

# APPENDIX A

## MITIGATION AND MONITORING GUIDELINES FOR VERNAL POOLS

### **I. Introduction**

These vernal pool guidelines (Guidelines) are a supplement to the South Pacific Division (SPD) Final Regional Compensatory Mitigation and Monitoring Guidelines (MMG) for mitigation banks, in-lieu fee programs and permittee-responsible projects involving compensatory mitigation for unavoidable losses of vernal pools and vernal pool complexes. The Corps of Engineers (Corps) and the Federal and state agencies that review Corps permits under Section 404 of the Clean Water Act of 1972 and Section 10 of the Rivers and Harbors Act of 1899 reserve the right to make case-by-case determinations that may vary from these Guidelines. On April 10, 2008, the Corps and U.S. Environmental Protection Agency promulgated the “Compensatory Mitigation For Losses of Aquatic Resources; Final Rule” (Federal Register Vol. 73, No. 70, April 10, 2008; 33 CFR Parts 325 and 332 for U.S. Army Corps of Engineers and 40 CFR Part 320 for U.S. Environmental Protection Agency) (Rule). All elements of the regulations and MMG also apply to use of these Guidelines.

Other Federal, state and local agencies with separate authority (e.g., the Endangered Species Act, administered by the U.S. Fish and Wildlife Service) over vernal pools may adopt, incorporate or use these Guidelines.

Compensatory mitigation ratios will be determined by the Corps on a case-by-case basis, through use of the SPD Standard Operating Procedure for Determination of Mitigation Ratios. In general, the goal of compensatory mitigation under the Clean Water Act is to establish highly functional wetlands, including vernal pools.

Specific mitigation for impacts to vernal pool complexes that support Federally-listed plants or animals will be determined on a case-by-case basis through the Endangered Species Act, Section 7 consultation process. Mitigation requirements will depend on the species, the extent and nature of the impacts, cumulative impacts to the species and their habitat, and other factors.

### **II. Definitions**

For the purposes of these Guidelines, vernal pools are defined as follows:

Vernal pools are seasonally inundated wetlands that form in relatively shallow soil depressions underlain by a water-restricting layer such as clay, cemented alluvium, or volcanic basalt at or near the surface. These depressions fill with rainwater, near surface groundwater and/or runoff from adjacent areas during the winter and may remain inundated until spring or early summer, sometimes filling and emptying multiple times during the wet season. Vernal pools are typically characterized by endemic plants species.

Vernal pools annually undergo four distinct phases: (1) the wetting phase occurs in the fall and early winter with the first rains; (2) the aquatic phase when persistent inundation occurs; (3) the drying phase, when many plants flower and produce seed and many animals disperse; and finally (4) the drought phase when the soil dries, and the plants go dormant, as seed or underground roots (Zedler, 1987).

Definitions of terms used in these Guidelines are in the Rule, MMG, or listed below:

**baseline:** the physical and biological conditions of the impact or mitigation site prior to any human impacts due to the project. Establishing baseline usually involves monitoring hydrology, vegetation, soils, and surveying for wildlife such as aquatic invertebrates, insects, birds, and mammals, with particular attention to the presence or absence of candidate and listed threatened and endangered species.

**mitigation vernal pool:** a vernal pool established, re-established, rehabilitated, or enhanced for the purposes of satisfying compensatory mitigation requirements.

**impacted vernal pool:** a vernal pool that is proposed to be filled, excavated or otherwise adversely modified.

**mitigation site:** area where vernal pool establishment, restoration, or enhancement is to occur.

**period of inundation:** the sum total of days of water standing on the pool bottom, starting from when first measureable and ending when the water level drops below the soil surface in the spring;

**preliminary monitoring:** initial monitoring of vernal pool and site conditions, including estimate of absolute vegetative cover, list of five most dominant plants and aerial percent of inundation for each mitigation pool.

**quantitative monitoring:** measured, numerical data.

**reference vernal pool:** a naturally-occurring vernal pool with high California Rapid

Assessment Method (CRAM) physical and biotic structure attribute scores, usually in the same watershed, on or near to the mitigation site that is and will remain undisturbed for the entire monitoring period. A reference pool represents the target vegetation, hydrology, soils and topography, of proposed mitigation vernal pools. Data from these pools is used to develop performance standards and to compare with mitigation vernal pools.

**vernal pool complex:** an assemblage of vernal pools, swales and associated uplands within a defined area (e.g., micro-watershed).

**vernal pool density:** the acreage of vernal pools divided by the acreage of vernal pool supporting soils of appropriate slope within the mitigation site.

### **III. Objective**

To provide guidance for permit applicants and others (e.g. bank and in-lieu fee program sponsors) to select appropriate compensatory mitigation sites, construct compensatory vernal pools and complexes, and establish a monitoring program that will adequately assess compliance with the performance standards established in the mitigation plan.

