _____ Sediment _____ Livestock feces _____
(record % of pool if approp.) Veg decomposition _____ Petrolium runoff _____ Fert/pest _____
Comments _____

Hydrological Alterations: Road runoff _____ Other runoff _____
1=seasonal & small amt. Culvert into pool _____ Culvert out of pool _____
2=unseasonal & med. amt. Ditch into pool _____ Ditch out of pool _____
3=unseasonal & large amt _____
Comments _____

Watershed Disturbance: Pavement _____ Structures _____
(record % of watershed) Soil disturbance _____ Ditches _____ _____
Comments _____

Notes: _____

RAMONA VERNAL POOL COMPLEX EVALUATION

Pool Complex Location _____ Parcel ID's _____

Survey Date _____ Biologists _____

Size and Fragmentation:

Size of open space in single ownership _____ APN #'s _____

Size of pool complex:	_____	Size of overall contiguous open space	_____
< 1 acre	_____	< 1 acre	_____
>1< 20 acres	_____	>1< 20 acres	_____
>20<100 acres	_____	>20<100 acres	_____
>100 <1,000 acres	_____	>100 <1,000 acres	_____
>1,000 acres	_____	>1,000 acres	_____

Is adjacent open space preserved? _____ Proposed for development? _____

Comments _____

If isolated, distance to natural open space _____

Distance to developed lands _____

Distance to paved or well travelled road _____

VP Complex / Parcel(s) Land Uses: Rangeland _____ Agriculture _____ Open Space _____

Commercial _____ Vacant Lot _____ Rural Res _____ Dense Res _____

(record % of site in each land use)

Comments _____

Surrounding Land Uses: Rangeland _____ Agriculture _____ Open Space _____

Commercial _____ Vacant Lot _____ Rural Res _____ Dense Res _____

(record % of site surrounded by each land use up to 1,000-foot buffer)

Comments _____

Watershed Integrity:

0=>50% altered, bare, & steep gradient

1=>50% altered (but veg) & variable gradient

2=25-50% altered

3=<25% altered

4= unaltered

Within-site fragmentation: (record % of site) _____

structures _____

paved roads _____

dirt roads _____

ORV damage _____

ditches _____

fences _____

Comments _____

Geologic Formation: _____

Soil Type: _____

VERNAL POOL SPECIES INVENTORY/RAMONA AIRPORT

SPECIES	POOL #																			
VERNAL POOL SPECIES																				
Epilobium pygmaeum																				
Callitriche marginata																				
Centunculus minimus																				
Crassula aquatica																				
Deschampsia danthonioides																				
Downingia cuspidata																				
Eryngium aristulatum																				
Isoetes orcuttii																				
Juncus bufonius																				
Lilaea scilloides																				
Lythrum hyssopifolia																				
Marsillea vestita ssp. vestita																				
Myosurus minimus																				
Phalaris lemmonii																				
Plagiobothrys sp.																				
Plantago erecta																				
Psilocarphus brevissimus																				
Psilocarphus tenellus																				
Veronica peregrina																				
OTHERS:																				
OTHER SPECIES IN BASIN																				
Ambrosia psilostachya																				
Brodiaea jolonensis																				
**Bromus hordeacous*																				
Cressa truxillensis																				
**Cynodon dactylon*																				
Distichlis spicata																				
**Erodium botrys*																				
Eleocharis macrostachya																				
Heliotropium curvassavicum																				
Hemizonia fasciculata																				
Hemizonia parryi ssp australis																				
Juncus mexicanus																				
**Lolium multiflorum*																				
Malvella leprosa																				
**Polypogon monspeliensis*																				
**Rumex crispus*																				
OTHERS:																				
* Introduced species																				
D = dominant (>20% cover), X = present, ## = approximate number of plants for rare species																				