### **IV. Data and Information Attributes**

Mitigation and monitoring plans required for projects involving impacts to waters of the U.S. under Section 404 of the Clean Water Act must provide data and information with specific, useful attributes that facilitate the resource and regulatory agencies' review of mitigation proposals, interpretation of monitoring results, and determination of mitigation success and/or permit compliance. The data and information must be verifiable, interpretable, practical, and consistent with the criteria in the Rule and MMG.

### **V. General Information**

#### **A. Reference Pools**

The Corps and relevant resource and regulatory agencies shall have the final approval of the number and location of reference pools to be monitored prior to approval of the compensatory mitigation plan, bank instrument, or in-lieu fee program site.

If no appropriate reference pools are available, narrative and quantitative descriptions of the targeted hydrology, soils, and vegetation community performance standards may be substituted with agency approval. For vegetation targets, a regionally-tailored list of vernal pool species which represents the potential impact site may be used. [Appendix 1 of the California Rapid Assessment Method \(CRAM\) for Vernal Pool Systems and](#)

[Individual Vernal Pools](#) provides a list from which a regionally-tailored list of species can be developed for a specific compensatory mitigation project.

*Selection and Number of Reference Vernal Pools:* The number of reference pools will be a minimum of thirty or ten percent of the number of mitigation vernal pools, whichever is greater. If there are fewer than thirty mitigation vernal pools, then the number of reference pools will be equal to or greater than the number of mitigation vernal pools. The selection and number of reference pools will be based on a number of factors, including soil type, geologic landform, proximity to the mitigation site, level of past disturbance, size of pools, and vegetation. Reference pools must be on sites where they are protected from adverse impacts and long-term access is assured. Reference vernal pools will be specifically-selected to be representative of high functioning vernal pools, with a range of specific attributes (e.g., size, depth, period of inundation, or occupancy by listed species) as appropriate for the landscape setting of the mitigation site. Baseline data for proposed references must be provided to the Corps for review and approval.

**B. Site Selection** (see 33 CFR Part 332.3 (c) and (d) and 332.4(c) (3) and MMG Section 4.3 for more information): Vernal pool mitigation efforts should target mitigation sites that formerly supported vernal pool complexes. Lands which historically supported vernal pools may be restored to their documented historic density provided such restoration is supported by a current watershed analysis. An example of appropriate documentation of historic vernal pool density would be that shown on a 1937 aerial photograph. Mitigation sites must be large enough to accommodate mitigation and existing vernal pools, density, and buffer requirements. Additionally, mitigation sites shall be selected utilizing a watershed approach (see 33 C.F.R. 332.3(c) and Section 3.2 of the MMG). Specifically, compensatory mitigation sites shall be located in the same watershed, have the same landform, geologic formation, and soil type as the impact and reference sites, to the maximum extent practicable.

**C. Baseline (or Pre-project) Monitoring:** A baseline survey of the vernal pools on the impact (where applicable), reference, and mitigation sites shall be conducted in advance and the baseline data shall be included in the mitigation plan. Baseline conditions in some of these vernal pools may need to be monitored for more than one year to provide meaningful, useful data. The baseline survey shall include: a delineation of current wetlands and other waters for all applicable sites, including representative data sheets pursuant to the 1987 Corps of Engineers Wetlands Delineation Manual and appropriate Regional Supplements; specific information on soil conditions, including modifications, farming history, etc.; historic and existing plant communities, including an inventory of species, their relative distribution, percent cover, etc.; historic and existing hydrology, including connectivity, and any irrigation or drainage patterns; the presence, absence and relative abundance of any Federal- or state-listed species or candidates proposed for listing; and a CRAM vernal pool

assessment conducted by qualified biologists. If any special-status species are found, the relative abundance of each species will be included in the draft plan. See “Baseline Information” requirements in the Compensatory Mitigation Rule (33 CFR 332.4(c)(5)) and MMG Section 4.8.8.

**D. Design Considerations:** In addition to the requirements of Section 4.4 of the MMG, each vernal pool mitigation plan and subsequent reports shall describe the proposed types of mitigation vernal pools and/or complexes in accordance with a published classification method, and with a crosswalk to Cowardin and the California Aquatic Resource Inventory (CARI) Classifications. Mitigation vernal pools proposed to be established or re-established should be of similar sizes, depths, and types as reference and impacted vernal pools and must be connected to each other and downstream waters by a system of drainage swales to duplicate natural vernal pool complexes exhibiting such features. Compensatory mitigation may include vernal pool restoration in previously cultivated or otherwise disturbed or degraded vernal pool habitat provided the restricting layer(s) are intact. No artificial layers or soil amendments (e.g., Bentonite) may be used.

The plan must describe the soil types, slopes, general drainage pattern, and other aspects of the watershed that will influence successful vernal pool establishment.

Plans which include establishment of vernal pools in the vicinity of existing vernal pools must consider and discuss adjacent landscapes and land uses and the measures that will be taken to minimize adverse effects to the existing vernal pools. Examples of such measures include designing for appropriate vernal pool density, directing urban runoff away from vernal pool mitigation sites and not placing mitigation vernal pools within high quality vernal pool preservation or on-site avoidance areas.

*The following specific items must be included in the Mitigation Plan:*

1. A site assessment identifying the presence, depth, and topography of water-restricting layer(s),
2. A site assessment of surface topography and extent of watershed (catchment) contribution to hydrology of proposed mitigation vernal pools.

Additionally, in certain circumstances (e.g., construction in existing vernal pool complexes), a water balance for every proposed mitigation vernal pool or complex under dry, average, and wet year scenarios using the following equation, or other Corps-approved equation or model, may be required:

$[\Delta S = (P + Q_i + \theta) - (ET + Q_o)]$ , where Storage (S), Rainfall (P), Evapotranspiration (ET), surface and groundwater runoff in ( $Q_i$ ), surface and groundwater runoff out ( $Q_o$ ),

existing soil moisture ( $\theta$ ) (soil saturation 35-50% of soil volume)]

### **E. Construction Techniques:**

1. Mitigation vernal pools must have the same physiographic features (e.g., side slopes, depth of inundation, and aerial extent of inundation) and similar plant community associations as the reference pools. Proposals must accurately match side slope and pool bottom construction specifications for mitigation vernal pools with those of the reference pools. In addition, proposals must match the depth, surface area, and inundation period of the mitigation vernal pools with the reference vernal pools.
2. If the use of inoculum is approved, remove soils containing seeds, cysts, eggs and/or other inoculum-bearing material from donor pools only after soils are thoroughly dry and all endemic vernal pool plant species have dispersed seed. Vernal pools from which inoculum is collected, shall be free of plants with an overall High rating by Cal-IPC. Reserved soils should be placed in the mitigation vernal pools prior to the next rainy season, but in no case shall the soil be stored for more than one year or mixed with soils from another complex.
3. Remove all spoil and borrow material resulting from the construction or restoration of vernal pools from the mitigation or preserve site.
4. The mitigation plan must include the locations of the mitigation vernal pools and where they are in relationship to existing pools on site. In addition, the mitigation plan must clearly identify the areas of cut or fill that are adjacent or within preserve or mitigation areas.
5. Provide and maintain a buffer of at least 100 feet around all vernal pool preserves and mitigation sites. Buffers will consist of native vegetation or regionally characteristic annual grassland without cut or fill as a result of adjacent development, developed recreation facilities, roads, trails, fire breaks, or other intrusive development. The appropriate buffer width will depend on adjacent land uses and resource values that need to be maintained in the preserve, in consideration of the topographic and hydrologic conditions.
6. Fencing and low earthen berms may be required in certain cases to protect the mitigation vernal pools from vehicular traffic or unwanted disturbance. Berms must not adversely alter the mitigation area hydrology and construction activities must minimize adverse impacts to the mitigation area.

### **VI. Performance Standards and Mitigation Monitoring Methods:**

For each permittee-responsible, mitigation bank or ILF program site, monitoring will include CRAM vernal pool assessments, reference data, and monitoring data in accordance with the approved plans (e.g. hydrologic and vegetative standards, including invasive species), fauna, and reporting signs of unauthorized human disturbance. In some instances, other agencies will require monitoring such as special status plant and animal species (if found on site). The intensity and extent of monitoring will depend on site-specific conditions and surrounding land uses and will be included in the final mitigation plan to be approved by the Corps. The specific performance standards to be used for vernal pool mitigation projects are summarized below:

A. Performance Standards:

1. Final Performance Standard for Vernal Pool Area:

The acreage of mitigation vernal pool habitat must equal the acreage required by the Corps permit or approved development plan.

2. Final Performance Standards for Hydrology:

a. The total area of inundation of the mitigation vernal pools must be equal to the area proposed in the approved mitigation plan.

b. Each mitigation vernal pool must be inundated for a duration and depth that is within the range of inundation for the reference vernal pools.

c. The average depth and duration of inundation of the mitigation pools must be within one standard deviation of the average depth and duration of the reference pools.

3. Final Performance Standards for Vegetation:

a. The absolute cover for each mitigation vernal pool must fall within or above the range of the reference pools.

b. The average absolute cover of the mitigation pools must meet or exceed the average absolute cover for the reference pools. Constructed vernal pools that fail to meet vernal pool performance standard 3a, 3c, or 3e will be excluded from the mitigation pool average.

For example, if the reference pools range from 40-70% cover with an average of 58%, then all mitigation pools with 40-70% cover would meet the standard, providing the average % cover for the mitigation pools was at least 58%.

- c. The total number and relative cover of vernal pool endemic species (from Appendix 1 of the CRAM Vernal Pool Systems and Individual Vernal Pools Modules) for each mitigation vernal pool must fall within or above the range observed in the reference vernal pools.
- d. The average number and relative cover of vernal pool endemic species of the mitigation pools must meet or exceed the average number and relative cover of vernal pool endemic species for the reference pools. Constructed vernal pools that fail to meet vernal pool performance standard 3a, 3c, or 3e will be excluded from the mitigation vernal pool average.
- e. The absolute cover and number of non-native or invasive species for each mitigation vernal pool must fall within or below the range observed in the reference vernal pools.
- f. The average absolute cover and average number of non-native or invasive species of the mitigation pools must be less than the average absolute cover and average number of non-native or invasive species for the reference pools. Constructed vernal pools that fail to meet vernal pool performance standard 3a, 3c, or 3e will be excluded from the mitigation vernal pool average.

#### 4. Interim Performances Standards:

Interim standards allow for an assessment of whether the mitigation vernal pools are developing as proposed in the approved mitigation plan and early identification of problems or issues which may require remedial action.

For example, the interim standards for vegetative cover (e.g., relative percent cover of vernal pool endemic species in reference pools) for each mitigation vernal pool must increase in each successive year (e.g., year two 10%, year four 20%, year five 30%, etc.) based on initial quantitative monitoring of reference pools. Similarly, CRAM scores on representative assessment areas should increase, both by index (or total) scores and by attribute scores, but mostly by physical and biotic attribute scores.

Interim standards are not necessary for hydrology, since the final standards should be met in the first rainy season following construction.

#### 5. Projected Numerical Performance Standards:

When the Corps determines that reference pools are not available and that the mitigation site is otherwise appropriate, baseline monitoring of impacted vernal pools or regionally available data may be used to develop numerical performance standards. Such standards must be based on attributes which are objective, verifiable, and utilize the best available science that can be measured or assessed in a practicable manner.

## 6. Multiple Classes of Vernal Pools:

Where substantially different classes (e.g., shallow vs. deep) of vernal pools would be constructed at a mitigation site, there should be reference pools and performance standards that are specific to each class.

## **B. Monitoring Methods**

### **1. Hydrology Monitoring for Vernal Pools**

Hydrology monitoring will be conducted for all mitigation vernal pools and reference vernal pools in the first, second, third, fifth, seventh and tenth years of the monitoring program. Hydrology monitoring will not be necessary in additional or intervening years except in those cases where the hydrology monitoring or vegetation monitoring indicates a potential problem. If vernal pools are constructed within an existing vernal pool complex, adjacent pools will be selected and monitored for hydrology.

#### a. Quantitative Hydrology Monitoring

- i. Install level loggers at the deepest location of each vernal pool to be monitored. Monitoring will be conducted continuously from November 1 until May 15. Record depth and duration of inundation for each vernal pool. Data collected must be provided in the monitoring reports.
- ii. Aerial photographs of the monitored pools will be taken at least once annually during monitoring years to document the extent of inundation in the mitigation and reference vernal pools. The aerials will be taken at maximum inundation (typically January or February).
- iii. Record area of inundation for each pool. Area of inundation will be determined either through digitizing the maximum inundation on the aerial photo or in the field using a sub-meter accurate GPS unit and importing the data into ArcGIS or similar software program for acreage calculations. Data documenting the areas of inundation must be provided in monitoring reports.

### **2. Vegetation Monitoring for Mitigation Vernal Pools**

Vegetation monitoring for mitigation vernal pools will focus on both species composition and the vegetation communities present. Mitigation and reference vernal pools shall be monitored during the peak of the spring flowering phase.

a. Methods for Quantitative Vegetation Monitoring:

i. Identify vegetation zones within a pool. When zones are present, divide each pool into visually homogeneous zones. While walking through or around a pool, choose one or more vegetation zones that are visually distinct from each other. Vegetation homogeneity can be defined by the presence throughout a zone of the same dominant species and a set of less abundant associated species having a uniform architecture and phenologic stage. Typically, two or three zones are present in a given pool. The boundaries between zones may be sharp and clear, reflected by the change in flower color of dominant taxa (see examples on Figure 1) and the height of the plants.

ii. Map pool vegetation zones. On datasheet 1 (see Appendix 1) and on CRAM data sheets as appropriate, make a simple sketch of the entire pool that shows pool shape, maximum length and width (in meters), and the approximate location for all vegetation zones. Site-specific information (site name, geomorphic surface, landform, and soil series) can be completed prior to or after the fieldwork, based on soil and geologic maps. Pool-specific information (pool number, date of the survey, surveyor, pool length (m), pool width (m), pool maximum depth (m), surrounding vegetation type(s), and geographic setting - slope steepness and aspect, pool elevation (m), and Lat/Long coordinates of the pool's approximate center) will be provided in the appropriate field on the datasheet.

iii. Locate plots within a zone. Within each unique vegetation zone, at least one 10 m<sup>2</sup> plot must be placed to characterize its vegetation. If a given zone is represented in the pool in several separate areas, choose and sample the area that will best represent that vegetation zone. The plot should be both relatively homogenous and representative of the vegetation of the entire patch. Habitat conditions and plant cover should be visually uniform within the plot area. That is, the plot should not have dense plant cover on one part and very open cover on another. The plot should not be dominated by one species on one part and by a second species in another. The plot shape should be square when possible, but it can become narrowly rectangular for narrow zones. Figure 2 shows plot locations in a pool with two vegetation zones. To avoid areas where the vegetation appears to be transitioning from one type to another, locate the plots well away from boundaries. If patch width is > 3.2 m, the center of the plot should be placed at the intersection of two longest perpendicular transects across the biggest patch. The diagram in Figure 3 shows locations of sample plots in a pool with three zones. If the surveyor thinks that the centrally located plot is atypical for this zone, one additional plot should be sampled. If the zone is < 10 m<sup>2</sup>, then the entire zone will be sampled, making notes about its size and shape paying special attention to plot homogeneity.

iv. Take plot data. On datasheet 2 (see Appendix 2), record all plot data, including site-specific information (site name, geomorphic surface, landform, and soil series) and

pool-specific information (date, pool number, surveyor, pool length/width/maximum depth, surrounding vegetation, date, surveyor). After recording Lat/Long coordinates (using reference datum of NAD83) for each plot, the following plot-specific data should be recorded: total herb cover (%), bare soil (%), rocks/cobbles (%), open water (%), algal matting (%), thatch (%), plot length (m), plot width (m), plot depth relative to the pool edge (cm), position of the plot within the pool, phenology, evidence of grazing, type of grazing animals, and percent of the pool's area that the plot represents. Then the complete list of all taxa, together with an estimate of each taxon's absolute percent cover, should be recorded for each plot. Nomenclature of vascular plants must follow the most recent CRAM Vernal Pool Plant List.

v. Complete the pool map. (i) Regarding the "syntaxonomy" box: Give descriptive, provisional names to patch type/zones. The name of the zone typically includes names of one or two dominant species. It also can include names of less abundant species if they are more typical for this zone relative to other vegetation zones in the pool. Record the names of all zones, with their percent cover in the pool, in the syntaxonomy box. The cumulative percent cover of all zones should total 100%. If part of the pool was covered by bare ground or open water without vegetation, the percentage of non-vegetated area must be recorded. (ii) Regarding the "cross section" box: Make a cross-sectional sketch of the pool that shows the position of each zone along the gradient of relative elevation within the pool. Indicate zones on the sketch by giving them the same number as in the "syntaxonomy" box. These should be consistent in the CRAM datasheets if a CRAM assessment is being done on the same pool or complex.

#### b. Preliminary Vegetative monitoring:

For each mitigation and reference vernal pool, record total absolute cover and absolute cover for all dominant species (in accordance with the 50/20 rule).

#### c. Faunal and Water Quality Monitoring

At this time, there are currently no specific faunal or water quality monitoring indicators being considered for inclusion in these methods. On a case-by-case basis, faunal or water quality monitoring may be required.

#### d. Site Quality Monitoring

1. Each time the site is visited, monitor the area for signs of excessive or uncontrolled human disturbance or other adverse conditions to develop. Potential problems include: erosion flooding, plowing, ditching, feral animals, off-road vehicle use, trash and litter, human foot traffic, excessive grazing, run-off water, etc.

2. Performance Standards for Site Quality Monitoring: There are currently no specific attributes for this element. However, any excessive signs of disturbance must be documented in the annual report. The Corps project manager will decide, in consultation with the review agencies if necessary, on any appropriate remedial action.

### **C. Duration and Schedule of Monitoring**

1. Duration: Vernal pool construction projects will be monitored for a minimum of 10 years, beginning the first wet season after the construction of the mitigation wetlands is completed. In addition and prior to sign-off, continued success of the mitigation vernal pools, without human intervention, must be demonstrated for at least 3 consecutive years. For example, if remedial action is required in the 8th year, then the vernal pools and associated habitat requiring remediation will be monitored at least until the 11<sup>th</sup> year. Extension of the monitoring period to meet the consecutive year requirement need only be applied to those features not meeting the quantitative performance standards.

2. Monitoring Schedule: In Years 1, 2, 3, 8, and 9, preliminary vegetation monitoring of the mitigation and reference vernal pools is required as outlined in table 1. In the first three years, the purpose of the monitoring will be to determine if the mitigation vernal pools are beginning to support appropriate vernal pool vegetation or if there is an obvious need for remediation. In later years, this monitoring will allow the monitoring biologist to track increases in invasive plant species composition and to take action, if needed. Quantitative vegetative monitoring is required for all reference and mitigation pools in years 4, 5, 6, 7, and 10. If a mitigation pool meets all the vegetation performance standards during 3 consecutive years of detailed monitoring, quantitative monitoring will not be required again until year 10. If a mitigation vernal pool does not meet all the vegetation performance standards for 3 consecutive years by year 7, it will be monitored quantitatively in years 8 and 9 and potentially longer to meet the 3-year standard (monitoring of reference pools would then also be required, but not adjacent pools). All mitigation, adjacent, and reference vernal pools will be quantitatively monitored in year 10 to demonstrate continued success.

**Table 1. Monitoring Schedules**

Year 1	Year 2	Year 3	Year 4	Year 5
All reference and mitigation vernal pools receive preliminary vegetative and quantitative hydrologic monitoring	All reference and mitigation vernal pools receive preliminary vegetative and quantitative hydrologic monitoring	All reference and mitigation vernal pools receive preliminary vegetative and quantitative hydrologic monitoring  Wetland delineation	All reference and mitigation vernal pools receive quantitative vegetative monitoring  CRAM	All reference and mitigation vernal pools receive quantitative vegetative and hydrology monitoring
Year 6	Year 7	Year 8	Year 9	Year 10
All reference and mitigation vernal pools receive quantitative vegetation and hydrology monitoring	All reference and mitigation vernal pools receive quantitative vegetative and hydrology monitoring  CRAM  Wetland delineation	All reference and any mitigation vernal pools that do not pass 3 consecutive years receive quantitative vegetative and hydrology monitoring	All reference and any mitigation vernal pools that do not pass 3 consecutive years receive quantitative vegetative and hydrology monitoring	All reference and mitigation vernal pools receive quantitative vegetative  CRAM  Wetland delineation

**VII. Remediation/Adaptive Management of Mitigation Vernal Pools**

If at any time preliminary or quantitative monitoring indicates mitigation vernal pools are not demonstrating adequate progression toward the performance standards, remedial action and/or substitute mitigation must be proposed by the permittee or sponsor in accordance with the approved mitigation plan or bank or ILF instrument for Corps review and approval.

The Corps will make final determinations of compensatory mitigation performance and permit compliance, and may require additional mitigation monitoring and/or remedial action or substitute mitigation.

A minimum of three years of quantitative monitoring after any human intervention, other than required/approved site management will be conducted for any mitigation vernal pool that is remediated.

Monitoring will follow the schedule outlined above if remediation occurs in the summer of Years 1 through 7 (i.e., there will be no difference between the monitoring schedule for remediated pools and for the remaining mitigation vernal pools). If remediation occurs in Year 8 or after, the Quantitative monitoring period for the remediated vernal pools as well as the reference pools will be extended until the remediated pools meet the performance standards for 3 consecutive years without human intervention.

If the remediated pools do not meet the vegetation performance standards at the end of the three years of Quantitative monitoring, it will be determined by the Corps if further remediation and monitoring are warranted or if the mitigation vernal pools will not count toward the mitigation requirement and additional mitigation is required.

### **VIII. Quality Assurance and Quality Control (QA/QC)**

QA/QC procedures must be developed for all monitoring programs. Reference vernal pools must be approved by, and accessible to, agency staff during the entire monitoring period. Field personnel must be trained to collect, observe and record hydrologic data. If water quality data is collected, field sampling must follow standard protocols. Statistically valid methods of analysis must be used and references for those methods cited as appropriate.

CRAM data must be collected by personnel formally trained in the CRAM vernal pool module. Data must be entered into [www.cramwetlands.org](http://www.cramwetlands.org) with appropriate assurances that the data were reviewed, checked for transcription and transposition errors, and geo-spatial information was correct. Permittees and sponsors must seek appropriate agency representation on CRAM teams.

### **IX. Reporting**

As discussed in the MMG, monitoring data must be compiled in an annual report that accurately documents monitoring results and QA/QC procedures, interprets data, states conclusions, and makes recommendations. See Regulatory Guidance Letter 2006-03 and MMG Section 6.4.3 for content and format of reports.

Monitoring reports shall be submitted for each year that monitoring is required for the duration of the project, including a final report at the end of any extended monitoring demonstrating continued success of the mitigation without human intervention.

Reports shall be submitted to agencies with jurisdiction over the compensatory mitigation project (Corps, US Environmental Protection Agency, US Fish and Wildlife Service, and the California Department of Fish and Wildlife). In accordance with the 33 C.F.R. 332.6(c)(3), the District Engineer must provide copies of monitoring reports to other interested Federal, tribal, state, and local resource agencies, and the public upon request.

As built drawings with micro-topography (1-inch contours) of the entire mitigation site, including all mitigation vernal pools, must be prepared and submitted within 90 days following completion of mitigation construction.

Reports must include all of the data and information required by the MMG and the following:

1. Graphical comparison of quantitative monitoring data for mitigation pools and reference pools (e.g., bar graphs showing inundation, percent cover with target plants, species richness). See Appendix 3 for example.
2. Documentation of hydrologic connectivity between mitigation pools and down-slope waters.
3. Pictures of each mitigation and reference pool from fixed reference points.

## **X. General References**

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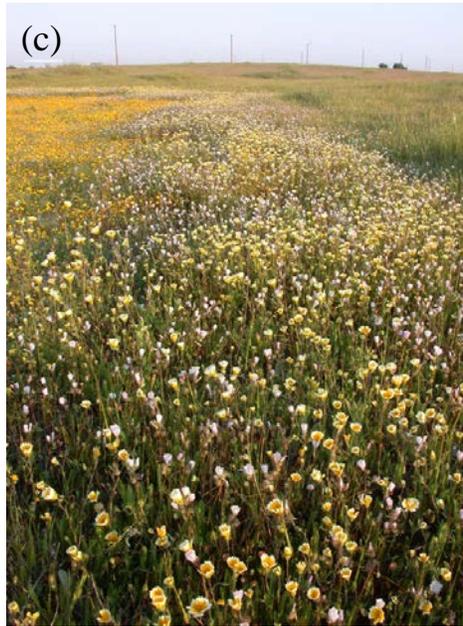
**Figure 1.** Examples of vegetation zones recognized by dominant species



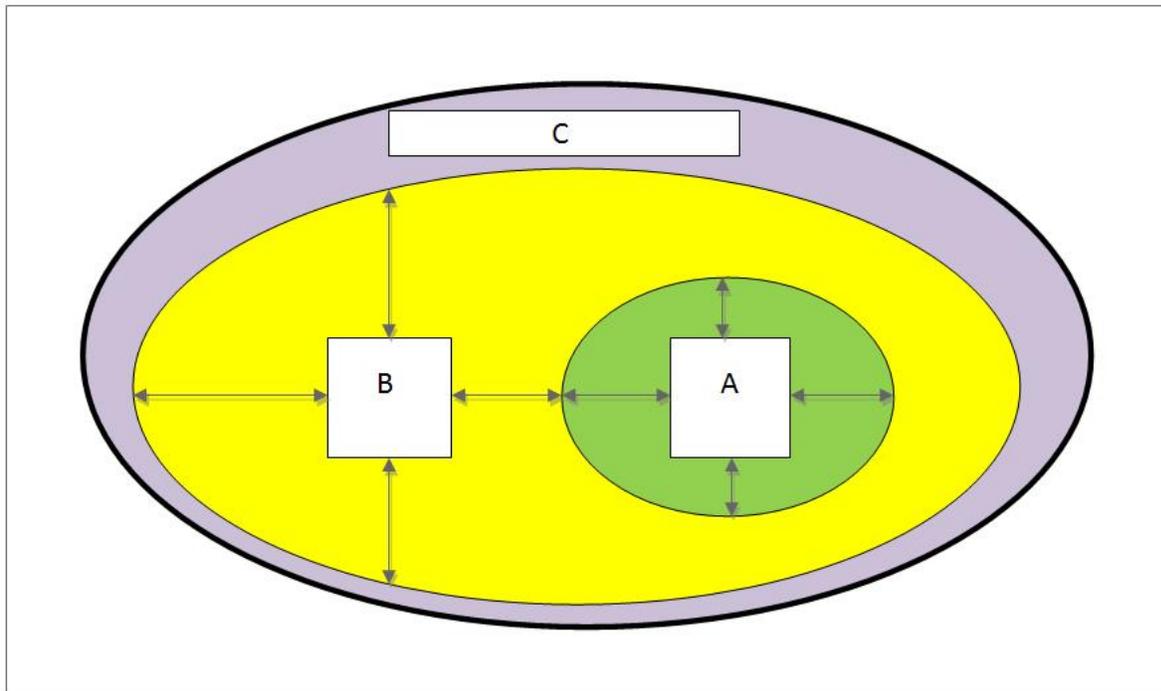
**Figure 2.** Locating 10m<sup>2</sup> plots within the pool with two vegetation zones.

- (a) Plot A on pool bottom has quadrat shape and pool B representing pool edge has a rectangular shape
- (b) Plant community of the pool bottom was wide enough to accommodate a quadrat plot 3.2 x 3.2 m
- (c) The pool edge was narrow and the the widest homogeneous plot we were able to use was 1.5 x 7m





**Figure 3.** A diagrammatic example of locations of sample plots in pool with three vegetation zones.





GPS coordinates for each releve

A = \_\_\_\_\_  
B = \_\_\_\_\_  
C = \_\_\_\_\_  
D = \_\_\_\_\_  
E = \_\_\_\_\_  
F = \_\_\_\_\_  
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Q = \_\_\_\_\_  
R = \_\_\_\_\_  
S = \_\_\_\_\_  
T = \_\_\_\_\_  
U = \_\_\_\_\_  
V = \_\_\_\_\_  
W = \_\_\_\_\_  
X = \_\_\_\_\_  
Y = \_\_\_\_\_  
Z = \_\_\_\_\_



# Appendix 2. Data Sheet 2, Plot Data

2002 Vernal Pool Classification - Relevé Data Form (3/25/02 Version)

Site Name: \_\_\_\_\_ Pool Number: \_\_\_\_\_

Geomorphic Surface: \_\_\_\_\_ Landform: \_\_\_\_\_ Soil Series: \_\_\_\_\_ Surrounding Vegetation: \_\_\_\_\_

Date: \_\_\_/\_\_\_/2002 Botanist: \_\_\_\_\_ Pool Length: \_\_\_\_\_ m Pool Width: \_\_\_\_\_ m Max Depth: \_\_\_\_\_ cm GPS: \_\_\_\_\_

SPECIES	REL#					SPECIES	REL#							SPECIES	REL#					OTHER SPECIES	REL#							
Adynchaena mollis						Elatine								Myosurus minimus														
Agrostis						Eleocharis acicularis acicularis								Navarretia														
Aira caryophyllia						Eleocharis macrostachya								Navarretia														
Allium amplexans						Epilobium								Navarretia														
Alopecurus saccharus						Eremocarpus setigenus								Ptilularia americana														
Anagallis arvensis						Erodium cicutarium								Plagiobothrys stipitatus micranthus														
Anstata oligantha						Eryngium								Plagiobothrys														
Avena						Gastrophilus ventricosus								Plagiobothrys														
Blennosperma nanum nanum						Geranium dissectum								Plantago elongata														
Biza minor						Glycyrrhiza								Plantago														
Brodiaea N-I-F						Gratiola ebracteata								Pleuropogon californicus														
Brodiaea						Hemizonia filifolia								Poa annua														
Bromus hordeaceus						Hordeum murinum gussoneanum								Poa														
Calanthe ciliata						Hypochaeris glabra								Pogogyne zizyphoroides														
Callitriche marginata						Isoetes macrospora								Polygonum arenastrum														
Candollea oligosperma						Isoetes								Polygonum mongolicum													% TOTAL HERB COVER	
Castilleja attenuata						Juncus bufonius								Psilocarphus brevissimus brev.													% bare soil (all forms)	
Castilleja campestris						Juncus capitatus								Psilocarphus oregonus													% rocks/robbles	
Centaurea solstitialis						Juncus uncialis								Psilocarphus tenuis glaberrimus													% open water	
Cerastium minus						Lactuca scariola								Ranunculus aquatilis													% algal matting	
Cerastium glomeratum						Lasthenia californica								Ranunculus konanensis triseptalis													% cryptogams	
Chamaesyce						Lasthenia fremonti								Rumex crispus													% thatch (thick matting)	
Chlorogalum angustifolium						Lasthenia glaberrima								Rumex													% litter (under plants)	
Ciceraria quadrangularis						Layia fremonti								Scribneria bolanderi													% animal droppings (cow)	
Clarkia purpurea						Leontodon taraxacoides								Sidalcea														% animal punch (2 cm deep)
Compositula arvensis						Lepidium								Spergularia														% animal throw (current yr)
Cotula coronopifolia						Linmarthes								Taeniatherum caput-medusae													% surface damage (other)	
Crassula aquatico						Lolium multiflorum								Trichostema lanceolatum													AVG HEIGHT HERBS (cm)	
Crassula						Lupinus								Trifolium														MAX HEIGHT HERBS (cm)
Crypsis						Lythrum hyssopifolia								Trifolium														RELEVÉ LENGTH (m)
Cuscuta howelliana						Marsilea vestita								Trifolium														RELEVÉ WIDTH (m)
Cynodon dactylon						Micropus californicus californicus								Trifolium														RELEVÉ REL ELEV (cm)
Damissonium californicum						Microseris								Trifolium														** POSITION IN POOL
Deschampsia danthonioides						Microseris								Veronica peregrina californica														*** PHENOLOGY
Dichelostemma						Mimulus tricolor								Vulpia bromoides														GRAZING? (Y/N) (N/A)
Downingia						Minuartia californica								Vulpia microstachya														(S) Sheep, (C) Cows, (H) Horses
Downingia						Monia fontana								Vulpia myuros														RELEVÉ % OF TOTAL POOL

\* Not necessarily part of 100%.

\*\* Position: 1 = summit, 2 = shoulder, 3 = slope, 4 = toe, 5 = bottom

\*\*\* PHENOLOGY: 1 = aquatic, 2 = wet/muddy, 3 = early-floem, 4 = full-floem, 5 = past-floem, 6 = dead-dry

Additional information on reverse: YES / NO



Appendix 3. Example of Graphical Comparison

